KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
(Established Under Section 3 of UGC Act 1956)
Coimbatore – 641 021.
(For the candidates admitted from 2018 onwards)

DEPARTMENT OF CHEMISTRY

SUBJECT NAME: TEXTILE CHEMISTRY **SUBJECT CODE:18CHP305B**

SEMESTER: III **CLASS: II M.Sc CHEMISTRY**

Scope

Textile chemistry frames much of our understanding of the natural world and continues to bring new technologies that are useful to every aspect of human life. Textile chemistry is an exciting and challenging course, which helps us to understand the various aspects of compounds used in our day to day life. Textile chemistry interfaces with a myriad of other disciplines and fields. It is fundamental to understand other areas of chemistry. Due to highly prized nature of Textile chemistry and its diverse topics, it lays the foundation for extremely productive and exciting career in variety of disciplines. The importance of this subject would not diminish over time, so it will remain a promising career path. This course presents the classification of fibres, Dyeing of fabrics and related process.

Objectives

1. To learn about the classification of fibers.
2. To learn about the dyeing process on fibers.
3. To learn the effluent treatment from a fiber industry.

Methodology

Blackboard teaching, Powerpoint presentation and group discussion.

UNIT- I

Fibers: General classification of fibers-chemical structure, production, properties and uses of the following natural fibers (a) natural cellulose fibers (cotton and jute) (b) natural protein fiber (wool and silk).

Chemical structure, production, properties and uses of the following synthetic fibers. (i) Manmade cellulosic fibers (Rayon, modified cellulose fibers) (ii) Polyamide fibers (different types of nylons) (iii) Poly ester fibers.

UNIT- II

Dyeing Process: Impurities in raw cotton and grey cloth, wool and silk- general principles of the removal – scouring – bleaching – desizing – kierboiling- chemicking.

Dyeing - Dyeing of wool and silk –fastness properties of dyed materials – dyeing of nylon, terylene and other synthetic fibres.

UNIT- III

Finishing: Finishes given to fabrics- mechanical finishes on cotton, wool and silk, method used in process of mercerizing –anti-crease and anti-shrink finishes –water proofing.

UNIT-IV

Types of Dyes: Quinonoid dyes-examples and structure-Anthroquinone and Mordant dyes-synthesis and applications of Alizarin-Phthalocyanin dyes-Copper Phthalocyanin-synthesis and applications.

Diphenylmethane dyes- Auramine-Triphenylmethane dyes-Malachite green, Crystal violet, Pararosaniline-preparation and applications.

Indigo dyes-preparation and application-derivatives of Indigo- synthesis and uses of Indigosol and tetrahaloindigo.

Phthalein dyes-Phenolphthalein- preparation and applications.

Xanthene dyes-Rhodamine B, Fluorescein-Eosin- preparation and applications.

UNIT-V

Pollution Control in Textile Industry: Textile effluent-characteristics, effect of untreated effluent, degradability of wastes. Effluent treatment plants-aerated lagoon, photo oxidation process.

SUGGESTED READINGS:

Text Books:

1. Chatwal, R. (2009). *Synthetic Dyes*. Mumbai: Himalayan Publishing House.
2. Sadov, F., & Horchagin, M. (1978). *Chemical Technology of Fibrous Materials- A.* Matetshy. U.S.A: Mir Publishers Easton's Books. Inc. Mount Vernon.
3. Joseph, M. L., Hudson, P. B., Clapp, A. C., & Kness, D. (1993). *Joseph's Introductory Textile Science* (VI Edition). Fort Worth: Harcourt Brace Jovanovich College Publishers.
4. Luniak, B. (1953). *The Identification of Textile Fibres: The Identification of Textile Fibres: Qualitative and Quantitative Analysis of Fibre Blends*. London: Pitman Publisher.
5. Mather, R. R., and Wardman, R. H., *The Chemistry of Textile Fibres*, 2nd Edition (2015) Published by The Royal Society of Chemistry, Thomas Graham House, UK.

Reference Books:

1. Sharma, B. K. (1997). Industrial *Chemistry*. New Delhi: Goel Publishing Co.
2. Prayag. R. S. (1989). *Dyeing of Wool, Silk and Manmade Fibres*. Dharwad: Noves Data Corporation.
3. Shenai. V. A. (1973). *Chemistry of Dyes and Principles of Dyeing*. Bombay: Sevak Publication.
4. Shenai. V. A. (1980). *Technology of Textile Processing*. Bombay: Sevak Publication.
5. Carr. C. M. (1995). *Chemistry of the Textiles Industry.*Blackie Academic & Professional Publication.
6. Marsh,J .T. (2001). *Textile Science*. B.I. Publications, Bombay.

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
(Established Under Section 3 of UGC Act 1956)
Coimbatore - 641 021.
(For the candidates admitted from 2018 onwards)

DEPARTMENT OF CHEMISTRY

SUBJECT NAME: TEXTILE CHEMISTRY **SUBJECT CODE: 18CHP305B**

SEMESTER: III **CLASS: II M.Sc CHEMKISTRY**

LECTURE PLAN
DEPARTMENT OF CHEMISTRY

S.No	Lecture Hour	Topics to be Covered	Support Materials/Page Nos
		UNIT I	
1.	1	General classification of fibers	T1: 2.1-2.2 R3: 1-2
2.	1	Chemical structure, production, properties and uses of the following natural fibers (a) natural cellulose fibers (cotton)	T1: 2.2 R3: 7-9 T2: 26-32
3.	1	Natural cellulose fibers (jute)	T2: 55-57
4.	1	Natural protein fiber (wool)	T1: 2.2-2.3
5.	1	Natural protein fiber (silk)	T1: 2.3
6.	1	Chemical structure, production, properties and uses of Manmade cellulosic fibers (Rayon)	R1:1148-1149
7.	1	modified cellulose fibers	T1: 2.3-2.4
8.	1	Polyamide fibers (different types of nylons)	R1:1153-1159
9.	1	Poly ester fibers	T1: 2.4
10.	1	Recapitulation and Discussion of important questions	
	Total No of Hours Planned For Unit I =10		
		UNIT II	
1.	1	Dyeing Process: Impurities in raw cotton and grey	R2: 61-62

2.	1	Impurities in raw wool and silk	R2: 62-63
3.	1	General principles of the removal – scouring	R2: 71-72
4.	1	Bleaching – desizing	R2: 63-64
5.	1	Kierboiling- chemicking	R2: 63-66, R2: 29
6.	1	Dyeing - Dyeing of wool and silk	R1: 1558-1559
7.	1	Fastness properties of dyed materials	R2: 308-310
8.	1	Dyeing of nylon, terylene and other synthetic fibres	R2: 397-398
9.	1	Recapitulation and Discussion of important questions	
	Total No of Hours Planned For Unit II =9		
		UNIT III	
1.	1	**Finishing:** Finishes given to fabrics	R4: 286-287
2.	1	Mechanical finishes on cotton	R4: 287-289
3.	1	Wool and silk	R4: 291-292
4.	1	Wool and silk	R4: 292-295
5.	1	Method used in process of mercerizing	R4: 302-305
6.	1	Anti-crease	R4: 344-346
7.	1	Anti-shrink finishes	R4: 341-344
8.	1	Water proofing	R4: 364-366
9.	1	Recapitulation and Discussion of important questions	
	Total No of Hours Planned For Unit III =9		
		UNIT IV	
1.	1	**Types of Dyes:** Quinonoid dyes-examples and structure-Anthroquinone	T1: 17.1-17.8
2.	1	Mordant dyes-synthesis and applications of Alizarin-Phthalocyanin dyes	T1: 18.1
3.	1	Copper Phthalocyanin-synthesis and applications	T1: 18.2-18.3
4.	1	Diphenylmethane dyes- Auramine-Triphenylmethane dyes	T1: 11.1-11.3

5.	1	Malachite green, Crystal violet	T1: 12.2-12.3 T1: 12.6-12.7
6.	1	Pararosaniline-preparation and applications	T1: 12.7-12.8
7.	1	Indigo dyes-preparation and application-derivatives of Indigo- synthesis and uses of Indigosol and tetrahaloindigo	T1: 16.4-16.9
8.	1	Phthalein dyes-Phenolphthalein- preparation and applications	T1: 13.1-13.3
9.	1	Xanthene dyes-Rhodamine B, Fluorescein-Eosin-preparation and applications	T1: 14.5-14.7 T1: 14.2-14.3
10.	1	Recapitulation and Discussion of important questions	
	Total No of Hours Planned For Unit IV =10		
		UNIT V	
1.	1	Pollution Control in Textile Industry: Textile effluent-characteristics	R2: 432-435
2.	1	Textile effluent-characteristics	R2: 435-437
3.	1	Effect of untreated effluent	R2: 438-439
4.	1	Degradability of wastes	R2: 439-441
5.	1	Effluent treatment plants-aerated lagoon	R2: 441-442
6.	1	Effluent treatment plants-aerated lagoon	R2: 442-445
7.	1	Photo oxidation process	R4: 217-219
8.	1	Recapitulation and Discussion of important questions	
9.	1	End semester question paper discussion	
10.	1	End semester question paper discussion	
	Total No of Hours Planned For Unit V =10		
Total Planned Hours		**48**	

SUPPORTING MATERIALS:

Text books:

T1: Chatwal, R. (2009). *Synthetic Dyes*. Mumbai: Himalayan Publishing House.

T2: Mather, R. R., and Wardman, R. H., *The Chemistry of Textile Fibres*, 2nd Edition (2015) Published by The Royal Society of Chemistry, Thomas Graham House, UK.

Reference Books:

R1: Sharma, B. K. (1997). Industrial *Chemistry*. New Delhi: Goel Publishing Co.
R2: Shenai. V. A. (1980). *Technology of Textile Processing*. Bombay: Sevak Publication.
R3: Carr. C. M. (1995). *Chemistry of the Textiles Industry*. Blackie Academic & Professional Publication.
R4: Marsh, J .T. (2001). *Textile Science*. B.I. Publications, Bombay

UNIT I

SYLLABUS

Fibers: General classification of fibers-chemical structure, production, properties and uses of the following natural fibers (a) natural cellulose fibers (cotton and jute) (b) natural protein fiber (wool and silk).
Chemical structure, production, properties and uses of the following synthetic fibers. (i) Manmade cellulosic fibers (Rayon, modified cellulose fibers) (ii) Polyamide fibers (different types of nylons) (iii) Poly ester fibers.

Introduction:

There is a very wide range of textile fiber types available in the marketplace. They vary not only in chemical type but also in physical characteristics, reflecting the wide variety of applications they have. Many people relate textiles to apparel and to materials for domestic uses, such as carpets, bedding and soft furnishings, but in fact textiles also have many specialized industrial applications. These textile products are referred to as 'technical textiles' and are produced mainly for their functional and technical performance, rather than their aesthetic characteristics. There are no clear distinctions between apparel and technical applications either, in the sense that the 'performance' apparel market, for which garments are produced to meet specific requirements in terms of, for example, functionality or personal protection, is a hugely important one.

For centuries, the textile industry was comprised exclusively of natural fibers, particularly cotton, wool and silk. Indeed, in the UK the textile industry was dominated by wool, because it was not until the beginning of the eighteenth century that cotton began to be imported. Towards the end of the nineteenth century the first 'man-made' fibers were commercialized, these being regenerated fibers, such as viscose rayon, based on cellulose. The textile industry then made considerable technological advances from the 1930s with the development of many types of commercially important synthetic polymers. In the period since the emergence of the first synthetic polymers, the nylons and polyesters, considerable development of this class of fibers has taken place, with the aim of producing fibers of very high technical specifications.

CLASSIFICATION OF TEXTILE FIBRES

It is useful to classify the various types of textile fibers and, since many have similar chemical characteristics, the best method of classification is according to chemical type. Before the various chemical groups are established, however, the various fiber types can be broadly classed as either natural or man-made.

As was stated earlier, the overwhelming majority of fibers are polymeric in nature. In broad terms, they may be classified thus:

Natural

- Animal (protein) fibers
- Vegetable (cellulosic) fibers

Man-made

- Regenerated cellulose fibers
- Chemical derivatives of cellulose

Synthetic polymer

- 'First-generation' (up to 1970s): commodity domestic and industrial fibers
- 'Second-generation' (1970s on): high-performance and specialized fibers

Other

- Metal fibers
- Ceramic fibers

Natural fibers fall into three chemical classes:

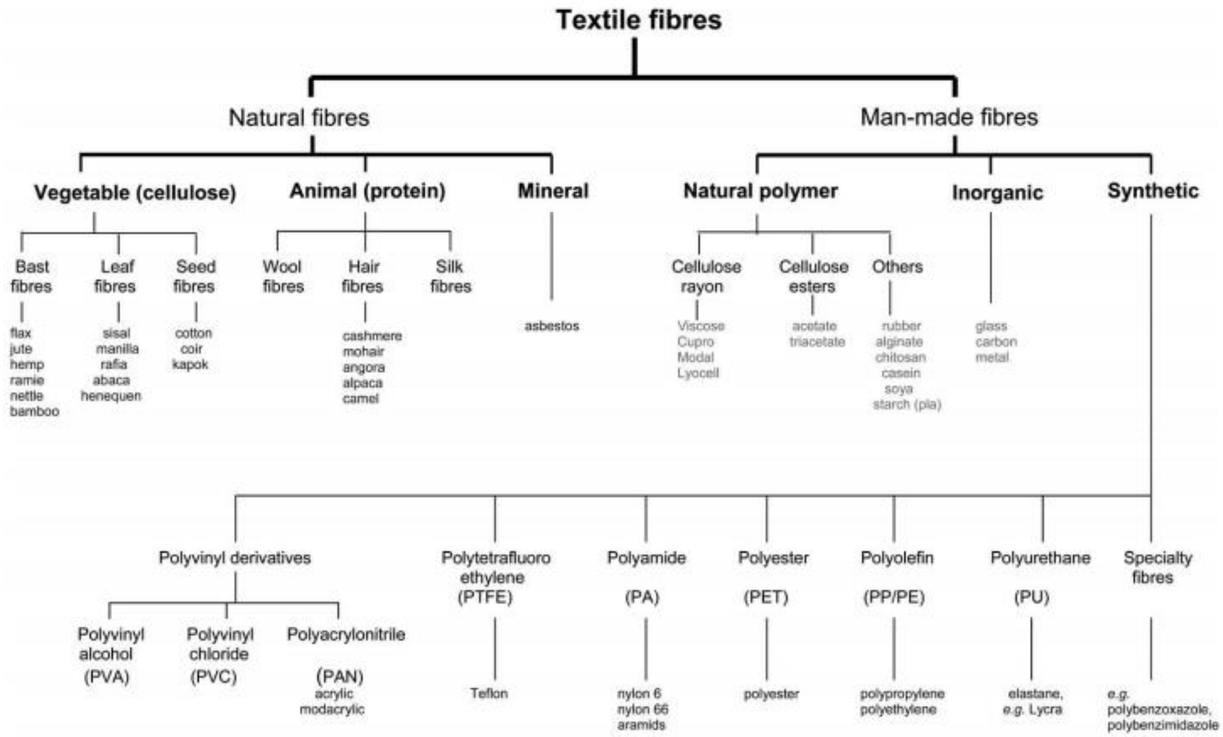
- Cellulosics, which are the fibers obtained from various parts of plants, such as the stems (bast fibers), leaves and seeds.
- Protein (keratin) fibers, which are the fibers obtained from wool, hair and silk.
- Mineral (the only naturally occurring mineral fiber is asbestos but its use is banned in many countries because of its toxicity).

Man-made fibers (also referred to as ‘manufactured fibers’) can also be further sub-divided into three broad groups:

‘Regenerated’ fibers, which are fibers derived from natural sources comprising organic polymers by chemical processing to both extract the fiber-forming polymer and to impart novel characteristics to the resulting fibers.

- Synthetic fbres that are produced from non-renewable sources.

Inorganic fbres, such as ceramic and glass fbres.



Textile fiber types are given what are called generic names and in Europe the organization responsible for allocating generic names is the Bureau International pour la Standardisation des Fibres Artifcielles (BISFA). IUPAC nomenclature does not meet the needs of the textile industry for naming actual fibers and so BISFA established a method and published its first list of generic names in 1994. The geric fiber names are based on common chemical groups that impart characteristic properties, such as:

-CONH- for polyamides

-COO- for polyesters

-(CH_2-CH·CN)- for acrylics

It is possible that a particular fiber type has two generic names, a prime example being the names polyamide and nylon, which both cover nylon 6, nylon 4.6, nylon 6.6 and nylon 11. Generic names are used extensively in garment labeling and facilitate global trading, avoiding the need for countless chemical names and trade names. There are some instances, however, where trade names are used in garment labels. Often trademarks (symbol ®) are used, which can cover a broad range of fiber types and suffix names for a very specific category of a manufacturer's fibers, so that consumers can identify particular qualities or performance characteristics with a specific manufacturer.

The European Commission, in Regulation No. 1007/2011, requires (among other things) all textile products to be labeled with the name and percentage content of all constituent fibers by reference to the recognized fiber names specified in the Regulation. The fiber names specified in the Regulation correspond to those established by BISFA. Each EU member state is obliged to implement this Regulation and in the UK its requirements are enforced under the Textile Products (Indications of Fiber Content) Regulations.

In the USA, the Federal Trade Commission (FTC) assigns generic names and there are instances of different names being used in the USA and the EU for the same fiber types, such as: elastane in the EU is called spandex in the USA, and viscose in the EU is called rayon in the USA. Unfortunately, such duplicity can lead to some confusion amongst consumers when buying clothes.

In addition to generic names, BISFA has developed a list of codes for the various fiber types, the aim of which is to facilitate communication when referring to fibers. While these codes are widely used by professionals in industry and academia, one anomaly seems to be the code assigned to polyester. For this fiber type, BISFA has assigned the code PES, but most professionals prefer to use the code PET, which is understandable given that the chemical name for the polymer is polyethylene terephthalate.

Cellulosic fibrre –Cotton

Cotton has been used as a textile fibre for thousands of years with India being generally considered as the birthplace of cotton cloth. Cotton is a hair attached to the seed of several species of the genus Cossypium, a shrub up to 2 metres in height, indigenous to nearly all tropical regions but growing best near the sea, lakes or large rivers where there is a warm humid climate and sandy soil. Cotton or cotton mixed with synthetic polymers provides most of the clothing in the world. It is used in making the finest garments suited to hot or cold weather, bedsheets, and for worldwide popular jeans. Each cotton fibre has 20-30 layers of cellulose built up in an orderly series of spring-like spirals. These fibres bring out certain characteristics like absorbency wet-strength, softness and durability in cotton clothing.

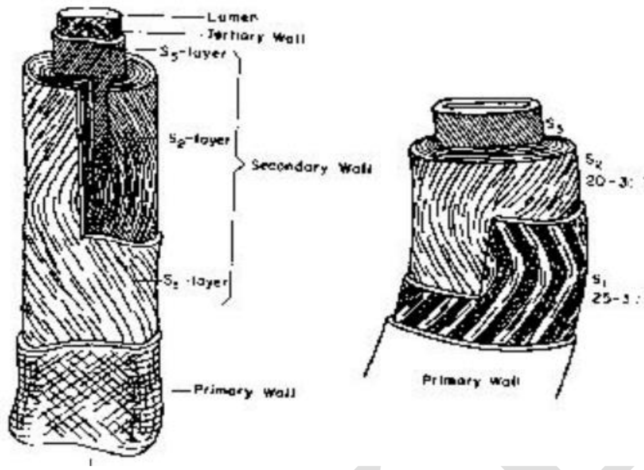
India was the first country to manufacture cotton. Among the latest finds at Mohenjo-Daro were a few scraps of cotton were found sticking to the silver vase. This shows that cotton had been produced in India as far back as even the fourth millennium B.C. Historians speak of the beautiful painted and printed cloth which was sold in Egypt and some parts of Europe long before the time of Alexander.

Properties of cotton

Cotton is the seed hair of the shrub which bears the botanical name of Gossypium, a member of the mallow family. The shrub grows to 6 feet tall height. From 80 to 110 days after planting the plant bears beautiful creamy white blossoms, which turn pink and fall off and are replaced by a green triangular pod called boll. The fiber develops within the boll. The boll is the size of a walnut. The mature boll bursts open from the fiber pressure, exposing the fluffy mass of white cotton fibers. Cotton is classified according to fiber length, fineness, lustre and geographical location.

Internal structure of cotton

The cotton fibre which are visible to the naked eye, when viewed under high magnification as with electron microscope are shown to be comprised of many layers of tiny fibrils arranged in definite spiral pattern with the different layers at right angles to each other. This structure as the fibre ripens may account to the twisting of the fibre as it dries. The picture shows the layered structure of cotton fibre as revealed by the microscope after staining and swelling treatment.

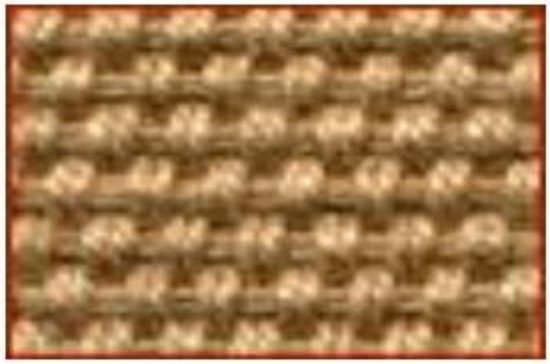


Uses

Cotton plant in Indian tradition is much more than the source of raw material for textile above. Cotton flowers give us nectar and if bee keeping is planned, it gives highly flavoured healthy and tasty honey. Cotton seed oil is a well-known edible oil. It is also used in Vanaspati formulations. In Ayurveda, equal quantity of ginger is used for external application to relieve pains due to rheumatism and arthritis. Roots of cotton plants are used for female diseases. Leaves are good for green manuring. Oil cake is a cattle feed and a good raw material for industrial adhesive besides being a good manure.

Cellulosic fibre- Jute

Jute ranks next to cotton in the amount of fibre produced in the world and in commercial value. It is the world's most plentiful, cheapest and weakest fibres. Jute is grown mainly in Pakistan, India and Brazil. Before partition of India, India produced almost all the supply of jute. Microscopic structure of jute resembles that of flax, but it usually lacks the cross markings characteristics of bast fibres. Raw by one of four hand methods. Then it is washed repeatedly to remove bits of bark, gum etc. and dried in the shade. Sunlight weakens the fibre. The colour and quality of the fibre depend considerably on the degree of maturation of the plant when harvested. Jute is a week fibre, it is harsh brittle with low elongation and little elasticity. Colour is from creamy white to is used for rope twine, cord, and backing for carpet and rugs. Recent uses in hand purses and apparel have given the fabric a boost. Burlap is the fabric made from jute.



Jute Fiber

Uses

It has many uses:

- It is used as under covering for upholstered furniture for bulletin 40 boards, slip, covers.
- It has limited use in apparel.
- Recent researches have blended jute with cotton to bring it into apparel use, and also in home furnishing.

WOOL – THE PROTEIN FIBRE

Wool is the first fiber that man learnt to make into fabric, either by felting or matting. Wool is the hair or fur covering of the sheep. Originally, sheep had two coats a coarse protective wiry coat and a soft warm fleecy undercoat of very fine texture. History clearly shows that Mesopotamia was the birthplace of wool. The early Romans encouraged sheep farming and wool weaving in England in A.D. 80. Soon the British woollen clothes gained reputation. Woollen Kashmiri shawls are as old as the epics of India. Tradition has it when Lord Krishna went to Kurus as a delegate from the Pandavas, the presents of Dhritrashtra to him were ten thousand shawls of Kashmir.

Structure of Wool

Varieties of wool and their origin

All wools are classified as fine, medium, long and carpet wool.

Fine wool:

The merino sheep is the outstanding example which supplies this type of wool. Fine wool may vary in length from 1½ to 5 inches. We get this wool from merino sheep. The original merino sheep were from Bikaner, India, these were taken to Australia. They are noted for softness, fineness, strength, elasticity and superior spinning and felting qualities. They are used for high quality flannel, knit goods, broad cloth, meltons and other face finished fabrics.

Medium wool: These are by Oxford, Hampshire, Suffolk and Dorset.

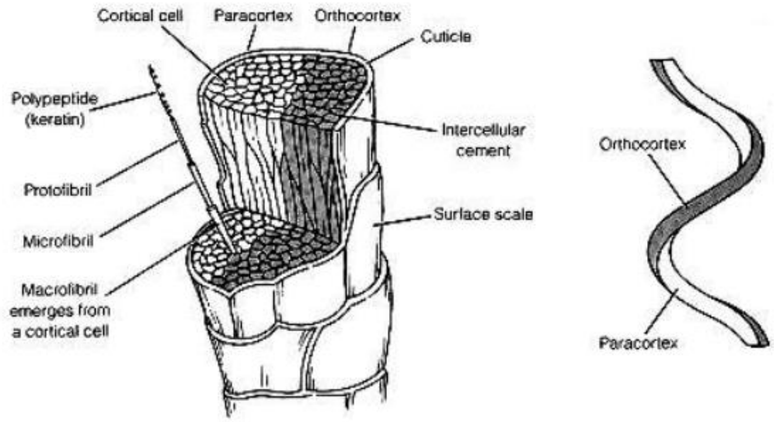
Long wool:

Large sheep such as the Lincolns Cotswold from Leicester produce long strong, lustrous wool. The fibre length varies from 5 to 6 inches for a Romney marsh, 10 to 15 inches for a Cotswold. This is coarse wool with poor felting quality, they are used for coarser tweeds, serge, overcoating, blankets, braids and worsteds.

Carpet wool:

This wool is procured from various crossbreeds. As the name implies it is largely used in the manufacture of carpets and rugs and for other coarse fabrics, horse blankets, coarse upholstery fabrics, etc.

Structure of wool:



Wool is a natural protein fibre. It is composed of a chain of amino acids combined by condensation (eliminating water) through peptide linkage to form chains. Wool is composed of five elements in approximately these percentages: carbon 50%, oxygen 22-25%, nitrogen 16-17%, hydrogen 7% and sulphur 3-4%. In addition, there is a very small amount of mineral matter present in the fibre. The weakest part of wool are the sulphur linkages, they are the parts most readily attacked by oxidizing and reducing agents, and even by light.

Most clean wool is off-white in colour, although grey, brown and black wooled sheep are not uncommon in the various breeds. Wyoming wool is the whitest produced in the United States. Colour is due to the pigment in the cortical and medullary areas of the wool; the scales are not pigmented.

Lustre is due to the nature and transparency of the scale structure of wool; it varies among animals and breeds, with the area of a fleece and with climatic conditions. Wool is made of three distinct parts.

- The outer horny transparent flattened scales.
- A cylindrical cortical layer (cortex which makes up the soft plastic bulk or body).
- A medulla or central air filled canal. These are made visible under a microscope. The scales vary in size and shape and the free ends projecting outward and upward towards the tip of the fiber. In the finest wool, the scales encircle the fiber and fit one into another like stacked cups and bowls. In coarser wool, the scales overlap like shingles on a roof, and

there may be several encircling rows depending on the diameter of the fibre. The scale structure make wool identifiable.

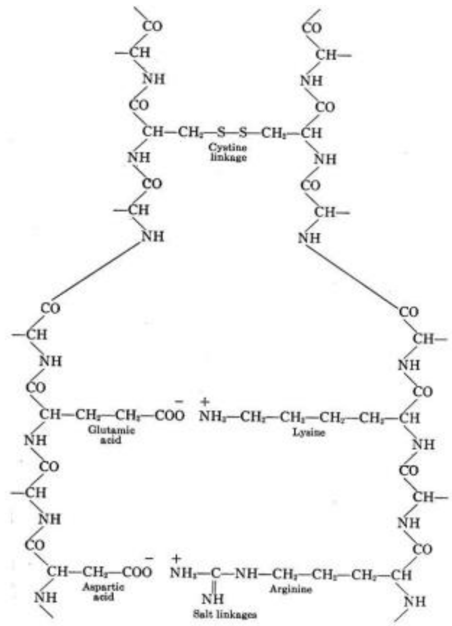
- The scale structure forms a protective hide for the more delicate part of the fibre and gives it form and a certain degree of rigidity. The cortical layer is responsible for the strength and elasticity of the fibre. The medulla increases the insulative property of the fibre by incorporating a built-in air space. Wool like human hair is an outgrowth of the skin. It grows from the hair follicle which also has sebaceous glands attached and which serve the same function as those adjunct to human hair.

Molecular structure of wool

The protein fibre have complicated molecules composed of varying numbers and kinds of amino acids, which have combined to form long chains. 20 amino acids have been identified in wool. Larger amounts are glycine, alanine, serine and tyrosine. These are largely the group that form proteins called "keratin." Wool contains a large amount of glutamic acid (16%) has considerable amount of cystine, leucine, serine, arginine, aspartic acid, proline, threonine, glycine, tyrosine, valine and alanine. The general chemical formula for amino acids is:

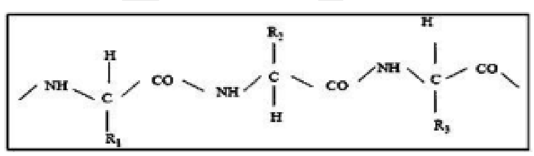
$$R-\underset{\displaystyle NH_2}{\underset{|}{CH}}-COOH$$

The folded chain structure of wool is believed to straighten out when pull or pressure is exerted on the wool fibre, and to revert to its original position when released. The unfolding refolding ability of the chain would account in large measure for the high degree of elasticity, elongation, resiliency, and crease resistance of wool fabrics. The side chains between molecules are believed to hook together to give still more resistance to packing or crushing. The cystine side chains, composed in part of sulphur are believed to form stable links at the sulphur atoms between different chains. Other linkages occur between molecular chains also but they are less stable than the sulphur bonds. The following diagram is a possible linkage between molecular chains, showing both sulphur and salt linkage as theorized by Astbury and Speakman.



Properties

Wool is said to be a poor conducter of heat. However, the amount of heat conducted along the fibre is not the important factor in the warmth of wool. Wool fibres do not pack well because of the natural crimp. This makes the wool fabric porous and capable of incorpoting much air giving the fabric a lofty hand.



Absorbency:

Absorbency is defined as the ability of a fibre to take up moisture and is expressed in terms of moisture regain, which is the percentage of moisture that a bone dry fibre will absorb from the air under standard conditions of temperature and moisture. Absorbent fibres make fabrics which are comfortable on hot humid days or in damp climate. Absorbent fibres do not build up static electricity, which also makes them more comfortable in dry cold weather. Absorbent fibres are hydrophillic or “water loving” while non-absorbent fibres are hydrophobic or “water repellent.”

Resiliency:

This is greater when it is dry. This property is important in the manufacture of fabric because it permits energetic mechanical treatments in finishing woollens and worsteds. Press retention is good. It holds crease well. Crease is set by moisture, heat and pressure. Wool fibres are weak but fabrics are durable.

Felting:

It is a term applied to progressive shrinkage of wool. Felting occurs when wool is subjected to heat, moisture and friction (conditions present at the underarms of sweater and shirt and soles of socks). To make felting possible a fibre must have a surface scale structure. Felting is also a disadvantage as it makes washing of wool difficult.

Amphoteric nature:

This means it will unite and react with both acid and basic dyes. Wool is very stable to acids but it is harmed by alkalies. In the manufacture of fabrics acids are used to remove cellulosic impurities. This process is called carbonizing.

Elongation:

Elongation of wool is 20 to 50% and both elongation and elasticity are higher when the wool is wet.

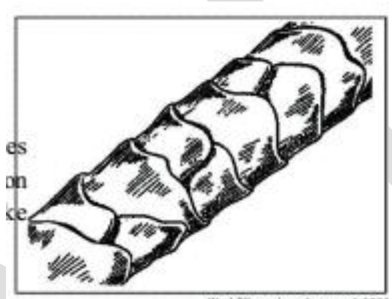
Processing

Shearing: It is the process of clipping the fleece from a living animal. Sheep are sheared once or twice a year, depending on their locality by travelling crews. An expert shearer can clip 100 to 200 sheeps a day. In most parts of the world shearing is done only once a year in late spring or early summer. Shearing is a high paying job in range areas. Skill is reqired to sheer the sheep and leave as much wool on its body to protect the animal from the sun and the rain.

Pulling: Pulled wool is obtained from animals which are sold for meat. The pelts are washed and brushed and then treated chemically to loosen the fibre. The yield of pulled wool is one fifth of sheared wool. Wool as it comes from the sheep is called *grease wool*, as it contains impurities such as sand dirt, grease and dried sweat. The grease in stages of purification is used for a wide variety of other commercial products, such as medicines softeners, toilet preparations. **Sorting:** Wool is sorted according to quality and dirt is removed by machine known as duster. The best quality of wool comes from the shoulder of the sheep and the sides of the sheep and the poorest quality from the lower legs.

Physical structure

Fibres of wool vary in length from 1 inch to 14 inches and in thickness from 10 to 70 microns. 18 to 30 micron fibres are used for clothing, coarser wool is used to make rugs. High quality wool does not imply high durability.



A hot 5% solution of alkali will destroy wool completely, as it disintegrates the fibre and it becomes slick, turns to a jelly like mass, and goes into solution. Alkali is sold in the market as lye.

The wool with a blend will dissolve leaving behind only the fibre that has been blended.

Natural protein Fibre – Silk

The manufacturing of silk dates back to 2640 B.C. Silk has been considered one of the most elegant and luxurious of fibres. It is still recognised as such all over the world. It is called the queen of all textile fibres. There are several species of silk producing caterpillars, but the mulberry silkworm, or bombyx morri produces most of the commercial silk fibre. These mulberry silkworms have been cultivated for many centuries. There are other associated varieties which live on the scrub oak and produce the fibre known as wild silk.

Antiquity

Silk was discovered by a Chinese empress in 2640 B.C. The Chinese carefully guarded the secret of the silk cocoon for 3000 years. They wove beautiful fabrics which were sold to Eastern traders at a high price. In 300 A.D., refugees from china took cocoons to Korea and started raising silk- worms. Japan learnt about silk from Korea. The industry spread through central Asia into Europe, and by the 25th century Italy was the silk center of Europe. This was later taken over by France in the 17th Century. Weaving of silk became important in England when the huge number of weavers emigrated from France to England in 1685.

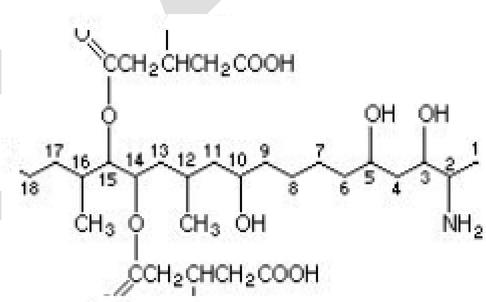
In India, Kashmir and Karnataka produce a lot of mulberry silk. Other varieties of silk Eri, Muga are produced in the northeast of India. Tasar silk is produced in Uttarakhand. India produces more than 7% of the worlds silk output. Production of mulberry silk in India has been on the rise and growth has been gaining momentum on account of abundant natural resources and cheap labour. Still techniques of cocoon production is considered to be of low level by international standards. Though 70% of the world mulberry silk is produced by China and Japan, India can boast of producing all kinds of silk viz. muga, mulberry eri and tasar. Presently eri silk is being produced primarily in Assam. Eri silkworms are hardier than mulberry silkworms and can be reared with greater ease.

Eri culture has a high potential as a subsidiary occupation to augment farmers' income in north-eastern India. Eri silk can be processed into the most comfortable warm clothing. Eri is also spun in combination with muga or tasar silk waste or cut cocoon to give a rigid texture and an attractive look for use in suiting or upholstery. Among the large varieties of silk goods produced in India for the domestic and export markets are:

- Mixed/blended silk fabrics.
- Dress material.
- Sarees.
- Scarves and stoles.
- Made-up articles like cushion covers and bed spreads.
- Silk carpets.
- Silk garments.

The world market for silk and silk products is a lucrative and growing one. Developing countries that already produce silk in various forms or that have the potential to do so should explore the requirements for products and develop market in this sector as one of the means to increase their export earnings. More than 90% of the world market for silk garments is accounted for by women's clothing. This covers a wide range of items from lingerie to high fashion evening wear. Silk goods for men include shirts, ties, socks, underwear and to a limited extent, knitted goods. The main importer of silk is U.S.A. to the tune of 25% of the total Indian silk exports, followed by Germany, U.K., Switzerland, U.A.E., Italy, Singapore, Japan, Canada, Austria. The Netherlands, Belgium, Poland, Australia, etc. The main items of export are dress material, madeup articles (pillow covers, cushion covers, scarves, curtains, bedcovers and silk paintings), readymade garments, sarees and ties. The items are mainly exported from New Delhi, Kolkata, Mumbai, Chennai and Bengaluru.

Chemical structure of silk



Approximately 66% of raw silk is the fibre of fibrion, 22% sericin, 11% water and 1% oil and colouring matter. In order to free the fibrion from its glue like case of serecin and render it capable of acquiring dyestuff and a satisfactory finish that will enhance the beauty and sheen of the silk, it is necessary to find a solvent for sericin. Silk like wool is a protein fibre. Therefore, it yields amino acid upon hydrolysis – CO-NH – groups. It is quite similar to wool in general behaviour.

Heat: Silk can be heated to a higher temperature than wool without disintegration. However, if white silk is held at 231° F for fifteen minutes it becomes pale yellow. For this reason, silk garments must be dried carefully after laundering and should be pressed quickly with an iron that is not too hot. Silk disintegrates above 330° F.

Silk is attacked by the ultraviolet rays of the sun and acid forming gases and moisture. Weighted silk is more quickly injured.

All the man-made fibres have some process in common. They have been produced from nonfibrous material, in the process loose their fibrous nature to being in viscous state to be reformed into fiber. This is done to by forcing the solution through the device called spinnerets. All the fiber then coagulates or hardens within a reasonable time after leaving the spinnerets so that they will not stick together and may be wound on bobbin or cones, or be deposited in pots as cakes of yarn to be readied for conventional processing into fabrics.

The non-thermoplastic group of man-made fibres include several subgroups: those of cellulosic origin, alginates, minerals, and protein based fibres. The largest group at present are the fibres of cellulosic origin all of which are identified as rayon in the Federal Trade Commission (FTC).

The non-thermoplastic fibres, except for the mineral fibres may be cared for much as cotton, linen, silk or wool whichever they most resemble, both in visible characteristics and in their reaction. They are not softened by heat so will not melt if ironed although they will scorch if ironed at sufficiently high temperature. As a group they are soft absorbent, pliable, comfortable to wear, do not pill, do not accumulate static charge and are not subject to attack by moths. In longitudinal view under the microscope, in common with most other man-made fibres they look alike. All appear as smooth rods, black specked if delustred but with no characteristic by which the individual fibres can be positively identified.

The Rayons (Cellulosic Fibre)

Rayon is a manufactured fibre composed of regenerated cellulose in which substituents have replaced not more than 15% of the hydrogen of the hydroxyl group. By this definition rayon includes viscose rayon, cuprammonium rayon, Fiber E fortisan, Topel, corvel Fiber Fm 27, Avril (Fiber 40, Zantrel). It is an interesting fact that much of the rayons' early development is tied to the attempt to develop filament for incandescent electric lamps, then newly discovered by Thomas Alva Edison.

Many developments of rayon explore in considerable detail the early suggestions and attempts for making artificial silk without the benefit of silk worm. Dr. Robert Hooke and Rene F. Reaumur who predicted such a possibility in 1664 and 1710, respectively. F. G. Keller (1840) inventor of a mechanical process for producing wood pulp, and Louis Schwabe (1840) who experimented with a crude type of spinneret for drawing thread for drawing various solutions through holes in thread form.

Nitrocellulose was the first to be produced successfully and commercially. The early history of this kind is of importance. In 1855, Georges Aeudamers (Switzerland) patented a process of transforming nitrocellulose solution into fine threads.

The rayon and staple fibre handbook has given this account of Chardonnet's work:

"From a textile point of view, Count Hilare de Chardonnet began his work in 1878 and obtained his first French patent on November 11th, 1884, cumulating all the efforts of his predecessors Hooke, Reaumur, Audamers Ozanam, Weston, Huges, Powell, Evans, Wynne, Crooks and Swinburne. His labour won him by general acclaim the title of 'father of rayon industry.'

How is rayon used?

Rayon and acetate both found usage in home furnishing 27%, juniors wear 17% and boys wear 9% and girls wear 2%. Most of the rayon and acetate was used for tires, cords, transportation upholstery, tents, carpets rugs, curtains, bedspreads, coats, knitted wear, woven underwear, suits, blouses, skirts and other items. A large amount went into nightwear and underwear. The rayon fibre has a number of properties in common with each other and with cotton and linen. They burn readily with a yellow flame and with the odour of burning paper or cotton leaving a little cobwebby residue which crumbles into fine, powdery grey ash. The rayon may be successfully fire retardant treated, they are all sensitive to acids but are not generally damaged by alkali. Most of them have low resiliency and elasticity and without special crease resistant treatments wrinkle considerably and need to be ironed frequently. Crease resistant treatments are very commonly applied to many of the fabrics made from these fibres.

Manufacturing process of rayon

Preparation of cotton linter cellulose: linter are small fibres adhering cotton seeds. They are removed after ginning. They are removed at the mill where the seed has to be used for oil and other products. All linters are removed from the process called mill run or in two ginning processes. If the two are used the first ginning cuts are used by the mattress industry or for cheap qualities of cotton fabric. The second and the shorter cut is less expensive and is cleaner. It becomes the cotton for chemical cotton, much of which is utilized in the man-made industry. The initial quality of the linters depends on their quality of the linters and the condition in which the seed has been received at the mill. Different lots of linters are blended to achieve a uniform quality of chemical cotton. The cleaned blended linters are carried to the digester where the fibres are mixed with dilute caustic soda solution (NaOH) then are carried into the digesters for cooking process. Temperature, pressure, time, and proportion depend on the product desired, all processes are carried out under carefully controlled conditions. At the right time the linters are removed from the digester and washed in soft water to stop the action of the alkaline solution. The cooked linters are then bleached with chlorine, rewashed thoroughly and dried. The method of utilizing these linters for the manufacture of linen differs for each process and the difference in method results in characteristic differences in the quality of fibres and hence fabric.

Spinnerets are also called spinning jets, must be made with extreme care and polished until no possibility of the slightest roughness remains anywhere. The instruments of making holes in the spinnerets are finer than the human hair and the holes should be uniform in size and exceedingly smooth. Spinnerets are made from platinum and platinum alloy for viscose rayon and other processes where fibres coagulate in chemical baths but may be made of steel or other metals for air or water coagulating processes.

Properties

Under the microscope in longitudinal view, viscose rayon fibres appear much as smooth glass rods although under high magnification striations may be visible parallel to the fibre length. In cross-section the fibres may be round, oval or flat but all show serrated edges. The typical serrated edge is a positive means of identifying the fibre.

Elongation varies from 9 to 30%. Rayon exhibits a property called creep or delayed elasticity. It takes days to get back in its shape after it has been stretched. Elasticity and resiliency both are low, so that rayon wrinkles badly unless treated with special finishes. Resin treatments on rayon are more successful than any other man-made fibre and is usually quiet permanent. The specific gravity of rayon is 1.52 about the same as cotton which is medium among fibres. It is very absorbent and exhibits about 11 percent hygroscopicity. It dyes in darker colours than cotton does. Dyes must be chosen carefully for mixtures and blends, or the rayon will have exhausted the dye even before the other fibre has had a chance of even getting wet. Rayon does not accumulate static electricity. Resin finishes may alter some of these properties. Viscose looses some strength on prolonged exposure to sun light. It is more resistant to light than silk but less than acetate orlan, and fortisan. Rayon can be satisfactorily laundered like cotton and can be ironed at the same temperature as cotton. Boiling and sterilising the fabric is not advisable. Clean dry viscose is not attacked by moth and mildew.

Properties

The microscopic appearance is different from that of viscose rayon. Rests of the properties are the same, microscope in cross-section, cuprammonium fibers appear as tiny, smooth featherless circles. White cuprammonium does not yellow with age because it has traces of copper remaining, it is more resistant to mildew and mould than other cellulosic fibers.

Uses

Cuprammonium rayon is used for sheer dresses and curtain fabrics, for tricot lingerie and hosiery. It is blended with silk and with cotton.

Man – made fibres

Man-made fibres were first made experimentally in Europe in 1857. Commercial production of man-made fibres began in the United States in 1910. Production of a new fibre is a long and expensive procedure. First, a laboratory research program is set to discover a new material. When a promising material is made it is patented to give the producer exclusive rights to the process for a period of 16 years. Laboratory procedures must then be converted into large scale production. This is usually done in a very small plant called a pilot plant.

All the man-made fibres have some processes in common. They have been produced commercially from non-fibrous material, or if fibrous to begin with, have somewhere in processing lost their fibrous nature and must then reform into fibre must then coagulate or harden within a reasonable amount of time after being extruded from the spinneret. After leaving the spinneret the fibres must be wound on bobbins or cones or are deposited in pots as cakes of yarn. The man-made fibres are divided into two groups: non-thermoplastic and thermoplastic. The non-thermoplastics form several subgroups, the largest group being of cellulosic origin, all of which are identified as rayon. The non-thermoplastic fibres except for the mineral fibres may be cared for much as cotton, linen, silk, or wool whichever they most resemble, in their visible characteristic and their reaction. They are not softened by heat, so they do not melt on ironing. As a group they are absorbent, pliable, comfortable, to wear, do not pill, do not accumulate static electricity and are not subject to attack by moth. In longitudinal look under the microscope they all look alike.

Although all the eleven fibre families differ in chemical composition and structure, they are grouped together because they have many common properties of which heat sensitivity is the most outstanding. These fibres are also referred to as synthetic or thermoplastic, or chemical fibres.

Heat sensitivity is that property of a fibre that causes it to shrink, soften, or melt when heat is applied. These properties are not common with cellulosic or protein fibres.

The fibres differ in their degree of heat sensitivity and even within a family the individual types may vary. For example, Orlon 38 type will shrink 20% or more when heat is applied. Whereas regular orlon has very little shrinkage. This high shrinkage property is used to advantage in factory process to create bulky yarn or to give three-dimensional effects in pile and upholstery fabrics. To create these effects blending is done with low shrinkage fibres. On applying heat these heat sensitive fibres cringe to give a buckle appearance.

Nylon

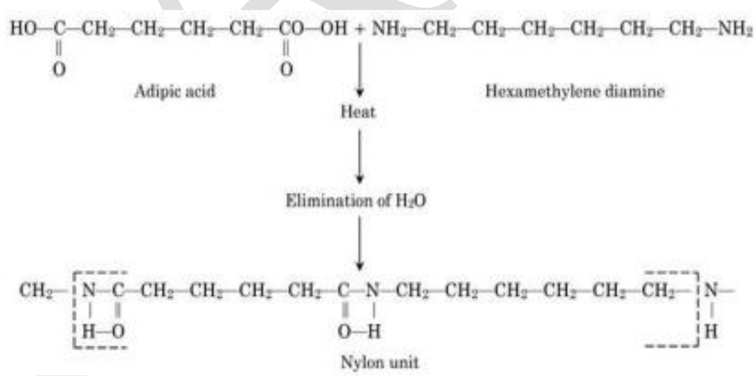
Nylon is a generic name applied to a number of related products. Nylon 6,6 was produced by the DuPont Company. It is a manufactured fiber in which the fiber forming substance is any long chain of synthetic polyamide having recurring amide groups as an integral part of the polyamide chain. Nylon is composed of carbon oxygen, hydrogen and nitrogen as are the protein fibers. But since it is not made of amino acids its properties are not like that of silk or any protein fiber. In chemical structure, it is composed of long straight chains with neither side chains nor crosslinkage. Thus, the chains pack closely together In the fiber, accounting for its smooth rather slippery quality.

Nylon is polymerised by condensation reaction, under pressure of adipic acid and hexamethylene diamine. The molecules of the two substance hook together alternatively (copolymerisation) that is a molecule unit of acid and a molecule unit of diamine, with the elimination of water. The following formula demonstrates the polymerisation of a unit molecule of nylon. Many such units make up the nylon molecule. The process is controlled carefully to stop polymerisation within a narrow range, or the chains would become too long to possess the characteristic desired in a textile fiber.

From polymerisation to cold drawing there are several steps in the production of nylon. The acid and the amine are put together in a huge kettle equipped with a stirrer, which mixes thoroughly, forming a salt, then the mixture and some water are fed into an evaporator where the solution is dried to a desired consistency and concentration of the salt. The concentrated salt solution is fed into a jacketed autoclave where a sequence of high temperatures and pressures induce copolymerisation of the two materials to molecular chains of the desired length. The water evolved from the autoclave is removed by evaporation. Nitrogen is bubbled through the autoclave to ensure that air does not get in and the newly formed nylon gets exposed to oxygen. From a slot at the bottom the molten nylon resin is extruded in the form of a thick, white, translucent ribbon and a spray of water cools the ribbon and causes it to harden as it is carried away from the autoclave to a casting wheel. The ribbon has an appearance similar to white taffy and is quiet hard.

The next step is to break the ribbon up in to small pieces in a chipping unit, ready for forming into fibers. The process for spinning nylon is melt spinning. Nylon is composed of carbon hydrogen, oxygen and nitrogen as are the protein fibers, but since it is not made up of amino acids its properties are not like those of protein substances. In chemical structure it is believed to be composed of long straight chain molecules with neither side chains nor cross-linkages. Thus, the chain packs close together in the fiber accounting for its smooth slippery quality.

Nylon 6,6 is produced from an acid and a diamine which has in turn been produced from other material actually going back to petroleum and coal tar derivatives. Nylon is polymerised by condensation reaction under pressure of adipic acid and hexamethylene diamine. The molecules of the two substances hook together alternatively (copolymerisation) that is a molecule unit of acid and a molecule unit of one diamine then acid again and so on repeatedly with the elimination of water. Many such chains makeup the fibre. The process is controlled carefully to stop polymerisation within a narrow range or the chain would become too long to posses the characteristic desired in a textile fiber.



Cold drawing is the process that gives nylon many of its qualities for which it is most noted, that is great strength, toughness, elasticity, abrasion resistance. Drawing is carried out as for other fibres by passing the filament over rollers which revolve at different controlled speeds. Nylon is drawn three to seven times its original size. Drawing orients the molecular chain in the direction of the fibre axis, lines the chain up parallel to each other and permits a high degree of crystallinity of the fibres. Crystallinity tends to give a rigid structure to the fibres. Despite drawing the nylon fibre still retains greater elasticity than most other fibres. After drawing, nylon may be given an oil or antistatic spraying, twisted and heat set before being wound on the bobbins for weaving knitting or lacing. Heat setting is necessary to stabilize nylon in shape and dimensions. Nylon may be stabilized yarn, as woven or knitted fabric or as a knitted garment.

Properties

Nylon has a somewhat cool clammy feel in filament form. Some people like this feel and others dislike it as much. Nylon is lustrous, white fibre, transparent to translucent, that can in common be made in varying diameters, lengths and degrees of abrasion resistance and lustre. Its translucency has led to dissatisfaction at the consumer level. Nylon is both tough and pliable. Nylon does not flame readily, but burns slowly or fuses and drops off if flame is applied to it. It burns with the odour of cooking green beans or celery and as it burns or melts forms a waxy roll along the edge which becomes hard and tough as it cools. Regardless of the colour of the nylon fabric the curled, waxy edge is a light tan colour after burning. Although nylon may be termed non-flammable, the fusing and dropping off present a great hazard in many ways. Finishes may change this quality of nylon as it does for other fibres.

Nylon is potentially the strongest of fibres. The wet strength of nylon is 85% of dry strength. Elongation is 18 to 37 percent. Nylon has a specific gravity of 1 to 1.4. Absorbency is low. Hygroscopicity is 4 percent. The low hygroscopicity amounts to accumulating static electricity. Nylon is somewhat rigid and does not drape as well as the acetates or silk. It is quick drying. Does not stain readily, it tends to pick up colour grease and soil in laundering with other garments, therefore white and pastel nylon needs separate laundry. Nylon is not affected by cold temperature but looses strength and yellows at sustained high temperatures. Ironing should be done at low temperature to prevent softening, glazing or melting and eventual discolouration. Nylon possesses a fair wrinkle resistance and crease recovery. It has excellent abrasion resistance, because of its strength and elasticity it is considered a very durable fibre. Nylon is degraded by exposure to sunlight, it leads to considerable loss in strength in a short time. It is very less sensitive to light degradation than silk.

Polyester Fibres

Dacron was the first polyester fibre introduced in 1953. Exclusive patent was given to DuPont Co. of England. It is a long chain polymer composed of 85% by weight of an ester of dihydric alcohol and terephthalic acid (p-HOOC-C6H4-COOH). Dacron found immediate acceptance in easy care, wash and wear garments such as tricot blouses and men's shirts. Comfort properties were improved by blending cotton in Dacron with 65% Dacron and 35% cotton. In 1959, three new polyesters hit the market.

Fortrel: Formerly known as teron, is produced under license by fibre industries. **Vycron:** It is produced by Beunit Mills and Co.

Kodel: The third fibre was developed by the Tennessee Eastman Co. and is fundamentally different from other polyesters so no license arrangement was needed.

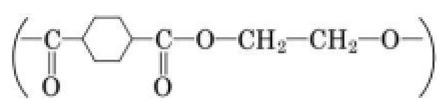
Manufacture

The manufacturing of polyester fibres is quiet similar to nylon. Both fibres are melt spun. Ethylene glycol and terephtlalic acid are polymerised at high temperature in a vacuum kettle. The polymer is a pasty substance which is extruded as a ribbon and cooled on a casting wheel as a white porcelain like substance. The ribbon is put through a chipping unit, dried and led into a hooper. The polymer is solidified and cut into cubes which are melted and spun into fibers. The fibers solidify in air and they are then hot stretched to orient the molecules and reduce the denier of the fiber.

The fiber is heat set before use. Polyester fibers are produced in filament and staple form in bright and dull lustres in regular and high tenacity strength and can be solution dyed.

The molecule unit of Dacron is heavy stiff and resilient. They resist bending but recover from bending quickly. The molecule chains are held together by numerous bonds of such a nature that they cannot be relaxed by moisture, hence the fabric has good wrinkle recovery.

Appearance



The fibre has a smooth rod like shape which is typical of melt spun fibres. Dacron 54 has a ribbon like shape which blends better with cotton. Dacron 62 has a trilobal shape which is similar to silk. Although nylon and the polyesters burn alike in some ways they can be distinguished in some ways by the odour and smell with which they burn. Both are relatively non-flammable in the unfinished state. Both form tan beads when the melt hardens. Some dyes may however cause a darker bead to form. Polyesters have an aromatic odour, and a dark black soot. Nylons odour is celery-like and the smoke is white.

Dacron type 62 is trilobal with a silk like appearance. It is more susceptible to acids and alkalies and dyes more readily than other regular Dacron.

The man-made fibres lacked the unique combination of aesthetic properties of silk. Dacron and nylon achieved that goal. The processing of Dacron was changed to finish that goal. Man-mades are processed under tension by a continuing process rather than a batch processing method. The Dacron fibre was processed under very relaxed conditions. Finishing started with a heat setting process which stabilizes the fabric to control width, removes any wrinkle and imparts resistance to creasing.

The caustic soda treatment is given. In this treatment, part of the fibre gets dissolved away like serecin of silk. As a result the fabric structure is more mobile. To get weave crimp, the remaining finishes of bleaching, colouring, washing and a final heat setting is done to fix the colour and assure stability and are all done with the fabric under completely relaxed conditions.

The trilobal shape has resulted from the shape of the holes in the spinneret. Melt spun fabrics posses the ability to retain shape of the spinneret holes. Dacron has found usage in bedding, furniture, pillow fillings. It can be sterilised, so it has found usage in hospital bed fillings and pillow fillings.

Properties

Pilling is a common problem with Dacron fabrics. They require blending with cotton and also finishing treatment to combat the pilling problem.

Singeing is the most sought after finishing method to burn of the linters on the surface of the fabric. The double flame burns off the fuzz giving the fabric a neat appearance. When cooled the fibres are set and locked in the yarn and the fabric structure. Both treatments improve the hand and heat-setting improves drape and wash and wear performance. Dacron is an opaque white fabric with high strength and elongation of 20 to 48%. The specific gravity is 1.38, because of its strength it can be drawn into a very fine fabric with fine diameter. It can make very sheer fabrics.

The polyesters are more electrostatic than other fibres and hence they attract more dirt quickly giving an untidy appearance. Colour crocking is another disadvantage with many printed Dacrons. Dacron has an affinity for oil. The collar of the garment absorbs so much oil and grease that when it is washed the colour of the collar also faded rendering the garment unuseable. Dacron has however been popular in curtains because it has good light resistance. Wicking is a property that makes Dacron quick drying and easy to maintain. Dacron melts at 480 degrees. It has a good resistance to some of the weak acids even at boiling temperature. It is degraded by concentrated sulphuric acid. It is not affected by bleaches.

POSSIBLE QUESTIONS

UNIT-I

PART-A (20 MARKS)

1. Define fiber.
2. Write the chemical composition of jute fiber.
3. How will you prepare nylon 6,6?
4. What are the main classification of fibers?

(Q.NO 1 TO 20 Online Examination)

PART-B (2 MARKS)

PART-C (6 MARKS)

1. Write notes on the production, properties, structure and uses of silk.
2. (i) What are the different types of nylons?
   (ii) Give an example for polyamide fibre. Write the preparation, properties, uses and chemical structure of Nylon.

3. Explain in detail for the removal of impurities in raw cotton.
4. Write short notes on i) scouring ii) Bleaching iii) desizing iv) kierboiling v) chemicking
5. i)Define – Fibre. What are the general uses of fibers?
   (ii) Write the preparation and uses of any one poly ester fiber?
6.

KAHE

S.No	Question	Option 1	Option 2	Option 3	Option 4	Answer
1	Fibre obtained by chemical treatment of wood pulp is called?	Natural silk	Rayon	Nylon	Polyester	Rayon
2	What is the full form of FSP?	Fiber suction point	Fiber soft point	Fiber saturation parcel	Fiber saturation point	Fiber saturation point
3	Which one is stronger than steel wire?	Cotton fibre	Silk thread	Plastic thread	Nylon fibre	Nylon fibre
4	Which polyester is used for making bottles, utensils, films?	Leather	Nylon	PET	Plastic	PET
5	Muga is the strongest variety of-	cotton	silk	wool	None of these	silk
6	You must not wear synthetic fibres while working with fire because of what?	They make you feel cold and so you may get a frost-bite	They are lustrous and so they shine under the flame	They melt on heating ans stick to your body when they cath fire	None of the above	They melt on heating ans stick to your body when they cath fire
7	Which synthetic fibre is used for making woollen clothes?	Acrylic	Polyester	Fibre	Cotton	Acrylic
8	Synthetic fibres are made using which raw material?	Woolen products	Polymers	cotton	Petrochemicals	Petrochemicals
9	Which is used commonly for making parachute ropes?	Polyethylene	Polyester	Nylon	Silk	Nylon
10	Which is a popular polyester?	Plastic	Rayon	Polyethylene	Terylene	Terylene
11	The fibres which are obtained by blending natural and synthetic fibres are called?	joint fibres	mixed fibres	real fibres	artificial fibres	mixed fibres
12	Which of the following is used for making gunny bags?	Cotton	Jute	Wool	Polyster	Jute
13	In which of these states does the jute plant grow?	Punjab	West bengal	Tamil nadu	Kerala	West bengal
14	Which one of the following is not a	Cotton	Nylon	Flax	Wool	Nylon

	natural fibre?					
15	Yarns is made from very thin strands called?	Fibres	Looms	Silver	Weft	Fibres
16	Polyester is referred as?	Dupont	Work horse	Cellulose acetate	Acrylic	Work horse
17	The fabric come out from the loom is known as?	Grey goods	Gray goods	Mercerized good	None of the above	Grey goods
18	Kevlar is commercial name for what?	Glass fibers	Carbon fibers	Aramid fibers	Cermets	Aramid fibers
19	Pick the synthetic fiber of the following?	Cotton	Nylon	Jute	Wool	Nylon
20	Which of the following is a source of rayon?	Wool	PET	Wood pulp	Silk	Wood pulp
21	Polycot is obtained by mixing of	Nylon and Wool	Polyster and Wool	Nylon and Cotton	Polyster and cotton	Polyster and cotton
22	Which is a thermosetting plastic?	Melamine	Polythene	PVC	Nylon	Melamine
23	The material similar to silk appearance is	Nylon	Rayon	Polyester	Terylene	Rayon
24	Woolen fibre is	cellulose	sericin	polyester	keratin	keratin
25	The material which is commonly used for the preparation of kitchen containers is?	PVC	Acrylic	Teflon	PET	PET
26	Nylon is a/an?	amides	peptides	polyamides	polyesters	polyamides
27	What could increase the fiber surface area?	Decrease inter-fiber bonding	Increase inter-fiber bonding	Decrease intra-fiber bonding	Increase inter-fiber bonding	Increase inter-fiber bonding
28	Which bonding holds ligo cellulose fibers together in paper?	Sulfate	Hydrogen	Halogen	Phosphate	Hydrogen
29	What is the pure form of Cotton?	Protein	Vitamins	Cellulose	Pulp	Cellulose
30	Which of the following is a fiber mat made using synthetic fibers?	Grasses	Canes	Reeds	Nonwovens	Nonwovens

31	Which are utilized in products such as battery separators, glass fiber filter mats, and as reinforcement in a large variety of reinforcement materials?	Glass fibers	Ceramics	Thermosetting tissue	Pulpwood	Glass fibers
32	Nylon 6 is obtained from which raw material?	Caprolactum	Hexanoic acid	Adipic acid	Ethylene	Caprolactum
33	Which is very utilized in the determination of isolated fibers?	Spotting	Pitting	Gourding	Lightening	Pitting
34	Cotton is affected by ?	alkalies	strong acids	cold dilute acids	all the above	strong acids
35	“King of fibres” are?	cotton	jute	silk	nylon	cotton
36	What is Sunn?	cellulosic fibre	protein fibre	minarel fibre	Rubber	cellulosic fibre
37	Which is synthetic fibre?	silk	jute	wool	rayon	rayon
38	Which fibre is used as artificial wool?	Nylon	Rayon	polyster	Acrylic	Acrylic
39	Which one is biodegradable?	cotton cloth	metal cans	plastic bags	aluminium foil	cotton cloth
40	The direction in which the yarn is passing in the fabric?	Fiber	Grain	Length wise	Cross wise	Grain
41	Any product capable of being spun/ woven or otherwise made into a fabric is?	Fiber	Yarn	Tread	Cotton	fibre
42	Find the odd one out.	Cotton	Jute	linen	Silk	Silk
43	The basis of poly propylene fibers are ?	methane	propane	propylene	ethane	propane
44	The secondary property of a textile fiber is?	tenacity	luster	flexibility	uniformity	luster
45	Fibers that are measured in centimeters or inch are ?	staplefibers	filament fibers	shorfibres	long fibres	staplefibers
46	Fibres that are measured in miles or	staplefibers	filament fibers	shorfibres	long fibres	filament fibers

	kilometers are ?					
47	Tenacity is the term usually applied to the strength of ?	Fiber	yarn	fabric	cotton	Fiber
48	The primary property essential for a fibre is ?	lustre	density	length to width ratio	resiliency	length to width ratio
49	Lustre of fibres can be reduce through the addition of ?	sodium hydroxide	titanium dioxide	diphosphate	pottasium dichromate	titanium dioxide
50	The ability of a fiber to return to shape following compression, bending or similar deformation is termed as ?	elastic recovery	elongation	resiliency	spinning quality	resiliency
51	When the fibre molecules are arranged in random then it is?	high orientation	Low orientation	crystalline	amorphous	amorphous
52	Which part of the jute plant does give fibre?	Root	Stem	Leaf	Flower	Stem
53	The leaf fibre is?	Cotton	palm	jute	kapok	palm
54	Which fibre is popularly called 'Golden fibre'?	Cotton	Silk thread	Jute	flax	Jute
55	In fabric form jute is frequently called ?	blended fabric	burlap	Jute	kenaf	burlap
56	What is the other name for artificial silk?	Nylon	Rayon	Acrylic	polyster	Rayon
57	The strongest synthetic fibre is?	Nylon	Rayon	polyster	Acrylic	Nylon
58	Synthetic fibres synthesised from raw materials are called?	Jute	rayon	petrochemicals	bakelite	petrochemicals
59	Which of the following is natural fibre obtained from plants?	cotton	wool	rayon	nylon	cotton
60	The fibre abaca is obtained from?	sisal	banana	pineapple	jute	banana

UNIT I

SYLLABUS

Dyeing Process: Impurities in raw cotton and grey cloth, wool and silk- general principles of the removal – scouring – bleaching – desizing – kierboiling- chemicking.
Dyeing - Dyeing of wool and silk –fastness properties of dyed materials – dyeing of nylon, terylene and other synthetic fibres.

Introduction:

Raw wool contains 40% or more by weight of impurities in the form of waxes, suint, cellulosic material such as straw and dried grass, dirt, and proteinaceous material. Besides, during spinning and weaving other impurities are added.

- Wool waxes are recovered from the grease during scouring. These waxes are comprised of a variety of monocarboxylic, dicarboxylic and hydrocarboxylic acids as well as steroidal alcohols. It has been determined that unscoured wool contains an unoxidized fraction of wool grease and other contaminants that is easily removed and readily recoverable and an oxidized fraction at the tip of the hair that is difficult to remove and separate from other oxidized contaminants.
- Suint is usually considered to be a variable composition of water-soluble materials that is readily removed by scouring.
- The dirt that is removed from the scoured wool consists of both inorganic and organic materials.
- The proteinaceous material has recently been discovered to consist of skin flakes from the sheep and soluble peptides.

The process that can remove the impurities has various steps:

1. Wetting:

The first treatment given to wool is wetting. This treatment releases latent strains and gives permanent set provide, wet treatment is not done at temperatures higher than that used in crabbing.

2. Crabbing:

This treatment is given to woolens to eliminate the tendency to cockle or distort. The wool is wound tightly on a roll which is made up of iron. The roll is a perforated cylinder covered with cotton cloth in order to prevent staining. It is rotated during treatment. Steam is passed in the cylinder at 40-150 lb/inch square pressure (as and when required). Now the wool is unwound and rewound, so that the outer roll of wool after crabbing becomes the inner roll, and steam is passed again, steaming enhances affinity of wool for dyes. The pH value of crabbing water determines the setting of wool. A low pH produces little setting and maximum degree of setting is attained at pH 10.2.

3. Scouring:

Scouring of wool differs from cotton. Firstly, wool contains a high percentage (30-60%) of wool grease compared with 0.5% of oil and wax in cotton. Secondly, wool is degraded rapidly with alkali, hence it saponification of oils, and fats is to be done with alkali; it should be done very carefully and below the boiling temperature. Sodium hydroxide is replaced by sodium carbonate, ammonia or ammonium carbonate. Raw wool is scoured by the counter current method, using a machine with four or five bowls arranged in a sequence, so that the wool passes directly out of the first into second and so on. Each bowl has a wringer at the exit, a false bottom and rakes. Below the false bottom is a spirally fluted shaft which rotates and carries the deposited solid dirt to the central outlet for discharge. The rakes make the wool travel forward, beneath the surface of liquor and also agitate to keep the dirt and emulsified grease in suspension. The scouring liquor falls back in the bowl after the wool passes through the wringer. The process is repeated at each bowl. Finally it is washed in water.

	Soap In Solution	Sodium Carbonate	Temperature
First bowl	2-3%	3-4%	49-52°C
Second bowl	1-3%	2-3%	46-49°C
Third bowl	1-1.5%	1-2%	43-46°C
Fourth bowl	water only	-	40.5-43°C

The pH should never be above 10. Soap reacts with hard water and precipitates calcium and magnesium salts, hence they have been replaced by synthetic detergent, and moreover syndents are more Gardinol and Teepol. There are stable to hard water and acids and are not used up at all during scouring and can be reused. Moreover some pressure on wet wool in presence of soap can felt it which is not desirable.

	Synthetic Detergent	Sodium carbonate	Common Salt	pH	Temperature
First bowl	0.25%	0.25%		9.0	54°C
Second bowl	0.2%	0.2%	0.4%	10-10.5	52°C
Third bowl	0.12%	0.02%	0.5%	10	49°C
Fourth bowl	0-0.1%	0	0	-	46°C

After every 1000 lb of 454 kg of wool have passed over, the bowl should be fortified. Woven piece goods and knitted wool fabrics are sewn together to form an endless rope. These contain much less fats etc. and scoured with 0.5% soap solution or surfactant at 40C. If alkali is required, ammonia is preferred.

4. Carbonizing (removal of burrs):

Burr is mainly cellulosic material. Some cellulosic materials which form burr on the animal have to be removed. The method consists of hydro extracting with 6-8% H_2SO_4 then drying at 60-70C, heating at 105-110C and finally raising the temperature to 150C. After carbonizing fabric is passed through milling machine when hydrocellulose and hemicelluloses falls down, thus removing all vegetable impurities from wool.

5. Milling:

It is done after or before dying process of milling is based on proper of wool, that when it is wet and subjected to pressure it felts permanently specially in presence of soap, alkali and acid. Felting gives denser or more durable fabrics of more pleasing appeal. Milling can be of three different types: soap, grease, and acid.

6. Bleaching:

Yellowish color on the fabric may be removed only if the goods are to be sold as white or light colors where as for dark colors are washed by dye. Bleaching can be done by

• *SO_2:* It is a cheap process known as staving. In this case sulphur is burnt in chambers where the wool is hanging in loop form on wooden poles. Sulphur forms sulphur dioxide which acts on the yellow coloring matter.

• *Hydrogen peroxide*: It gives a better white light out. Fabrics are treated in winch machine i.e. without tension. Hydrogen peroxide contains acid for preservation hence sodium silicate is added to neutralize. (I.e. it acts as buffer to stabilize). Hydrogen peroxide is heated to 40-50C. The materials are left overnight in the bleach liquor for complete bleaching wash the fabric with water and then with dilute acetic acid, again wash with water. This is preferred to staving. Heavy weight woolens are given this treatment on a jigger machine. Cloth is rolled on rollers A and B, roller C can be shifted from roller A and B squeezing. Cloth moves from A to B a number of times. Jigger washing is done (by changing the bath) then wool is dried. When bleaching is done on jigger machine the strength of H_2O_2 should be 4-5 times higher than for light out fabrics as on a winch machine.

Definition of Bleaching

A process of whitening fibres or fabrics or depriving a colored material. This is brought about by using various bleaching-agents. Generally chlorine is used for cotton and other vegetable fibers and peroxide and sulphur dioxide for animal fibers.

Bleaching of cotton

Cotton is bleached in the raw state (as yarns) or in piece. The impurities present are cotton wax, fatty acids, peptic substances, coloring matters and albuminoids (another mineral matter). Although these are do not amount to more than 5% of the weight. Bleaching of cotton is comparatively a simple process, the main operations being:

- Boiling with alkali.
- Bleaching the organic matters by some bleaching agents.
- Souring treatment with dilute H_2SO_4 or HCl.

Loose cotton

In this process, the necessary operations are:

- Steeping in warm solution of soda for some hours.
- Washing.
- Bleaching powder treatment or sodium hypochlorite.
- Washing.

- Souring with dilute acids.
- Washing free of acids.

Cotton yarns

In principle the process employed for yarns is the same as for loose cotton, but this requires different machinery:

- Boiling in alkaline lye. This is carried out in kier-boil (6 to 8 hours) in alkaline lye (3% soda ash or 2% caustic soda on weight of cotton).
- Washing.
- Bleaching powder solution 2% Tw treatment contained in stone cistern which is provided with a false bottom.
- Washing.
- Souring with dilute acids HCl about 2% Tw.
- Washing to remove traces of acids.
- Optical bluing.

The bleaching of cotton yarns is a very straight-forward process and with reasonable care, is almost foolproof.

Cotton-pieces

By far the largest bulk of cotton-goods are bleached in the piece as this happens to be the most convenient form, the principle is similar to yarn-blending but here some alter-actions and additional operations have to be performed. These are necessary to remove factors like sizing and other chemical substances which are generally added in sizing or weaving operations. The sizing materials are starches, farinas with other substances like tallow, $ZnCl_2$, soaps, $MgCl_2$, etc., and sometimes some mineral oils. All these materials have to be completely removed if perfect results are desired. So two steps viz. singeing, and desizing become necessary.

The surface of the fabric, coming from weaving dept has a downy appearance as it is covered with nap and loose fibres. A clean surface of the fabric is absolutely necessary for further operations. The napping must be removed first, and this is achieved by singeing.

Singeing

The cotton-pieces are run at full width through the singeing machines, over a non-luminous gas flame.

Grey-washing

The operation simply consists of running pieces through ordinary washing machines. In order to wet these out on leaving the machines, these are piled in heaps and left as such overnight when fermentation sets in which results in hydrolysis of starch and renders it soluble in water.

Treatment with alkaline-charge (NaOH + Na_2CO_3)

In this operation the pieces are first run through alkaline of strength of about 4% of the weight of charge. They are run into kier. After this the pieces are run through continuous washing machine with plentiful supply of water.

Grey-souring

In this operation, the goods are run through a washing machine containing HCl of strength of 2_0 Tw. Object of this is to remove the lime completely. The goods are then well washed.

Chemicking

The pieces are then washed free of alkali and the bleaching proper or chemicking follows. This operation is effected in various ways. The most efficient or effective being to run the goods in a washing machine through bleaching powder solution (1_0 Tw), and allow them to lie loosely piled up overnight. The goods are then washed and run through very dilute solutions of acids (at 2_0 Tw), called white-sour and again washed thoroughly to free them completely from acids as otherwise this results in tendering of fibres. The next operation of bleaching is scotching or opening the cloth out from rope form to its full width. After scotching the opened cloth is dried on drying machine.

Dyeing process:

Dyeing Polyester with Disperse Dyes

Polyester requires the use of disperse dyes. Other types of dyes leave the color of polyester almost entirely unchanged. While novices happily charge into dyeing with acid dyes (for wool or nylon) and fiber reactive dyes (for cotton and rayon), often with excellent results, the immersion dyeing of polyester is a different story. However, disperse dye can be used by even young children to make designs on paper, which can then be transferred to polyester fabric, or other synthetics, with a hot iron. The possibilities are endless, using fabric crayons, rubber stamps, painting, and even screen printing.

Dyeing of polyester

Commonly, people who have never dyed anything before will e-mail me asking how they can dye dresses for their weddings, or their daughters' weddings. Attempting to do this would almost always be a grave error. Immersion dyeing with polyester is not a job for beginners; it is both more difficult and more dangerous than immersion dyeing cotton or wool. Furthermore, most such pre-made dresses are marked "dry clean only", and you simply cannot dye a garment that is not washable.

Immersion dyeing polyester

The difficulty with polyester dyeing is that it requires a lot of heat to get the dye into the fiber. Boiling water is not hot enough to do the job by itself, so a noxious-smelling carrier chemical must be added, for immersion dyeing, unless newer low-energy disperse dyes are used. Polyester dye actually transfers to the fibers best at very high temperatures, the temperature of a hot iron, or higher. Before you decide to try immersion dyeing polyester, study the directions at ProChem (see below, under "Specific Instructions") to get an idea of how difficult it may be.

Novel forms of disperse dyes

However, even if you should not attempt to dye your own formal dress, there are many fun projects that are highly suitable to even the least experienced fabric artist.

Crayons

Crayola, the maker of wax crayons for paper, also makes fabric crayons for use on polyester and other synthetics. These crayons consist of disperse dye, and can be found in most fabric or crafts stores, even in discount department stores such as Target or WalMart. You do not draw directly on the fabric; instead, you draw on paper - or have your children draw on paper! - and then iron the resulting pictures onto the fabric. (Be sure that any writing is backwards on the paper, since it will come out reversed on the fabric.) The crayons are not particularly bright on paper, but become vivid when heat-transferred to the fabric. For an example, see my page Iron-on Fabric Crayons for Synthetic Fibers.

Stamp Pad Ink

Disperse dye can be applied to paper with rubber stamps, and then ironed on to polyester, just like the crayons. You can use special, large-scale fabric stamps to apply other dyes to fabric, but only disperse dyes allow such fine lines that almost any rubber stamp designed for use on paper will work, if your fabric is smooth enough. Look for a product called "Heat Set Ink" at companies that sell rubber stamping supplies. Caroline Dahl's wonderful book Transforming Fabric gives source information for this material, in addition to many project ideas and beautiful inspiring photographs of works made with disperse dye on polyester.

Iron-on paintings - watercolor painting, hand painting, screen printing:

The powdered disperse dye can be mixed into paint to apply directly in any of several techniques. Just as with the Crayola fabric crayons, you can use disperse dye to paint on paper, then iron it on to your fabric. Mix the dye with enough boiling water to dissolve it, then dilute with cool water to the desired strength - trial and error must be your guide here, keeping in mind that you cannot know how intense the final color will be until you actually iron it on, as it is much more beautiful on the cloth than on the paper. See the Batik Oetoro web site and Prochem's instructions for transfer printing (via the links below) for detailed directions. If, like most irons, yours has holes in its face plate, you must be sure to move the iron around constantly during the transfer process, to prevent holes from appearing in your design, and yet you must not allow the paper transfer to move on the fabric, or the image will be blurred. A heat transfer press, such as are used in tshirt shops, would be more desirable, as it not only lacks holes, but, more importantly, reaches a higher temperature. However, at around a thousand dollars, this is far more of an investment than most individuals are prepared to make. For a more modest sum, consider the Dry Iron, without steam holes, at the Vermont Country Store's website.

Resisting dye transfer:

Here's a very simple project that can be done with disperse dye - simple in concept, that is, but very complex and beautiful in its details. As pictured in Kate Wells' Fabric Dyeing & Printing, artist Sarah Batho applied disperse dye paint to paper (you could equally well color it heavily with Crayola fabric crayons), scattered real bird feathers across her polyester fabric, then ironed the dye right over the feathers. The feathers prevented the dye from reaching the fabric, leaving a lovely delicate design of white feathers on an intense blue background. A consistently inspiring fabric artist and author, Carolyn Dahl, wrote a book called Natural Impressions: Taking an Artistic Path Through Nature with many inspirations as to the use of natural materials in applying designs to cloth; while it does not mention disperse dyes on polyester in this book, as far as I recall, some of the leaf projects, in particular, might be perfect for a similar technique. (I love Dahl's books, and recommend them highly.)

How to Tie Dye Polyester:

Tie-dyeing polyester is not a project for the novice tie-dyer. Only a real expert should even consider it. If you are just starting out, please try dyeing with fiber reactive dyes on cotton, rayon, or silk, first.

KAHE

Immersion Tie-dyeing:

Traditional single-color tie-dye can be done by tying the dry garment, then dropping it into a hot immersion bath. See the links for directions for immersion dyeing, below. You can get interesting results by tying and dyeing once, washing out, and retying in a different pattern before dropping in another boiling dye bath of a different color. For example, a first dyeing of turquoise followed by another dyeing with fuschia will produce a purple garment with patterns of turquoise and fuschia where the ties prevented full penetration of one of the dyes. Interesting shiborit-like textures result from boiling tied polyester.

Direct Application Tie-Dyeing:

ProChem's instructions for direct application on polyester (see link under "Specific Instructions", below) can be used for a more challenging approach that will give results similar to the currently popular cotton tie-dye techniques. After applying a paint that contains special thickener paste, citric acid, dye carrier, and disperse dye, steam or pressure steam for 30 to 60 minutes to set the dye in the fabric.

Sources for Disperse Dye:

As dyeing polyester is far less popular among artists and craftspersons than the dyeing of cotton or wool, there are fewer providers of disperse dyes for home or studio use. Among them are, in the US, PRO Chemical and Dye (PROchem), and Aljo Dyes, Batik Oetoro and KraftKolour in Australia, and Kemtex and Rainbow Silks in the UK. Dye suppliers that sell Jacquard Products may carry their brand of disperse dye, iDye Poly. Some suppliers label their disperse dyes as "transfer dyes". For contact information, see Sources for Dyeing Supplies.

Specific Instructions Online:

PROchem provides excellent technical support for their products, including online explicit directions for dyeing synthetic fibers with their PROsperse line of disperse dyes:

- Solid Shade/Immersion on Polyester
- Solid Shade/Immersion on Nylon/Acetate
- Solid Shade/Immersion on Acrylic

- Painting & Printing/Direct Application on Polyester
- Painting & Printing/Direct Application on Nylon
- Transfer Printing

The other US source of disperse dyes, Aljo Dyes, provides a small amount of information, as well:

Other names for synthetic fibers:

Polyester fibers are sold under various names, including the following: Crimplene, Dacron, Enkalen, Lavsan, Mylar, Tergal, Terlenka, Terylene, Trevira, Polarfleece, and Polartec. Polyester is, chemically, a fiber made of poly(ethylene terephthalate), and can be made from recycled plastic bottles. Plastics marked with the recycle logo containing a number 2 are HDPE (high density polyethylene), plastics marked with the recycle logo containing a number 4 are LDPE (low density polyethylene), and plastics marked with the recycle logo containing a number 1 are PETE (polyethylene terephthalate - e.g., Dacron, Fortrel, Mylar). A new polyester, called Corterra®, was developed in the 1990s by Shell and licensed by KoSa; it is composed of polytrimethylene terephthalate, and is dyed with disperse dyes like other polyesters.

Nylon

Nylon, chemically a form of polyamide, is sold as Antron. The form described as Nylon 6,6 is stretch nylon, sold as Ban-Lon and BriNylon. Nylon 6 (polycaprolactam) is sold under the names Akulon, Amilen, Carpolan, Enkalon, Grillon, and Perlon. Nylon 11 is sold under the name of Rislan.

Polypropylene should not be dyed at home or in the studio. It is popular for hiking socks and long undergarments. Names under which it is sold include Meraklon, Monolene, Polyfilene, Prolene, and Ulstron. Products marked with the recycle logo containing a number 5 are polypropylene.

Polyvinyl chloride. Products marked with the recycle logo containing a number 3 are PVC.

Acrylic is sold under names such as Orlon, Courtelle, Dralon, Leacryl, and Nitron. It is composed of poly(propenonitrile)(polyacrylonitrile) with small amounts of a comonomer. Acrylic can be dyed to pale or medium shades with disperse dye.

Modacrylic is sold under names such as BHS, Creslon, PAN, and Teklan, and also, according to Ingamells, as Lycra (which must have been a misprint). Modacrylic fibers are between 35% and 85% acrylonitrile, and are made from resins that are copolymers (combinations) of acrylonitrile and other materials such as vinyl chloride, vinylidene chloride or vinyl bromide. Modacrylic can probably be dyed just like acrylic.

Lycra, a spandex fiber produced by Dupont, is elastic spun polyurethane, a plastic which is also used to construct upholstery foams. It must not be subjected to high heat, and is thus not appropriate for use with disperse dye. Most lycra garments contain a high percentage of cotton, which can be dyed with cool water fiber-reactive dye; often, the undyed lycra does not even show on the outside of the garment.

Ingeo is a "natural" polylactate fiber derived from corn. It can be dyed only with disperse dyes, like polyester, but it shows lower washfastness with these dyes than does polyester.

Safety:

While the immersion dyeing with disperse dyes is difficult and somewhat dangerous, due to the temperatures required and the carrier chemicals, the disperse dye itself is considered nontoxic. Even children can engage in these crafts, if an adult is available to do the ironing step for them. All powdered dyes are dangerous to breathe, like most powdered substances. Even many foods can be quite damaging when inhaled in powdered form. Avoid breathing dye powder. Wear a dust mask while measuring any dye powder, and wipe up spilled dye, of any dye class, as it may turn back into powder when it dries.

Another safety issue is allergenicity. It seems that disperse dyes on fabric are more likely to cause allergies than other textiles dyes. Fiber reactive dyes are known for their ability to cause serious allergies to those who carelessly breathe the dye powder while measuring it out, but, once they are chemically bonded to the fiber and excess dye has been fully washed out, they are suitable for even the chemically sensitive. Disperse dye, in contrast, may cause allergic reactions in susceptible people, just by their wearing clothing dyed with it. This may be due to some dye molecules rubbing off of the fiber. This problem, though not at all common, may be seen with commercially dyed fabric as well as home-dyed fabric, and may be partially responsible for the preference for natural fiber clothing among the chemically sensitive.

Dyeing of Nylon

Classes of dye most frequently used to dye or print nylon textile materials are acid, disperse and premetallised dyes.

Acid Dyes

Acid dye molecules are sodium salts and will dissociate in an aqueous dye liquor to form the acid dye anion which are negatively charged. The dye anion is attracted to the positively charged groups in the nylon polymer. The cationic sites are the terminal amino groups. The wash-fastness of acid dyed or printed nylon textile materials is fair to good which depends on the specific acid dye, as the strength of the bond between the dye molecules and the nylon polymer varies with different dyes. If the bond is weak, alkaline detergents can cause easy removal of color from nylon textile materials. The good light-fastness of acid dyed and printed nylon textile materials is due to the electron arrangement within the acid dye chromophores which is reasonably resistant to the degrading effects of the sun's ultraviolet radiation. Under humid conditions the light-fastness of acid dyed or printed textile materials is detrimentally affected as the acid dye anion will react with oxygen from the atmosphere causing degradation of the dye anion, which results in fading.

Premetallised dyes

Premetallised dyes contain a metal atom which is chromium. The presence of the metal atom provides enough stability to resist the degrading effects of the sun's ultraviolet radiation. The stable electron arrangement of the dye molecule is responsible for the good light-fastness of premetallised dyed or printed nylon textile materials. The premetallised dye anion is larger than the acid dye anion and has a greater substantivity to nylon textile materials compared with the acid dyes. This result in premetallised dyed and printed nylon textile materials having very good wash-fastness.

Disperse dyes

The molecules of disperse dyes are non-polar and hydrophobic. Disperse dyes have a fair to good light-fastness on dyed and printed nylon textile materials. This due to the aromatic or ring structures within the disperse dye molecules which provide the stable electron arrangement which resists the degrading effects of the sun's ultraviolet radiation. The good wash-fastness of disperse colored nylon materials is due to hydrophobic and non-polar nature of disperse dyes making it difficult for their molecules to be washed out of the polymer system of the nylon filament or staple fiber.

Modified nylon fibres

Specialty yarns or modified nylon yarns are made by melt spinning similar to conventional nylon either with a chemically modified polymer or through a process involving physical modification. The wide spectrum of such yarns includes diverse products such as deepdyeable nylons, anti static nylon, hollow fibers etc. These modified products offer a number of advantages and also lead to value addition to the product.
To impart different dyeability to nylon yarns, the following modifications have been carried out:

1. As it is known, the amino end groups in nylon 6 have a predominant effect on the dye pick-up when dyed with acid dyes. The amino end groups are the functional sites in nylon for the adsorption of anionic dyes in acidic solution. Thus by varying the amino end groups in the polymer, light shade dyeable yarns as well as ultra deep shade dyeable yarns can be produced. Light shade dyeable nylon yarns can be produced by using an acidic stabiliser which reacts with the free amino group, thus reducing the amino groups. In other words, the amino end group is converted into carboxyl end group. On the other hand, for production of ultra deep dyeable nylon yarns, the amino end group content is increased by replacing the carboxyl end groups of nylon with amino groups using a diamine stabiliser.
2. Cationic dye able fibers can be produced by modifying nylon polymer with addition of an anionic sulphonate group. This can be achieved by using a stabilizer during polymerization which has one or two carboxyl groups (which react with the amino end group of nylon) and one

or two sulphonate groups, which makes the polymer anionic. An example of such a stabilise is disodium 3,5-disulphobenzoic acid which converts one amino group into two sulphonate groups. Apart from this, modification of nylon to produce antistatic nylon has been recently carried out. In general, artificial or synthetic polymers are poor conductors of electricity due to their low moisture content and thus create problems related to electrostatic charge development. This can be done by any of the following routes:

1. Chemical modification of nylon polymers by introducing polyether or polyacrylamide during polymerization to make the nylon polymer hydrophilic.
2. Physical blending of nylon polymer with hydrophilic polymers such as polyether during melt spinning.
3. Adding electrical conducting materials such as carbon, metal or metal oxide powders to the melt during melt spinning. Additionally, flame retardant fabrics are gaining importance in today's textile industry and thus, flame retardant nylon fabrics are also produced. It can be done be achieved by either mixing phosphorus containing compounds or halogen containing compounds to the polymer during the melting stage or during polymerization. On the other hand aromatic raw materials can be used to produce wholly aromatic polyamide with very rigid chains, which results in intrinsic flame retardant property[i].

Apart from the above developments, research work has been done on various other methods of modification of nylon fibres. Plasma treatment of Nylon 6 fiber has been reported by Zhu et al.[ii], to improve absorbency of the fabric. In the study nylon 6 fabrics with three different moisture regains were treated with atmospheric pressure plasma and it was observed that the plasma treated fibers had higher oxygen concentration than the control fibers. The scanning electron microscope showed that with the 9.70% moisture regain fibers, the surface layer of the fibers was partially peeled off after plasma treatment. With contact angle measurement it was confirmed that the absorbency of the fibers had improved since the contact angle of the fiber had reduced. Using acid dye and disperse dye, respectively, greater dye uptake was observed in treated fibers compared to control fibers. It may be attributed to the fact that the increased amount of amine end-groups induced by plasma treatment would be playing an important role in enhancing the formation of ionic linkage with acid dyes for plasma-treated nylon fibers. The dyeability of the treated fibers with 1.23% moisture regain was a little better than that of the other two treated groups. In addition, no significant change in single fiber tensile strength was observed among control and treated fibers.

Some major nylon fibre uses

- **Apparel:** dresses, foundation garments, hosiery, raincoats, ski apparel, windbreakers, swimwear, and cycle wear.
- **Home Furnishings:** Bedspreads, carpets, curtains, upholstery.

Industrial and Other Uses: Tire cord, hoses, conveyer and seat belts, parachutes, racket strings, ropes and nets, sleeping bags, tarpaulins, tents, thread, monofilament fishing line, dental floss

KAHE

POSSIBLE QUESTIONS

UNIT-II

PART-A (20 MARKS)

(Q.NO 1 TO 20 Online Examination)

PART-B (2 MARKS)

1. Define scouring.
2. Write any two fastness properties of dyed materials
3. What is meant by bleaching?
4. Define dyeing.

PART-C (6 MARKS)

1. Explain in detail for the removal of impurities in raw cotton.
2. Write short notes on i) scouring ii) Bleaching iii) desizing
3. Explain the following terms (i) kierboiling ii) chemicking
4. Define scouring. Explain the scouring principles for the removal of impurities in raw cotton and grey cloth.
5. Explain the various steps involved in the dyeing of Terylene
6. Explain the various steps involved in the dyeing of wool.
7. Define the process of desizing. Explain the principles involved in desizing on raw cotton.

S.No	Question	Option 1	Option 2	Option 3	Option 4	Answer
1.	Which is the second step of pre-treatment in dyeing process?	Bleaching	Singeing	Desizing	Scouring	Desizing
2.	Jet-dyeing machine is commonly used for dyeing of	Cotton	Polyester	Wool	None of the above	Polyester
3.	The desizing process mainly removes	Wax and tallow	Dirt and colour	Starch	Natural impurities	Starch
4.	Batch-wise scouring can be carried out in	Winch	Jigger	Kier	J-Box	Kier
5.	The most important ingredient of a scouring composition is	Wetting agent	Alkali	Emulsifying agent	Sodium silicate	Alkali
6.	Wool and silk can be bleached with	Sodium hydrosulphite	Sodium perborate	Hydrogen peroxide	Sodium hypochlorite	Hydrogen peroxide
7.	Singeing of cotton is carried out to	Remove protruding fibres fromfabrics surface	Impart luster	Cut long threads from fabricsurface	None of the above	Remove protruding fibres fromfabrics surface
8.	Dyeing of polyester is carried out by using	Acid dyes	Disperse dyes	Direct dyes	None of the above	Disperse dyes
9.	Vinyl sulphone Reactive dyes are applied on cotton under	alkaline pH	neutral pH	acid pH	None of the above	neutral pH
10.	Bleaching of cotton fabric is carried out by	Sodium Hydroxide	Hydrochloric acid	Hydrogen peroxide	Melamine formaldehyde	Hydrogen peroxide
11.	Which of the following is not a type of developer?	Dry powder	Water soluble developer	Oil soluble developer	Water suspendible developer	Oil soluble developer
12.	For how long is a penetrant allowed to soak in cracks?	5 to 15 minutes	10 to 30 minutes	15 to 35 minutes	20 to 40 minutes	10 to 30 minutes
13.	During sizing, pick up will increase if	Sizing speed	Squeezing	Position of	Temperature of	Position of

		increases	pressure increase	immersion roller islowered	drying cylinder decrease s	immersion roller is lowered
14.	Penetrants of which colour are not used?	Red	Blue	Green	Yellow	Red
15.	Which of the following is not an excess penetrant remover?	Solvent removable	Water washable	Lipophilic pre-emulsifiable	Lipophilic post-emulsifiable	Lipophilic pre-emulsifiable
16.	Which of the following is not a method of pre-cleaning?	Solvent	Acid blasting	Vapour degreasing	Media blasting	Acid blasting
17.	Which of the following is not a type of penetrant application?	Dipping	Spraying	Brushing	Pouring	Pouring
18.	Which of the following defect is not detected by dye penetrant test?	Non-metallic inclusions	Leaks	Cracks	Forging defects	Non-metallic inclusions
19.	Bleached cotton fabric was sent to a laboratory for determination of copper number, which is an estimate of the presence of	Hydroxyl groups	Carboxyl groups	Reducing groups	Oxidizing groups	Reducing groups
20.	During bleaching of cotton with H2O2, the stabilizer used is	Sodium Hydroxide	Sodium silicate	Acetic acid	Sodium carbonate	Sodium silicate
21.	The processes for sanforization is used for	Improvement in strength	Dimensional stability	Improvement in crease recovery	None of the above	Dimensional stability
22.	The process of adding pigments or insoluble dyes to a solution before it is extruded through the spinneret is called what type of dyeing?	product	Yarn	Solution	Direct	Solution
23.	Which dyes are water-soluble components that for insoluble colored molecules in the fiber during the dyeing process?	Vat	Azoic	Bleach	Fabric	Azoic
24.	Scouring of cotton is carried out	Alkaline	Acidic conditions	Neutral	None of the	Alkaline

	under	conditions		conditions	above	conditions
25.	What is “an insoluble, finely divided substance, such as titanium dioxide, used to deluster or color fibers, yarns or fabrics” ?	Washing	Yarn	Light	Pigments	Pigments
26.	Which is also known as piece dyeing, which dyeing fabric after it has been constructed?	Fiber	Solution	Product	Fabric	Fabric
27.	Which dyeing is used for acrylic fibers colored with cationic dyes?	Yarn	Gel	Reactive	Sulfur	Gel
28.	Which of the following is not a variety of silk?	Muga	Eri	Tassar	Merino	Merino
29.	The process of burning protruding fibers to deliver a smooth fabric thesurface	Singeing	Bleaching	Shearing	Cropping	Singeing
30.	The reactive dyes are applied to a cellulosic fiber in an alkaline dye bath,they forms which bond with hydroxyl group of the fiber by chemicallyreacting with fiber?	Covalent bond	Salt Linkage	Hydrogen bond	None	Covalent bond
31.	The application of color to the whole body of a textile material with somedegree of fastness	Dyeing	Printing	Discharge style	None	Dyeing
32.	In which stage of the life cycle of silk moth forms silk fibres	Larva	Pupa	Egg	Adult	Pupa
33.	The process of taking out thread from the cocoon for use as silk is called	Rolling	Spinning	Reeling	Grading	Reeling
34.	Cheapest desizing can be done which method?	Higher breaking strength	Increased elongation at break	Increased pliability	None of the above	Increased elongation at break
35.	Find the odd one out:	Shearing	Scouring	Moulting	Dyeing	Moulting

36.	The process of washing fleece to remove dust, dirt and grease is called	Reeling	Scouring	Shearing	Grading	Scouring
37.	Silk fibre obtained from silk moth is?	Carbohydrate	Fat	Protein	Sugars	Protein
38.	The process of selecting parent sheep for obtaining desirable baby sheep is called	Shearing	Selective breeding	Grading	Sericulture	Selective breeding
39.	Wool is graded according to its	colour	texture	length	All of these	All of these
40.	Shearing of wool in sheep is done during	Winter	early spring	autumn	early summer	early spring
41.	Acid dyes on nylon are held by	Electrostatic attraction	hydrogen bonding	Vander waal's forces	None of the above	Electrostatic attraction
42.	Dyes suitable for sublimation transfer printing are	Acid dyes	Disperse dyes	Direct dyes	None of the above	Disperse dyes
43.	Fixation of Disperse Dyes on Polyester is carried out of	atmospheric steaming	pressure steaming	curing at 140 ^{o}C for 5 minute	None of the above	curing at 140 ^{o}C for 5 minute
44.	Dope dyeing is also known as?	Solution pigments	Garment dyeing	Package Dyeing	Yarn Dyeing	Solution pigments
45.	Gummy materials can be removed by which one?	Bleaching	Singeing	Desizing	Scouring	Desizing
46.	Hairy and projecting fibres can be removed by which one?	Bleaching	Singeing	Desizing	Scouring	Singeing
47.	Removing of impurities from textile materials can be done by?	Bleaching	Singeing	Desizing	Scouring	Scouring
48.	Localised dyeing is also called as?	Printing	Desizing	Singeing	Bleaching	Printing
49.	What is the example for synthetic sizing agent?	Poly vinyl alcohol	Starch	Glue	Gelatinete	Poly vinyl alcohol
50.	Which is the odd one for Yarn dyeing?	Skein dyeing	Beam dyeing	Package Dyeing	Jet dyeing	Jet dyeing
51.	Which is the example for bleaching	Diluted Sodium	Diluted Sodium	Diluted Sodium	None	Diluted

	agent?	hypochlorite	hypophosphate	hypochloride		Sodium hypochlorite
52.	Which is bleached in the raw state or in piece?	Cotton	Wool	Nylon	Silk	Cotton
53.	What is the name of solvent used for Acrylic fibre?	DMF	dil.Sulfuric acid	Cupraamonium hydroxide	None	DMF
54.	Which type of enzyme is used for scouring?	Pectinase	Cellulase	Catalyase	α-amylase	Pectinase
55.	Which type of enzyme is used for desizing?	Pectinase	Cellulase	Catalyase	α-amylase	α-amylase
56.	Which type of enzyme is used for bio polishing of cotton?	Pectinase	Cellulase	Catalyase	α-amylase	Cellulase
57.	Which type of enzyme is used for peroxide killers?	Pectinase	Cellulase	Catalyase	α-amylase	Catalyase
58.	Bleaching with hypochlorite pH should be?	Acidic	Basic	7	None	7
59.	What is the Tg value of cotton?	No Tg for cotton	10 ^oC	1000 ^oC	50 ^oC	No Tg for cotton
60.	Hydrogen peroxide bleaching is carried out of	room temperature	50-60 ^oC	80-100 ^oC	100-120 ^oC	80-100 ^oC

S.No	Question	Option 1	Option 2	Option 3	Option 4	Answer
1.	Mercerization of cotton is carried by using	Sodium hydroxide	Sulphuric acid	Acetic acid	None of the above	Sodium hydroxide
2.	Crease resist finising of cotton fabric doesnot leads to	Reduction of tensile strength	Increase in dimentional stability	Increase in moisture regain	Increase in bending length	Increase in moisture regain
3.	Caustic soda mercerization of cotton iscarried out for improvement a of	Strength and luster	Whiteness	Wetting	None of the above	Strength and luster
4.	Decatising process is used for finishing of	Cotton	polyester	Wool	None of the above	Wool
5.	Limiting oxygen index is determined to testthe efficiency of	Wash and wear finishing	Water proofing	Flame retardant finishing	None of the above	Flame retardant finishing
6.	Range of Maturity Ratio (M) of cotton is	0 to 1	0 to 100	0.2 to 1.2	0.5 to 1.5	0.2 to 1.2
7.	When twist is increased in a spun yarn, itsstrength	increases	decreases	does not change	first increases and then decreases	first increases and then decreases
8.	Sectional warping is considered morepractical than beam warping	For executing big orders	For producing striped fabrics	When sizing is considered necessary	When two fold yarn has to be used inwarp and weft	For producing striped fabrics
9.	Chemical finishes are also called?	Dry finishes	Wet finishes	Mechanical finishes	Durable finishes	Wet finishes
10.	Which of these fibres are non-biodegradable?	Cotton	Jute	Wool	Nylon	Nylon
11.	What is the hardness suitable for textile wet-processing?	30-40ppm	10-20ppm	40-50ppm	20-30ppm	40-50ppm
12.	Which test is done to evaluate	BAN	PAN	TAN	None	BAN

	mercerization efficiency?					
13.	Mercerization is carried out with NaOH of	10-15% conc	18-25% conc	5-10% conc	25-35% conc	18-25% conc
14.	An optical brightener is	A synthetic bluing agent	A colorless dye	A fluorescent compound	An optical whitener	A colorless dye
15.	Shriking is also known as?	Sanforizing	Mercerizing	Bleaching	Spinning	Sanforizing
16.	Chemical suitable for discharge printing is	Zirconium sodium sulphoxylate formaldehyde	Hydorgenper oxide	Sodium silicate	None of the above	Zirconium sodium sulphoxylateformal dehyde
17.	Which process can improve luster and smoothness of the cotton fabrics?	Bleaching	Scouring	Mercerizatio n	Sizing	Mercerization
18.	Which is the last treatment of wet processing?	Mercerizing	Marketing	Printing	Finishing	Finishing
19.	The more common agents used for discharge printing are	oxidizing type	reducing type	Neutral in reaction	None of the above	oxidizing type
20.	This process facilitates easy handling and storage	Hydration	Dehydration	Mounting	Clearing	Mounting
21.	Which of the following has the poor water absorbency ?	Polypropylene	Viscose	Cotton	Wool	Polypropylene
22.	Which of these is not a property of nylon?	light weight	strong	absorbs water	wrinkle free	absorbs water
23.	Whcih of the following can absorb over 90% of its own mass of water and does not stick to wound ?	Rayon	Gun cotton	Cotton	Thiokol	Rayon
24.	The highest washing fastness in a dyed cotton fabric would be obtained if the dye-fibre bond is	Ionic	Hydrogen	Covalent	Van der Waal's force	Covalent
25.	What is the selvedge of the fabric?	The rough edge where	Fabric left over when	The profit made by the	The finished off edge of the	The finished off edge of the fabric

		the fabric has been cut	products have been cut out	fabric manufacturer	fabric	
26.	What is the name of process which involves pulling and twisting of strands of a fibre?	Ginning	Weaving	Spinning	None	Spinning
27.	The discharging agent used in discharge printing of cotton with reactive dyes is	Citric acid	Sodium dithionite	Thio-urea dioxide	Sodium formaldehyde sulphoxylate	Sodium formaldehyde sulphoxylate
28.	A dye is applied on a fibre using Na2S2O4 as an auxiliary. Washing fastness of the dye on fibre is good. The correct combination of the dye and the fibre is	Cationic dye, acrylic fibre	Vat dye, cotton fibre	Acid dye, wool fibre	Reactive dye, cotton fibre	Vat dye, cotton fibre
29.	Which is the most prevalent beach?	Sodium hypochlorite	Hydrogen sulphide	Hydrogen peroxide	Sodium chloride	Hydrogen peroxide
30.	Which one is not sensitive to weak acids?	Silk	Wool	Cotton	Nylon	Wool
31.	Tie and dye is a	Organic peroxygen bleaches	Reducing bleaches	Photo sensitizing agents	Inorganic peroxygen bleaches	Organic peroxygen bleaches
32.	Which one is the powerful oxidizing agent?	Sodium chloride	Sodium hypochlorite	Sodium perborate	Sodium bromate	Sodium hypochlorite
33.	Hydrogen peroxide is not used in	Jute	Cotton	Nylon	Silk	Nylon
34.	Polyester fibre have been bleached with Which type of chloroisocyanic acid?	Tri and Tetra	Di and Tri	Di and Tetra	Penta and tetra	Di and Tri
35.	Wool is sensitive to	Sodium bicarbonate	Nitric acid	Potassium hydroxide	Sodium hydroxide	Potassium hydroxide
36.	Which is composed of simple amino acids and contains no disulfide bonds?	Rayon	Silk	Nylon	Polyester	Silk

37.	At home fabric can be decorated easily by	Roller printing	Block printing	Screen printing	Stencil printing	Block printing
38.	In which type of mineral acids do cause wool to swell and gelatinize?	Dilute	Concentration	Reducing	Oxidizing	Concentration
39.	Garment dyeing is also known as	Piece dyeing	Binding dyeing	Resist dyeing	Decorative dyeing	Piece dyeing
40.	Which two fibre has been traditionally bleached by peroxide?	Cotton and Wool	Nylon and Silk	Jute and Rayon	Wool and Silk	Wool and Silk
41.	Mechanical finishes are also known as	Wet Finishes	Chemical Finishes	Dry Finishes	Semi durable Finishes	Dry Finishes
42.	Which is the reduction of a fabric or a garment in size?	Shrinkage	Desizing	Designing	Scouring	Shrinkage
43.	Fabrics that are treated for pre-Shrinking are labelled as	Sanfronished	Anti-Shrink	Shrink-Proof	All of these	All of these
44.	Which is the another aspect of water proofing?	Water repellent	Water resistant	Water vapor	Damp proofing	Damp proofing
45.	How many types are there in integral water proofing system?	Three	Two	Four	Five	Two
46.	In which system use fatty acid to block pores within the concrete preventing water passage	Hydrophilic	Hydrophobic	Anisotropic	Hydrostatic	Hydrophobic
47.	Which makes woven cotton fabric stronger,more lustrous	Bleaching	Mercerization	Scouring	Desizing	Mercerization
48.	Pre-shriking is a Which type of finishes?	Dry finishes	Wet finishes	Mechanical finishes	Durable finishes	Mechanical finishes
49.	Finishes may be classified into	Two	Four	Five	One	Four
50.	Which is the process of removing the sizing of the warp yarns?	Designing	Desizing	Finishes	Scouring	Desizing
51.	Which one is the powder bleach?	Hydrogen peroxide	Sodium chlorite	Sodium perborate	Peracetic acid	Sodium perborate

52.	Which is refers to beating or hand pounding of a fibre?	Tendering	Beetling	Pleating	Decatizing	Beetling
53.	What is the colour of bleached wool	Colourless	Yellow	gray	Pink	yellow
54.	Which one is the effect of mercerization?	Increased ability to absorb dye	Improved reactions with a variety of chemicals	Improved strength/elongation	All the above	All the above
55.	Which is Cloth mercerization?	Chain mercerization	Chainless mercerization	Batch-up mercerization	All the above	All the above
56.	Roller and clearer card is used for carding of	Cotton	Cotton waste	Wool fibres	Man-made fibres	Cotton waste
57.	Super finishing is largely used for	Internal surfaces	External surfaces	Both (A) and (B)	Flat surfaces	External surfaces
58.	Which is not a type of dry processing?	Sand blasting	Hand scraping,	broken and tagging	Acid wash	Acid wash
59.	What is Fulling?	caustic soda treatment of cotton	shrinkage treatment of wool	alignment of yarns in a fabric	whitening	shrinkage treatment of wool
60.	Which is water proof finish?	Semi durable finishes	Permanent finishes	chemical finishes	None	Permanent finishes

UNIT III

SYLLABUS

Finishing: Finishes given to fabrics- mechanical finishes on cotton, wool and silk, method used in process of mercerizing –anti-crease and anti-shrink finishes –water proofing.

Finishing :

Various finishing processes are applied to dyed fibers or cloth. These processes are essential to produce lustre resistance to shrinkage and creasing the other desirable qualities of feel and appearance. Dyeing processes are generally carried out using water as the medium. Hence purity of water is very important. It is necessary to soften water if not pure. The above operations may not be carried out in stated sequence. For example, in the dyeing of wool, first of all finishing treatments are carried out and then the dyeing operations are carried out. On the other hand, in the dyeing of cotton, the dyeing process may be can'ied out in between the two preparatory treatments.

KAHE

POSSIBLE QUESTIONS

UNIT-V

PART-A (20 MARKS)

(Q.NO 1 TO 20 Online Examination)

PART-B (2 MARKS)

1). What is meant by Quinonoid dyes?

2). Write the structure- of Anthroquinone dye.

3). Define Mordant dye.

4). Write any one preparation of Rhodamine B.

5). Write any three uses of Indigo dye.

PART-C (6 MARKS)

1). How is alizarin manufactured? Write a note on its use as a dye. Discuss its structure.

2). Write the preparation, structure and applications of Diphenyl methane dye auramine.

3). Name a triphenyl methane dye and a vat dye. Give the synthesis of dyes named by you.

4). Give the preparation and uses of the following i)Pararosaniline ii) tetra haloindigo Rhodamine B.

5). Give the preparation and uses of i)Malachite green ii) Phenolphthalein iii) Crystal violet

6). How will you prepare the following indigo dyes

i) Indigo dyes ii) Indigosol iii)tetrahaloindigo

KAHE

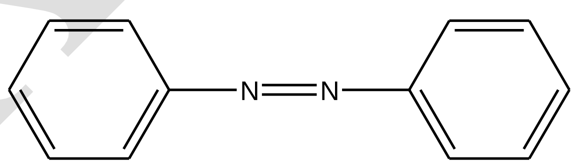
UNIT IV
SYLLABUS

Types of Dyes: Quinonoid dyes-examples and structure-Anthroquinone and Mordant dyes-synthesis and applications of Alizarin-Phthalocyanin dyes-Copper Phthalocyanin-synthesis and applications.
Diphenylmethane dyes- Auramine-Triphenylmethane dyes-Malachite green, Crystal violet, Pararosaniline-preparation and applications.
Indigo dyes-preparation and application-derivatives of Indigo- synthesis and uses of Indigosol and tetrahaloindigo.
Phthalein dyes-Phenolphthalein- preparation and applications.
Xanthene dyes-Rhodamine B, Fluorescein-Eosin- preparation and applications.

Definition:

A dye or a dyestuff is usual(v a coloured organic compound or mixture that may be used for imparting colour to a substrate such as cloth, pape/: plastic or leatIler in a reasonably permallent fashioll.

A dye is a coloured substance but all coloured substances are not dyes. Thus a dye should fix itself on the substrate to give it a permanent coloured appearance. Thus, azobenzene is not a dye even though it has red colour, as it cannot be attached to substrate. However, congo red is a dye as it can be applied on cotton and retained by it. Thus, the dyes should have certain groups which help the attachment to the fibre.



Azobenzene (Red coloured hut not a dye)

White Dye:

Some colourless compounds are used as the optical brighteners. They may also be called as the *white dyes.* They have the special property of absorbing ultraviolet light and re-emitting the visible light so that the fabric appears bright.

Pigment:

The coloured substance which is insoluble in water or other solvents is called a pigment. Thus the application of dye and pigment will be different. A dye is applied in the form of a solution, whereas the pigment is applied in the form of a paste in a drying oil, in which it is insoluble

Requisites of a True Dye:

All coloured substances are not dyes. However, the requisites
of a true dye are as follows :

(i) It must have a stable colour.

(if) It must have an attractive c%ur i.e., it should no! undergo struc/ura/changes readiZ)'·

(iii) It must be able to attach itself to material frol1l solution or to be capahle to fixed 01/ it.

For example, azobenzene is coloured but cannot fix itself to a fabric. Therefore, azobenzene is not a dye. Further, a dye may not be able to dye all types of substrates. For example, picric acid is able to dye silk or wool a permanent yellow but not cotton. Thus, a dye either forms a chemical union with the substrate being dyed or it may get associated with it an intimate physical union.

(iv) It must be solu!J.le in water or must form a stable and good di:.persion in watel: Alternatively, *it mu;l be soluble in the medium other than water. However, it is to be remembered that the pick lip ~f the dye from the medium should he good.*

(v) The substrate to be -(tved must have a natural affinity for an appropriate dye and must be able to absorb it from solution or aqueous dispersion. The presence under suitahle conditions ofconcentrat ioll. temperatllre and pH.

(vi) When a dye isfixed to a substrate. it must be filst to washing, dry cleaning. perspiration. light, heat and other agencies. It must be resistant to the action of water, acids or alkalis. particularly the latter due to the alkaline nature of washing soda and washing soap. There is probahly no dye which can be guaranteed not to alter shade under all conditions.

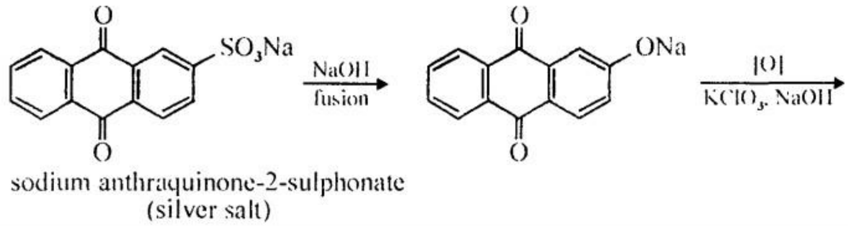
(vii) The shade and fastness ofa given dye may vary depending on the substrate due to different interactions ofthe molecular orbitals ofthe dye with the substrate, and the ease with which the dye may dissipate its absorbed energy to its environment without itself decomposing.

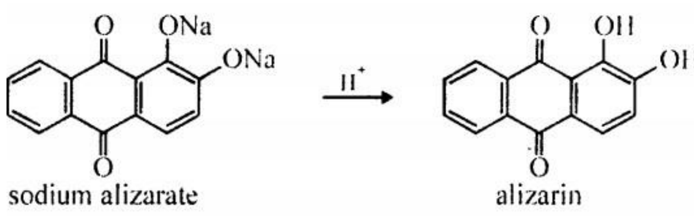
Anthroquinone:

Anthraquinone. the basic system of these dyes, has a faintly yellow colour, the edge of its long wave extends into the visible spectrum (Amal' 327 nm). It is not itself a dye. The introduction of relatively simple electron donors gives anthraquinone compounds which, accordmg to the strength of the electron donors (OH < NH2 < NR2 < NHAr), absorb m any desired region of the visible spectrum. The position of the substituents in anthraquinone not only intluences the absorption maximum but also some of the other properties. For exa.mple. anthraqumone denvatives that have hydroxyl or amino groups m the ~-position generally exhibit better resistance to sublimatIon, better solubility and better affinity for textile substrates than a-substituted compounds. Dyes based on anthraqumone and related polycyclic aromatic qUll10nes are of great Importance. Many of the most light-fast aCid, mordant, disperse, and vat dyes are of this kind. The chromophore is the quinonoid group> C = O.

(a) Anthraquinone Mordant Dyes : These contain groups such as hydroxyl or ammo group, which can combine with metal ions so as to from insoluble compounds called lakes. The colour of the lake depends upon the mordant, i.e., the metal used. Some of the important anthraquinone mordant dyes are as follows :

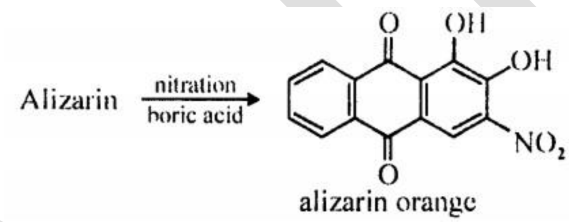
(i) **Alizarin**: It is 1, 2-dihydroxyanthraqumone. It is also known as mordant red 11. Previously it-as obtained from the roots of the madder plant now-a-days it IS obtained by heating. under pressure, silver salt (sodium anthraquinone-2-sulphonate, so callcd because of its silvery crystals), caustic soda. potassium chlorate and water in a steel autoclave at about 180°C. The resulting melt is blown into water and acidified to decompose the sodium alizarate, the precipitated alizarin is filtered, washed and llsed as a 20 per cent paste.



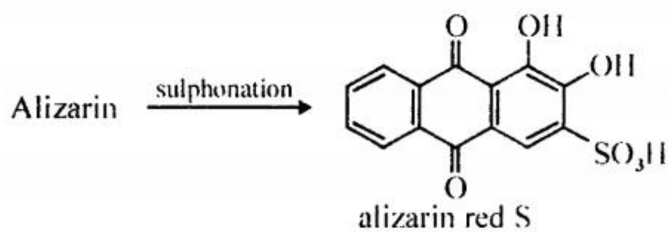


Alizarin is a red crystalline solid insoluble in water but s?lublc in alcohol and alkali. It is a mordant dye and combines,with mordants, *i.e.*. metallic hydroxIdes, to fOlm coloured insoluble compounds called *lakes.* The colour of the lake depends upon the mordant. *i.e.*. cation used. The colours of the lakes along with the respectIve mordant are given as follows:

(ii) ***Alizarin Orallge*** : It is obtained by nitrating alizarin in the presence of boric acid

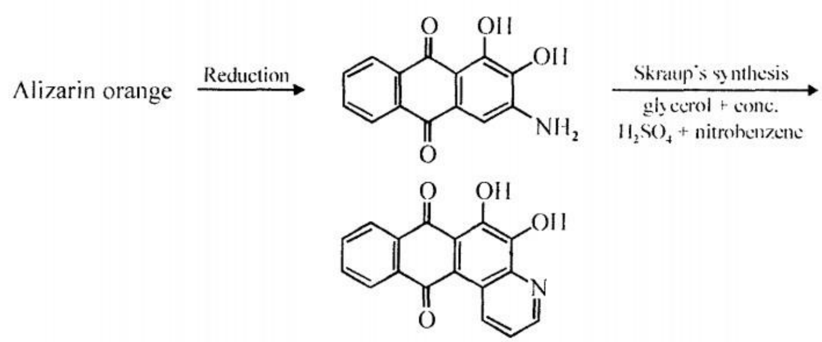


(iii) ***Alizarin Red S*** : *II* is obtained by the sulphonation of alizarin with fuming sulphuric acid.



(iii) ***Aliztlrill BIlle:*** It is obtained by reducing alizarin orange to 3-aminoaltzarin followed by

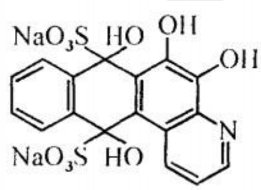
Skraup's synthesis of quinoline. *i.e.*. by heating wIth glycerol. cone. H_2SO_4 and nitrobenzene.



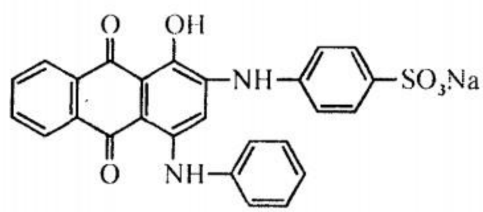
alizarin blue

Alizann blue dyes wool a blue colour when mordanted with chromium.

(v) ***Alizarin Bille S*****:** It is the sodium bisulphite salt of allzarin blue. It is soluble in water. It when mordanted with chromium gives a reddish-blue lake.


alizarin blue S

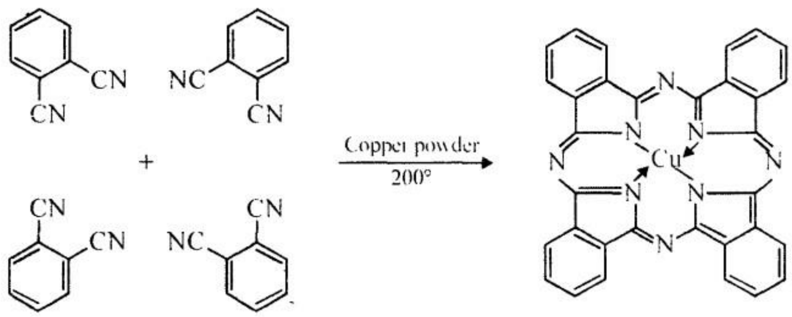
(vi) ***Mordant Black*** **13 : It** is made by condensing aniline with 1,2, 4-trihydroxyanthraquinone and sulphonating the resulting base.


mordant black B

It is applied to wool with a chromium mordant and is quite fast to light and washing.

Alizarin-Phthalocyanin dyes:

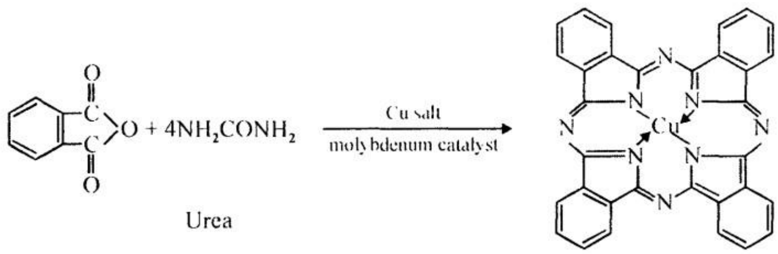
Metal phthalocyanine derivatives may be obtained by replacing the two hydrogen atoms of phthalocyanine (I) by metals such as copper, nickel, iron and cobalt. It actual practice metal phthalocyanine derivatives are not made from phthalocyanine (I) but are synthesIsed directly. For example, copper phthalocyanine, *i.e.*, pigment blue 15 is made by the fusion of phthalonitrile with copper metal or a copper salt.



(1)

Copper Phthalocyanine

Copper Phthalocyanin:

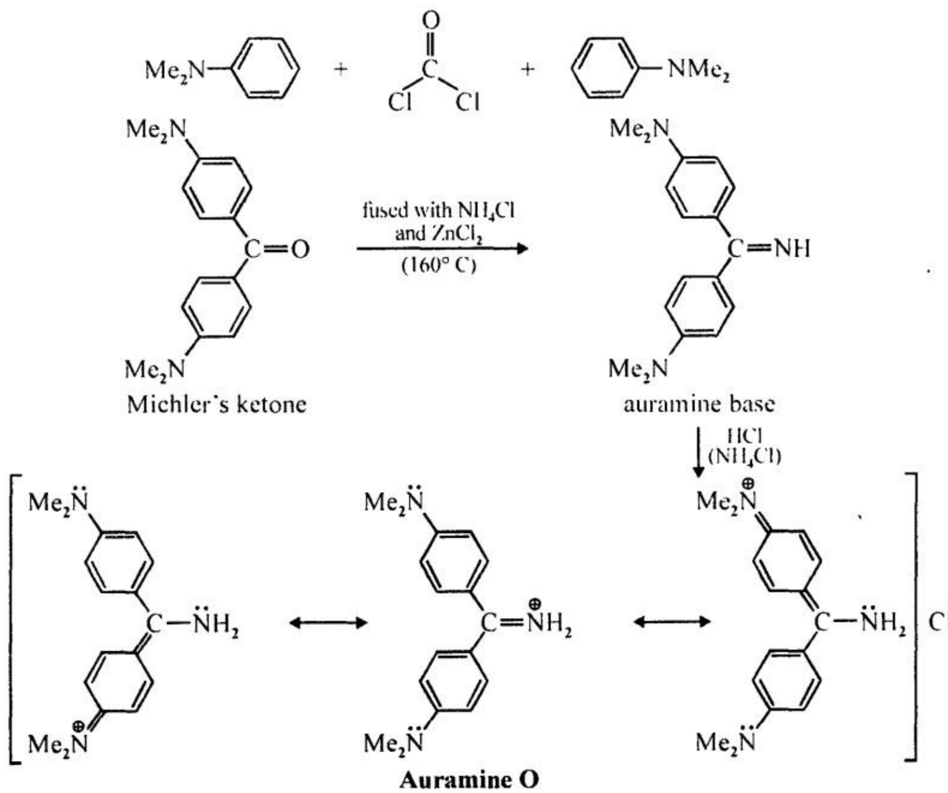


Phthalic anhydride

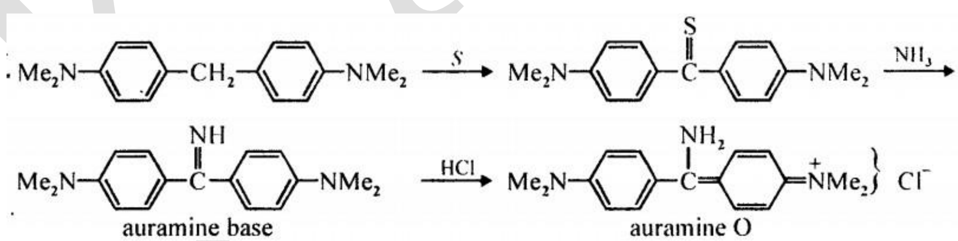
Copper Phthalocyanine

Auramine-Triphenylmethane dyes

1. **Auramine 0** : Kern and Karo prepared this dye by heating michler's ketone WIth ammonium chloride and zinc chloride at lS0-160°C. The auramine base so obtained on treatment with Hel is converted into auramine O. The michler's ketone reqUIred for this synthesis prepared by condensing N-dimethylaniline with phosgene.



Now-a-days, it is prepared by heating 4, 4'-bis (dimethylamino-phenyl) methane with sulphur, ammonium chloride and large excess of sodium chloride in an atmosphere of ammonia at 175°C. The auramine base so produced is treated with hydrochloric acid to get auramine 0. The sodium chloride is purely as a diluent.



It is marketed in the form hydrochloride. It is a cheap, brilliant yellow and extensively used dye for dyeing of paper, silk, leather and Jute. The yellow colour produced by it is not fast to light and is destroyed by boiling with water, and on treatment with hot acids and alkalis. However, it is still employed due to its cheaper cost than the other dyes of comparable colour.

KAHE

POSSIBLE QUESTIONS

UNIT-V

PART-A (20 MARKS)

(Q.NO 1 TO 20 Online Examination)

PART-B (2 MARKS)

1). What is meant by Quinonoid dyes?

2). Write the structure- of Anthroquinone dye.

3). Define Mordant dye.

4). Write any one preparation of Rhodamine B.

5). Write any three uses of Indigo dye.

PART-C (6 MARKS)

1). How is alizarin manufactured? Write a note on its use as a dye. Discuss its structure.

2). Write the preparation, structure and applications of Diphenyl methane dye auramine.

3). Name a triphenyl methane dye and a vat dye. Give the synthesis of dyes named by you.

4). Give the preparation and uses of the following i)Pararosaniline ii) tetra haloindigo Rhodamine B.

5). Give the preparation and uses of i)Malachite green ii) Phenolphthalein iii) Crystal violet

6). How will you prepare the following indigo dyes

i) Indigo dyes ii) Indigosol iii)tetrahaloindigo

KAHE

KAHE

S.No	Question	Option 1	Option 2	Option 3	Option 4	Answer
1.	The difference between a dye and a pigment is that a dye?	is held to the surface of the fiber by a resin.	is an inorganic chemical that permeates fibers..	usually diffuses into the interior of a fiber from a water solution.	lays on the surface of the fiber.	usually diffuses into the interior of a fiber from a water solution.
2.	Phthalocyanin dyes and Copper Phthalocyanin dyes are examples of which dye?	Quinonoid dyes	Diphenylmethane dyes	Indigo dyes	Phthalein dye	Quinonoid dyes
3.	Natural Indigo comes from?	only the Indigofera tinctoria plant	the Indigofera plant and the woad (Isatis tinctoria) plant and over 50 plants on the African continent	the madder (Rubia tinctorium) plant.	the Indigofera and the weld plants.	the Indigofera plant and the woad (Isatis tinctoria) plant and over 50 plants on the African continent
4.	Some examples of natural dyes are?	alizarin, carminic acid and tartrazine	indigo, bixin and alizarin	tartrazine, FD&C Blue #1, and indigo	chlorophyll, yellow #6 and haematin	indigo, bixin and alizarin
5.	Dye made from the weld plant and the woad plant were combined to make?	the "blue-bellied Yankee" color for their tunics.	the famous Lincoln Green worn by Robin Hood and his merry men.	the rich purple color for the Roman Empire.	the yellow bridal gowns of the Roman Empire.	the famous Lincoln Green worn by Robin Hood and his merry men.
6.	Tyrian purple comes from?	the cochineal insect (genus Dactylopius)	mollusk shells (genus Murex)	the madder plant (genus Rubia)	an anthocyanin.	mollusk shells (genus Murex)
7.	The main colorant used to dye leather black is?	haematin	a synthetic black dye	indigo and a mordant	no dye needed	haematin
8.	What is a mordant?	a dye color that bites into the fiber.	a metallic ion that attaches to fibers and causes a color emission.	a chemical that stops the dye process.	a metallic ion or salt added to the dye bath to make dyes more	a metallic ion or salt added to the dye bath to make dyes more colorfast by

					colorfast by forming a bridge between the dye and the fiber.	forming a bridge between the dye and the fiber.
9.	Which of these statements is true about the colorfastness of dyes?	If a dye is fast to light, it will also be fast to washing.	A dye that is fast on one type of fiber will be fast on all fabrics.	Wool is the most easily dyed fiber and the resulting color will change the least.	There are no standardized methods of testing colorfastness.	Wool is the most easily dyed fiber and the resulting color will change the least.
10.	A Vat dye....	must be reduced to a soluble form so that it can dissolve in the dye bath and get trapped in the cellulose fiber.	penetrates both the outer ring and the inner core of a piece of fiber.	remains in its soluble form inside the denim fabric.	must be in an insoluble form so that it can get trapped in the cellulose fiber.	must be reduced to a soluble form so that it can dissolve in the dye bath and get trapped in the cellulose fiber.
11.	The greater the number the double bonds in the carotenoid dyes?	the more water soluble it is.	the more non-water insoluble it is.	the more intense or darker the pigment will be.	the weaker the dye color will be.	the more intense or darker the pigment will be.
12.	What type of synthetic dye is crystal violet?	Azo dyes	Triphenylmethane	Xanthene dyes	Oxazine dye	Triphenylmethane
13.	These are commonly used to counterstain alum hematoxylin?	Eosin	Congo red	Safranin	All the above	All the above
14.	Eosin is widely used as an aqueous or alcoholic solution with a concentration of?	0.1-0.5%	0.5-1%	1-2%	2-3%	0.5-1%
15.	An azo dye is fixed on fabrics by the process applicable in?	Vat dyes	Mordant dyes	Developed dyes	Substantive dyes	Developed dyes
16.	Red ink is prepared from?	Phenol	Aniline	Conmgo red	Eosin	Eosin
17.	The blue print process involves the use of?	Indigo dyes	Vat dyes	Iron compounds	Zinc compounds	Iron compounds
18.	An azo dye is formed by	A phenol	An aliphatic primary	Benzene	Nitrous acid	A phenol

	interaction of an aromatic diazonium chloride with?		amine			
19.	Alizarin belongs to the class of?	Vat dyes	Mordant dyes	Substantive dyes	Reactive dyes	Mordant dyes
20.	An insoluble coloured compound formed by action of metallic salts on dyes is known as?	Lake	Mordant	Dye intermediate	None of these	Lake
21.	Alizarin dye obtained from the root of madder plant is anthraquinone derivative. Its structure corresponds to?	1, 2-dihydroxy anthraquinone	2, 3-dihydroxy anthraquinone	1, 4-dihydroxy anthraquinone	1-hydroxy anthraquinone	1, 2-dihydroxy anthraquinone
22.	To which class of dyes does phenolphthalein belongs?	Azo dyes	Nitro dyes	Triphenyl methane dyes	Phthalein dyes	Phthalein dyes
23.	Alizarin a mordant dye is not used in?	Cotton dyeing	Printing	Painting	Chromium lakes for wood dyeing	Painting
24.	The rose odour from an ester is formed by the action of HCOOH on?	Pine oil	Olive oil	Geraniol	Turpentine oil	Geraniol
25.	Which of the following is dye?	Methyl orange	Orange I	Aniline yellow	All of these	All of these
26.	Which of the following is an example of basic dye?	Alizarin	Malachite green	Indigo	Orange I	Malachite green
27.	Which of the following is a direct dye?	Phenolphthalein	Congo red	Alizarin	Indigo	Congo red
28.	Which of the following is a vat dye and often used in dyeing jeans?	Indigo	Alizarin	Picric acid	Crystal violet	Indigo
29.	Which of the following is not a chromophore?	$-N=N-$	$-NO$	$-NO_2$	$-NH_2$	$-NH_2$
30.	The compounds used to fix a dye to the fabric is known as?	Mordant	Azeotrope	Bleaching agents	Lake	Mordant
31.	Which one is disperse dye?	Congo red	Alizarin	Celliton	None of these	Celliton
32.	Malachite green is a direct dye for silk and wool. It is prepared by	Benzaldehyde and dimethyl aniline	Carbonyl chloride and dimethyl aniline	Benzene diazonium	None of the above	Benzaldehyde and dimethyl aniline

	condensing?			chloride with dimethyl aniline		
33.	Fluorescin, a well known dye is obtained by the reactions of?	Phthalic anhydride and phenol	Phthalic anhydride and resorcinol	Succinic acid and resorcinol	Phthalic anhydride and catechol	Phthalic anhydride and resorcinol
34.	Indigo shows cis-trans isomerism. Which is the stable form of Indigo?	Cis	Trans	Either cis or trans	Both of the above	Trans
35.	Which is the wrong statement with regards to Indigo?	Indigo was extracted in India from plants of the 'Indigo ferra' group	The chemical structure of Indigo was determined by Baeyer, a German chemist who also synthesized it	Indigo is a dark blue solid soluble in water giving a blue solution	Indigo is fixed to fabrics by the vat process	Indigo is a dark blue solid soluble in water giving a blue solution
36.	Which of the following structures represents a colourless substance?	$C_6H_5{-}N{=}N\|O{-}C_6H_5$	$C_6H_5{-}N{=}N{-}C_6H_5$	$C_6H_5{-}NH{-}NH{-}C_6H_5$	None of these	$C_6H_5{-}NH{-}NH{-}C_6H_5$
37.	Identify the wrong statement regarding alizarin?	Alizarin was extracted from the roots of the madder plant	It's chemical name is 1, 2-dihydroxy anthraquinone	It is fixed to fabrics by using mordants like aluminium sulphate giving fast red colour	It has red crystal soluble in alkalies and the solution imparts red colour to fabrics	It has red crystal soluble in alkalies and the solution imparts red colour to fabrics
38.	Methyl orange is an indicator in acid-alkali titration. It gives ?	Yellow colour in alkaline medium	Red colour in acid medium	Yellow colour in acid medium	Yellow colour in alkaline medium and red colour in acid medium	Yellow colour in alkaline medium and red colour in acid medium
39.	A dye imparts red colour on fabric. What colour of light was absorbed by the dye?	Blue	Red	Green	Orange	Green
40.	Which of the following is an azo	Orange-I	Phenolphthalein	Malachite	Methylene blue	Orange-I

	dye?			green		
41.	An example of anthraquinone dye is?	Alizarin	Basic acid	Methylene blue	Phenolphthalein	Alizarin
42.	Which of the following is a basic dyes?	Congo Red	Aniline Yellow	Alizarin	Indigo	Aniline Yellow
43.	The dyes which are applied to the fabric in the colourless reduced state and then oxidised to coloured state are called?	Vat dyes	Disperse dyes	Triphenyl methane dye	Azo dyes	Vat dyes
44.	What type of synthetic dye is EOSIN?	Xanthene dyes	Phthalein dyes	Diphenylmethane dyes	Indigo dyes	Xanthene dyes
45.	What type of dye is THIONINE?	Azo dyes	Triphenylmethane	Thiazine dye	Xanthene dyes	Thiazine dye
46.	All of the following are natural dyes EXCEPT?"	Saffron	Hematoxylin	Brazilin	None f the above	None f the above
47.	Artificial dyes are?	Coal tar dyes	Aniline dyes	Derived from hydrocarbon and benzene	All the above	All the above
48.	Auramine is an example of which type of dye?	Diphenylmethane dyes	Indigo dyes	Phthalein dyes	Xanthene dyes	Diphenylmethane dyes
49.	Which of the following is a flurescent dye?	DAPI	acridine orange	ethidium bromide	Rhodamine	Rhodamine
50.	Malachite green is an important dyestuff, the typical green colour is obtained when the dye molecule is ?	Non ionic	Cationic	Anionic	Made up of phenyl groups	Cationic
51.	Indigo belongs to the class of	Mordant dyes	Vat dye	Direct dye	Disperse dye.	Vat dye
52.	Which of the following is an example of anthraquinone dye?	Alizrin	Methyl orange	Methylene blue	Phenolphthalein	Alizrin
53.	Which one among the following is not a correct match ?	Silk (Polyamide)	Lipase (Ester)	Indigo (Azo dye)	Karatin (Protein)	Indigo (Azo dye)
54.	Which of the following is an azo	Phenolphthalein	Methyl orange	Malachite green	Methylene blue	Methyl orange

	dye ?					
55.	What is true about congo red ?	It is a vat dye	It is dircet dye	It is a disperse dye	It is basic dye	It is dircet dye
56.	Bismarck brown is example of ?	Phthalein dyes	Azo dyes	nthraquinone dyes	Nitro dyes	Azo dyes
57.	Which of the following is a correct statement ?	Every coloured compound can act as a dye	Presence of a chromophore is necessary for a compound to act as dye	Presence of chromophore as well as auxochrome group is necessary for a compound to act as dye	All of the above	Presence of chromophore as well as auxochrome group is necessary for a compound to act as dye
58.	Which dyes are synthesised and produced within the fibres and the colour so obtained is known as icecolours	Azoic dyes	Vat dyes	Adjective dyes	Direct dyes	Azoic dyes
59.	The dyes which are used in reduced state and are then oxidized in the fabric by air are called	Azo dyes	Dispersed dyes	Basic dyes	Vat dyes	Vat dyes
60.	Which dye is considered alkaline?	Methylene blue	Eosin	Nigrosin	Congo Red	Methylene blue

UNIT V
SYLLABUS

Pollution Control in Textile Industry: Textile effluent-characteristics, effect of untreated effluent, degradability of wastes. Effluent treatment plants-aerated lagoon, photo oxidation process.

Characteristics of Effluent Water in Textile Industries:

As discussed textile sector is putting enormous impact on Bangladesh economy yet this industry is currently facing several challenges. Out of various activities in textile industry, chemical processing contributes about 70% of pollution. Waste stream generated in this industry is essentially based on water-based effluent generated in the various activities of wet processing of textiles. It is well known that wet processing mills consume large volume of water for various processes such as sizing, desizing, andscouring, bleaching, mercerization, dyeing, printing, finishing and ultimately washing. In fact, in a practical estimate, it has been found that 45% material in preparatory processing, 33% in dyeing and 22% are re-processed in finishing. But where is the real problem? The fact is that the effluent in textilegenerated in different steps is well beyond the standard and thus it is highly polluted and dangerous. This is demonstrated in Table 1.

Properties of Waste Water from Textile Chemical Processing:

Property	Standard	Cotton	Synthetic	Wool
pH	5.5 – 9.0	8-12	7-9	3-10
BOD, mg/l, 5 days	30-350	150-750	150-200	5000 – 8000
COD, mg/l, day	250	200-2400	400-650	10,000 – 20,000
TDS, mg/l	2100	2100-7700	1060-1080	10,000 –13,000

Classification of Textile Waste Which are Generated in Textile Industry:

Textile waste is broadly classified into four categories, each of having characteristics that demand different pollution prevention and treatment approaches. Such categories are discussed in the following sections:

A. Hard to Treat Wastes:

This category of waste includes those that are persistent, resist treatment, or interfere with the operation of waste treatment facilities. Non-biodegradable organic or inorganic materials are the chief sources of wastes, which contain colour, metals, phenols, certain surfactants, toxic organic compounds, pesticides and phosphates. The chief sources are:

- Color & metal → dyeing operation
- Phosphates → preparatory processes and dyeing
- Non-biodegradable organic materials → surfactants

Since these types of textile wastes are difficult to treat, the identification and elimination of their sources are the best possible ways to tackle the problem. Some of the methods of prevention are chemical or process substitution, process control and optimization, recycle/reuse and better work practices.

B. Hazardous or Toxic Wastes:

These wastes are a subgroup of hard to treat wastes. But, owing to their substantial impact on the environment, they are treated as a separate class. In textiles, hazardous or toxic wastes include metals, chlorinated solvents, non-biodegradable or volatile organic materials. Some of these materials often are used for non-process applications such as machine cleaning.

C. High Volume Wastes:

Large volume of wastes is sometimes a problem for the textile processing units. Most common large volume wastes include:

- High volume of waste water
- Wash water from preparation and continuous dyeing processes and alkaline wastes from preparatory processes
- Batch dye waste containing large amounts of salt, acid or alkali

These wastes sometimes can be reduced by recycle or reuse as well as by process and equipment modification.

D. Dispersible Wastes:

The following operations in textile industry generate highly dispersible waste:

1. Waste stream from continuous operation (e.g. preparatory, dyeing, printing and finishing)
2. Print paste (printing screen, squeeze and drum cleaning)
3. Lint (preparatory, dyeing and washing operations)
4. Foam from coating operations
5. Solvents from machine cleaning
6. Still bottoms from solvent recovery (dry cleaning operation)
7. Batch dumps of unused processing (finishing mixes)

Effect of untreated effluent

Quality of ground water

Ground water is the most important source of drinking water. At present almost all depends on ground water for drinking purpose. As per the responses of the respondents presented in Table 3, it is observed that drinking water still remains uncontaminated due to haphazard discharge of industrial waste water though a very few of them expressed their concern about gradual deterioration of quality of the ground water for the same reason.

Quality of soil

Soil is the important medium of plant growth. It controls crops' quantity and quality. Continuous throwing of industrial wastes on soil reduces its quality. As per the findings shown in Table 4, it is seen that low lands are the worst victim of the situation compared to medium and high lands. This is because discharged wastes are ultimately deposited in the low land and remain there for a long time unless these are washed away through flood water.

Insect pest infestation

Generally speaking, insects are the enemies of crops they may cause a substantial loss of a crop yield. The information provided by the respondents indicated that after establishment of industries the insect pest infestation increased to a great extent (Table 5). Information displayed in Table 5 indicates that all the respondents (100%) mentioned about the increase of pest infestation (from LI to HI) in cereals, vegetables and fruits in their localities after establishment of industries. As per the responses of some respondents (24% and (6%) there was no increase in insect infestation in pulse and oilseed crops.

Yield of crops

Due to establishment and their indiscriminate discharges crop yield was found to be decreased (Table 6) as reported by the respondent. Findings shown in Table 6 indicated that similar to the increase in insect infestation, all of the respondents (100%) reported about the negative impact of unplanned discharge of industrial wastage on yield of cereal crops and fruits.

Effects of industrial discharges on human, animal and aquatic lives

Untreated and unplanned industrial discharges deteriorate not only the quality of soil, crop and environment but also directly affect the human, animal and aquatic lives. From the data displayed in Table 8 it is observed that most of the respondents (96%) in the industrial areas faced medium to high levels of dermal diseases and about equal portion of them (86%) have been suffering from respiratory diseases. The other diseases they suffered from Diarrhoea, Dysentery, Gall Bladder Cancer, Kidney problem, Sterility and Abortion of female. In case of domestic animals, all of the respondents directed their opinions that foot & mouth disease, dermal disease and mastitis occur due to these untreated wastes dumping in the areas. Similarly, all the respondents also pointed out dermal diseases, low growth, and foul odor of aquatic animals after cooking. Thus, human being, domestic animals and aquatic animals are also suffering from bad effects of industrial wastes which are dumped untreated.

Effects of industrial discharges on different types of animals

Most of the respondents (80%) in the industrial areas suppose that there are medium to high levels decrease of fishes, birds and earthworm while decreases of insect and frog are 70% and 60% respectively.

POSSIBLE QUESTIONS

UNIT-V

PART-A (20 MARKS)

(Q.NO 1 TO 20 Online Examination)

PART-B (2 MARKS)

1. Define photo oxidation process.
2. Write any two characteristics of textile effluent.
3. What is the degradability of wastes?
4. What is the effect of untreated effluent?

PART-C (6 MARKS)

1. How will you determine the following parameters in effluent waste water

 i) oil and grease ii)chloride content.

2. Write notes on degradability on wastes of textile effluent.
3. What are the characteristics of textile effluent? How will you identify and explain any one characteristics.

4). What is the effect of untreated effluent on the environment?

5). How will you treat the effluent using photo oxidation process.

6). Write short notes on the effect of untreated effluent on the environment?

KAHE

S. No	Question	Option 1	Option 2	Option 3	Option 4	Answer
1.	Which one is poisoning water in Japan is from fishes?	Bismuth	Arsenic	Antimony	Palladium	Arsenic
2.	Fishes can store more quantity of following in their bodies?	Mercury	Palladium	Bismuth	Chlorine	Mercury
3.	Waste water released from where?	Sanitaria	Tanning	Industries	Municipalities	Industries
4.	Bacteria and micro organisms present in the water will cause?	Indigestion	Intestinal tract	Brain tumour	Cancer	Intestinal tract
5.	Infectious hepatitis is caused by?	Bacteria	Viruses	Protozoa	Helminth	Viruses
6.	Amoebic dysentery is caused by?	Viruses	Helminth	Bacteria	Protozoa	Protozoa
7.	Bacteria in water causes?	Malaria	Typhoid	Dengue	Chicken guinea	Typhoid
8.	Helminth in the water causes?	Hook worm	Amoebic dysentery	Cholera	Typhoid	Hook worm
9.	What is an important requirement of the aquatic life?	Dissolved nitrogen	Dissolved chlorine	Dissolved oxygen	Dissolved methane	Dissolved oxygen
10.	What is the optimum value in natural water?	2-4ppm	4-7ppm	4-6ppm	2-7ppm	4-6ppm
11.	What is the full form of BOD?	Biochemical oxygen demand	Biological oxygen demand	Biometric oxygen deep water	Biological oxygen deep water	Biological oxygen demand
12.	The disappearance of the plants and animals in water due to?	Nitrogen depletion	Chlorine depletion	Oxygen depletion	Ozone depletion	Oxygen depletion
13.	The average quantity of water (in lpcd) required for domestic purposes according to IS code is?	100	120	70	135	135
14.	The average consumption of water required in factories in lpcd is?	15-20	20-30	30-45	70-80	30-45
15.	In which type of water demand,	Domestic water	Industrial water	Institutional and	Fire demand	Fire demand

	minimum average consumption of water takes place?	demand	demand	commercial water demand		
16.	What is the minimum water pressure available at fire hydrants?	80-100kN/m²	100-150kN/m²	40-60kN/m²	150-200kN/m²	100-150kN/m²
17.	Water lost in theft and waste contributes to how much % of total consumption?	5	10	15	20	15
18.	Which is the correct statement regarding per capita demand?	Daily water required by an individual	Water required for various purposes by a person	Water required by an individual in a year	Annual average amount of daily water required by one person	Annual average amount of daily water required by one person
19.	What are the factors affecting per capita demand?	Size of city	Size of city, habit of people	Cost of water, quality of water, size of city	Cost of water, quality of water, size of city, habit of people	Cost of water, quality of water, size of city, habit of people
20.	Which of the following statement is correct?	Rich class consumes less water	Intermittent water supplies leads to less water consumption	Loss of water is more if the pressure in the distribution system is less	Water consumption is less in flush system	Intermittent water supplies leads to less water consumption
21.	Sorter's disease is associated with-	Cotton industry	Silk industry	Wool industry	Both (a) and (b)	Wool industry
22.	What is the design discharge for intake structures?	Maximum daily demand	Maximum hourly demand	Maximum weekly demand	Average daily demand	Maximum daily demand
23.	In which of the following units, design period is maximized?	Distribution system	Demand reservoir	Water treatment unit	Pipe mains	Demand reservoir
24.	The following unit is not used to measure turbidity of water?	NTU	ATU	JTU	FTU	ATU
25.	A technique used to determine the concentration of odour compounds in a sample is known as?	Stripping	Settling	Flushing	Chlorination	Stripping

26.	In filtration, the amount of dissolved solids passing through the filters is ?	Difference between total solids and suspended solids	Sum of total solids and suspended solids	Independent of suspended solids	None of the above	Difference between total solids and suspended solids
27.	The Total dissolved solids (TDS) can be reduced by the following method	Distillation	Reverse osmosis	Ion exchange	All of the above	All of the above
28.	Which of the following is the physical monitoring of the lake?	PH	COD	BOD	Turbidity	Turbidity
29.	What is comes under the chemical monitoring of the lake?	Detergents	Pathogens	Conductivity	Turbidity	Detergents
30.	The workers of silk industry face risks of disease related to	skin	lungs	heart	both (a) and (b)	both (a) and (b)
31.	Workers of which fabric industry have maximum possibility of getting infected by anthrax?	silk	cotton	nylon	wool	wool
32.	What is the full form of GAP?	Ganga action pre distribution	Ganga action plan	Ganga affected plan	Ganga affected pre distribution	Ganga action plan
33.	The central pollution control board and the department of ocean and environment has established howmany stations over the entire coastal line of the country?	171	172	173	174	174
34.	Coastal water shows major differences in what?	Pollution	Sewage	Salinity	Conductivity	Salinity
35.	Monitoring systems can be carried out by using what?	Motors	Automatic sensors	Automatic motors	Turbines	Automatic sensors
36.	In what way river reduce the pollution in dry season?	Water	Nitrogen	Carbondioxide	Oxygen	Oxygen
37.	Determination of flow increase is used for the monitoring of which pollution?	sea pollution	River pollution	Lake pollution	Tank pollution	River pollution
38.	which of the following does not	Assessing the	Development	Determination of	Colour of the	Colour of the

	include in the monitoring of river pollution?	immediate water quality	activities in the region	flow increase	water	water
39.	Increase in the BOD value in the water indicates?	Decrease in pollution	Increase in pollution	Pollution is independent of BOD	Slight decrease in the BOD	Increase in pollution
40.	The bacterium by which the people working in wool industry get infected is	Rhizobium	Anthrax	Streptococcus	None of these	Anthrax
41.	Non hazardous organic wastes from the sewage is to be separated from what?	Toxic industrial wastes	Bacteria	Helminth	Protozoa	Toxic industrial wastes
42.	Domestic water treatment is carried out under which conditions?	Aerobic	Anaerobic	Cannot be known	Depends on the pollution level of water	Aerobic
43.	What is the BOD value of the industrial waste?	100	200	300	400	200
44.	Which is the primary process in domestic water treatment?	Screening	Sedimentation	Aerobic process	Anaerobic process	Screening
45.	In the domestic water process, when air is sent during the active sludge, then which one gets released?	Oxygen	Carbondioxide	Nitrogen	Chlorine	Carbondioxide
46.	In final step of the domestic water process, the effluent contain how much BOD?	10ppm	15ppm	20ppm	25ppm	25ppm
47.	Aerobic process is also called as?	Activated sludge process	Sludge thickening process	Sedimentation	Screening	Activated sludge process
48.	Organic contaminants are removed from the wastewater by	Water softening	Demineralization	Absorption	Adsorption	Adsorption
49.	Which of the following process is used to remove the colloidal particles	Chemical precipitation	Chemical coagulation	Ion exchange	Adsorption	Chemical coagulation

	from the effluent?					
50.	In which unit operation, gases are released or absorbed in the effluent?	Gas transfer	Ion transfer	Solute stabilization	Solids Transfer	Gas transfer
51.	In which process, excess lime is converted into bicarbonate?	Chlorination	Liming	Re-carbonation	Super-chlorination	Re-carbonation
52.	Solids are removed from the wastewater by which of the following unit operation?	Inter facial contact	Solid stabilization	Ion transfer	Solids transfer	Solids transfer
53.	In which unit operation objectionable solutes are converted into unobjectionable forms without removal?	Gas transfer	Ion transfer	Solute stabilization	Solids Transfer	Solute stabilization
54.	Which material is used in contact filters for removal of fluorides?	Calcium phosphate	Copper sulfate	Synthetic tri-calcium phosphate	Bone charcoal	Synthetic tri-calcium phosphate
55.	What is the key component of zero waste?	Biofuel	Recycle	Ecological footprint	Industrial ecology	Recycle
56.	The presence of Sulfate iron in the water results in	Odorless water	Acidity in water	Colorless water	Growth of crenothrix in water mains	Acidity in water
57.	What is the dose of copper sulfate required for the treatment of water?	0.3-0.6ppm	2-6ppm	4-8ppm	10-20ppm	0.3-0.6ppm
58.	Aerated lagoon is also known as?	Aerated lake	Activated lagoon	Aerated pond	None of the above	Aerated pond
59.	Photo oxidation requires?	Oxygen	Carbon dioxide	Nitrogen	All the above	Oxygen
60.	Problem of solid waste disposal can be reduced through	recycling	lesser pollution	more timber	population control	recycling

Reg. No.: ------------------------------ **[18CHP305B]**

KARPAGAM ACADEMY OF HIGHER EDUCATION
COIMBATORE-21
(For the candidates admitted from 2018 & onwards)
M.Sc. DEGREE EXAMINATION, AUGUST 2018
Third Semester
Chemistry
INTERNAL TEST - I
ELECTIVE –III (TEXTILE CHEMISTRY)

DATE: 30/8/2019 (FN) **SUBJECT CODE: 18CHP305B**
TIME: 2Hrs **TOTAL: 50 MARKS**

Part A(20x1=20 Marks)

ANSWER ALL THE QUESTIONS

1. a) Nylon fiber
2. b) Jute
3. b) Nylon
4. c) Aramid fibers
5. d) keratin
6. d) Petrochemicals
7. b) Work horse
8. d) Terylene
9. c) Starch
10. b) Disperse dyes
11. b) Alkali
12. a) Singeing
13. b) Scouring
14. b) Dimensional stability
15. a) Electrostatic attraction
16. Sodium hydroxide
17. b) Wet finishes
18. d) Nylon
19. c) 40-50ppm
20. a) Piece dyeing

Part B **(3x2=6 Marks)**

Answer All the Questions

21. There are many types of nylon available (e.g. Nylon 6 nylon 66, nylon 6/6-6, nylon 6/9, nylon 6/10, nylon 6/12, nylon 11, nylon 12). The material is available as a homopolymer, co-polymer or reinforced. Nylons may also be blended with other engineering plastics to improve certain aspects of performance.

22. Waxes are a diverse class of organic compounds that are lipophilic, malleable solids near ambient temperatures. They include higher alkanes and lipids, typically with melting points above about 40 °C (104 °F), melting to give low viscosity liquids. Waxes are insoluble in water but soluble in organic, nonpolar solvents. Natural waxes of different types are produced by plants and animals and occur in petroleum.

23. Pre-cleaning involves the rapid removal of materials that are either substantially larger or very light and much smaller than the crop seed. It may also include the removal of awns or beards stiff bristles growing from the ear of cereal grains (e.g. wheat, barley, rye and many grasses).

Part C **(3x8=24 Marks)**

Answer All the Questions

24. a) **Cotton production process**:

Collection and processing of cotton fiber is done by following steps:

Shearing: Sheep shearing is the process by which the cottonen fleece of a sheep is cut off. A ram or male sheep have 20 pounds of raw cotton of which 30-70% are contaminants.

Sorting: In sorting, the cotton is classified, marking and divided according to fibers quality from different parts of the body.

Cleaning and scouring: Scouring is the process of removal of impurities from greasy cotton using water, detergent and mild alkali.

Carbonizing: Cotton clips are contaminated with excessive vegetable matter, such as burrs and thorny branch segments, are carbonized using an aqueous sulfuric acid treatment, which is followed by heating to convert the defective material into carbon. The carbon is then crushed and shaken from the cotton.

Grading: After shearing, the fleece is graded into essentially four qualities (1=best, 4=worst). The grader classifies the cotton according to fineness, crimp, length, impurities and color.

Bailing: A cotton bale is a standard sized and weighted pack of graded and sorted cotton compressed by the mechanical means of a cotton press. Each bale contains 330 Kg of graded cotton, wrapped in plastic and tied by wire.

Physical and chemical properties of cotton:

Length: 60-100mm sometimes it goes 250mm.
Diameter: 20µm to 40µm
Strength: 1.0-1.7 gm/den
Elongation: 25-35% under standard condition.
Resiliency: Excellent
Hygroscopic (Moisture capacity 14-18%): Higher than other fibers
Hand feel: Soft
Specific gravity: 1.32 and so fabrics feel lighter than cellulose.
Cotton dissolved in alkali solution
Abrasion resistance: Good
Dimensional stability: Bad
Color: White to light cream in color.
Effect of alkalis: Cotton is easily and extremely vulnerable attacked by alkalis even by weak bses at low dilutions.
Effect of acids: Cotton is more resistant to acids.

Uses of cotton fiber:

Cotton is extensively used in textile applications where comfort and aesthetics are important. It is used in men’s and women’s apparel, outer wear and cold weather clothing, suits, blankets, felts and carpeting. It is often used in blends with cellulosic and man-made fibers.

(OR)

b). **Fiber**

a thread or filament from which a vegetable tissue, mineral substance, or textile is formed. "the basket comes lined with natural coco fibres".

Properties of Textile Fiber:

Before learning about properties of fiber, you should know about what is textile fiber? We can define fiber as; Any substance, natural or manufactured, with a high length to width ratio and with suitable characteristics for being processed into fabric; the smallest component, hair like in nature, that can be separated from a fabric.

Physical Chemistry

1. Length
2. Fineness
3. Crimp
4. Maturity
5. Lusture
6. Softness
7. Resiliency
8. Work of rupture
9. Density
10. Appearance
11. Flexibility
12. Toughness
13. Elongation

Mechanical properties

1. Strength
2. Elasticity
3. Extensibility
4. Rigidity

Chemical properties

1. Solubility in aqueous salt
2. Solubility in organic salt

25. a) The process that can remove the impurities has various steps:

1. **Wetting:**

The first treatment given to cotton is wetting. This treatment releases latent strains and gives permanent set provide, wet treatment is not done at temperatures higher than that used in crabbing.

2. **Crabbing:**

	Soap In Solution	Sodium Carbonate	Temperature
First bowl	2-3%	3-4%	49-52°C
Second bowl	1-3%	2-3%	46-49°C
Third bowl	1-1.5%	1-2%	43-46°C
Fourth bowl	water only	-	40.5-43°C

This treatment is given to cottonens to eliminate the tendency to cockle or distort. The cotton is wound tightly on a roll which is made up of iron. The roll is a perforated cylinder covered with cotton cloth in order to prevent staining. It is rotated during treatment. Steam is passed in the cylinder at 40-150 lb/inch square pressure (as and when required). Now the cotton is unwound and rewound, so that the outer roll of cotton after crabbing becomes the inner roll, and steam is passed again, steaming enhances affinity of cotton for dyes. The pH value of crabbing water determines the setting of cotton. A low pH produces little setting and maximum degree of setting is attained at pH 10.2.

1. **Scouring:**

Scouring of cotton differs from cotton. Firstly, cotton contains a high percentage (30-60%) of cotton grease compared with 0.5% of oil and wax in cotton. Secondly, cotton is degraded rapidly with alkali, hence it saponification of oils, and fats is to be done with alkali; it should be done very carefully and below the boiling temperature. Sodium hydroxide is replaced by sodium carbonate, ammonia or ammonium carbonate. Raw cotton is scoured by the counter current method, using a machine with four or five bowls arranged in a sequence, so that the cotton passes directly out of the first into second and so on. Each bowl has a wringer at the exit, a false bottom and rakes.

Below the false bottom is a spirally fluted shaft which rotates and carries the deposited solid dirt to the central outlet for discharge. The rakes make the cotton travel forward, beneath the surface of liquor and also agitate to keep the dirt and emulsified grease in suspension. The scouring liquor falls back in the bowl after the cotton passes through the wringer. The process is repeated at each bowl. Finally it is washed in water.

Milling:

It is done after or before dying process of milling is based on proper of cotton, that when it is wet and subjected to pressure it felts permanently specially in presence of soap, alkali and acid. Felting gives denser or more durable fabrics of more pleasing appeal. Milling can be of three different types: soap, grease, and acid.

4. **Bleaching:**

Yellowish color on the fabric may be removed only if the goods are to be sold as white or light colors where as for dark colors are washed by dye. Bleaching can be done by

- SO_2: It is a cheap process known as staving. In this case sulphur is burnt in chambers where the cotton is hanging in loop form on wooden poles. Sulphur forms sulphur dioxide which acts on the yellow coloring matter.

- Hydrogen peroxide: It gives a better white light out. Fabrics are treated in winch machine i.e. without tension. Hydrogen peroxide contains acid for preservation hence sodium silicate is added to neutralize. (I.e. it acts as buffer to stabilize). Hydrogen peroxide is heated to 40-50C. The materials are left overnight in the bleach liquor for complete bleaching wash the fabric with water and then with dilute acetic acid, again wash with water. This is preferred to staving. Heavy weight cottonens are given this treatment on a jigger machine. Cloth is rolled on rollers A and B, roller C can be shifted from roller A and B squeezing. Cloth moves from A to B a number of times.

(OR)

b). **(i) Scouring:**

Scouring of wool differs from cotton. Firstly, wool contains a high percentage (30-60%) of wool grease compared with 0.5% of oil and wax in cotton. Secondly, wool is degraded rapidly with alkali, hence it saponification of oils, and fats is to be done with alkali; it should be done very carefully and below the boiling temperature. Sodium hydroxide is replaced by sodium carbonate, ammonia or ammonium carbonate. Raw wool is scoured by the counter current method, using a machine with four or five bowls arranged in a sequence, so that the wool passes directly out of the first into second and so on. Each bowl has a wringer at the exit, a false bottom and rakes.

Below the false bottom is a spirally fluted shaft which rotates and carries the deposited solid dirt to the central outlet for discharge. The rakes make the wool travel forward, beneath the surface of liquor and also agitate to keep the dirt and emulsified grease in suspension. The scouring liquor falls back in the bowl after the wool passes through the wringer. The process is repeated at each bowl. Finally it is washed in water

	Soap In Solution	Sodium Carbonate	Temperature
First bowl	2-3%	3-4%	49-52°C
Second bowl	1-3%	2-3%	46-49°C
Third bowl	1-1.5%	1-2%	43-46°C
Fourth bowl	water only	-	40.5-43°C

The pH should never be above 10. Soap reacts with hard water and precipitates calcium and magnesium salts, hence they have been replaced by synthetic detergent, and moreover syndents are more Gardinol and Teepol. There are stable to hard water and acids and are not used up at all during scouring and can be reused. Moreover some pressure on wet wool in presence of soap can felt it which is not desirable.

	Synthetic Detergent	Sodium carbonate	Common Salt	pH	Temperature
First bowl	0.25%	0.25%		9.0	54°C
Second bowl	0.2%	0.2%	0.4%	10-10.5	52°C
Third bowl	0.12%	0.02%	0.5%	10	49°C
Fourth bowl	0-0.1%	0	0	-	46°C

(ii) Bleaching:

Yellowish color on the fabric may be removed only if the goods are to be sold as white or light colors where as for dark colors are washed by dye. Bleaching can be done by

- SO2: It is a cheap process known as staving. In this case sulphur is burnt in chambers where the wool is hanging in loop form on wooden poles. Sulphur forms sulphur dioxide which acts on the yellow coloring matter.

- Hydrogen peroxide: It gives a better white light out. Fabrics are treated in winch machine i.e. without tension. Hydrogen peroxide contains acid for preservation hence sodium silicate is added to neutralize. (I.e. it acts as buffer to stabilize). Hydrogen peroxide is heated to 40-50C. The materials are left overnight in the bleach liquor for complete bleaching wash the fabric with water and then with dilute acetic acid, again wash with water. This is preferred to staving. Heavy weight woolens are given this treatment on a jigger machine. Cloth is rolled on rollers A and B, roller C can be shifted from roller A and B squeezing. Cloth moves from A to B a number of times. jigger washing is done (by changing the bath) then wool is dried. When bleaching is done on jigger machine the strength of H2O2 should be 4-5 times higher than for light out fabrics as on a winch machine.

.

26. a). **anti creasing finishing:**

Purposes: wrinkle-free, ironing-free, easy to handle, shrinkage reducing, anti-pilling, improve the resilient recovery angle. According to China's national standards, this type of textile is defined as the anti-creasing textiles; this kind of finishing process is anti-creasing finishing. For fabrics, the purpose of the anti-creasing is: anti-wrinkles and shrink-proof after washing and drying (including dimensional stability, dimensional evenness and the appearance of seams). For clothing, the purpose of the anti-creasing is: durable press after washing and drying (including dimensional stability, dimensional evenness crease retention and the appearance of seams).

Anti-creasing resin crosslinking principle:

The anti-creasing resin finishing of cotton fabric is through the active gene of the resin molecule and the hydroxyl of the cellulose molecule, forming molecular bridge or covalent bond under certain conditions, combing with the neighboring macromolecular chains in the fiber, reducing the relative slip motion between the two molecular chains and thus improving the resilience of the deformation and the shrink-proof function of the fabric in the end.

Ingredients of anti-creasing resin:

Etherified dimethylol dihydroxy ethylene urea (M2D) In addition to the high formaldehyde whiskers resin and formaldehyde-free resin belongs to anti-creasing resin, others are all belong to etherified 2D resin. After etherification, chlorine resistance will increase, not yellowing, released lesser formaldehyde, but the reaction activity will be decreased, crease-free effect and the grade of anti-creasing will decline comparing with 2D resin.

Anti-shrink finishes

This is a generalized form of opinion which clearly indicates that without proper shrinking, these fabrics truly cannot be used to make garments. In fact preshrinking can only reduce the residual shrinkage to a lower percentage, but cannot completely eliminate it. Following are the measures one must take about the balance of residual shrinkage:

- On cotton fabrics, we can usually take away 8-10 %shrinkage by preshrinking, leaving about 5 – 6% in them. If you really do a good job on shrinking, you may bring it down to 4% which is generally accepted in the trade.
- On rayon fabrics we should know by normal preshrinking process alone it is difficult to bring the shrinkage down to 4-5 %as by nature, rayon fabrics tend to shrink each time you wash them in the first several washing. That is why people use the method of resin finish to try to control the shrinkage, or use Dry clean only on the care label to avoid the big shrinkage caused by washing. However both of these methods are not satisfactory because of the following
- When you apply resin to the fabric to stabilize the fiber, you may achieve better residual shrinkage, but the fabric will be less dray (not as soft). Besides the resin may be washed away slowly in a few washing and then the fabric will start to shrink again.
- When you see dry clean only on the care label consumers may not buy the garments as it is too expensive to dry clean by a commercial laundry.
- However of late a beater method has been worked out to pre-shrink the fabric starting from desiring and bleaching. As a result after dyeing or printing, we can use the normal pre-shrinking process to control the residual shrinkage to be about 5-6 % which should be the acceptable level.
- Therefore, when we order rayon fabrics, it is important that we discuss the possible shrinkage problem with the mill to make sure he knows what to do to control the shrinkage.

.

(OR)

b). **Mechanical Finishing:**

Involving the application of physical principles such as friction, temperature, pressure, tension and many others.

Calendering

Calendering is a process of passing cloth between rollers (or "calendars"), usually under carefully controlled heat and pressure, to produce a variety of surface textures or effects in fabric such as compact, smooth, supple, flat and glazed. The process involves passing fabric through a calendar in which a highly polished, usually heated, steel bowl rotates at a higher surface speed than the softer (e.g. cotton or paper packed) bowl against which it works, thus producing a glaze on the face of the fabric that is in contact with the steel bowl. The friction ratio is the ratio of the peripheral speed of the faster steel bowl to that of the slower bowl and is normally in the range 1.5 to 3.0. The normal woven fabric surface is not flat, particularly in ordinary quality plain weave fabrics, because of the round shape of the yarns, and interlacings of warp and weft at right angles to each other. In such fabrics it is more often seen that even when the fabric is quite regular, it is not flat. During calendering, the yarns in the fabric are squashed into a flattened elliptical shape; the intersections are made to close-up between the yarns. This causes the fabric surface to become flat and compact. The improved planeness of surface in turn improves the glaze of the fabric. The calender machines may have several rollers, some of which can be heated and varied in speed, so that in addition to pressure a polishing action can be exerted to increaselustre.

Compacting

Durable finish imparted on man-made fibres and knitted fabrics by employing heat and pressure to shrink them to produce a crêpey and bulky texture.

Embossing

This particular type of calendering process allows engraving a simple pattern on the fabric.To produce a pattern in relief by passing fabric through a calendar in which a heated metal bowl engraved with the pattern works against a relatively soft bowl, built up of compressed paper or cotton on a metal centre.

Sueding

Sueding finishing process is carried out by means of a roller coated with abrasive material. The fabric has a much softer hand and an improved insulating effect thanks to the fibre end pulled out of the fabric surface.

Raising or Napping

The raising of the fibre on the face of the goods by means of teasels or rollers covered with card clothing (steel wires) that are about one inch in height. Action by either method raises the protruding fibres and causes the finished fabric to provide greater warmth to the wearer, makes the cloth more compact, causes the fabric to become softer in hand or smoother in feel; increase durability and covers the minute areas between the interlacings of the warp and the filling. Napped fabrics include blankets, flannel, unfinished worsted, and several types of coatings and some dress goods. Other names for napping are Gigging, Genapping, Teaseled, Raised.

Shearing

Shearing is an important preparatory stage in the processing of cotton cloth. The objective of "Shearing" is to remove fibres and loose threads from the surface of the fabric, thus improving surface finish.

Stabilization
A term usually referring to fabrics in which the dimensions have been set by a suitable preshrinking operation

Fulling:
The structure, bulk and shrinkage of wool are modified by applying heat combined with friction and compression.

Reg. No.: ____________

[18CHP305B]

KARPAGAM ACADEMY OF HIGHER EDUCATION
COIMBATORE-21
(For the candidates admitted from 2018 & onwards)
M.Sc. DEGREE EXAMINATION, AUGUST 2018
Third Semester
Chemistry
INTERNAL TEST - I
ELECTIVE –III (TEXTILE CHEMISTRY)

DATE: 30/8/2019 (FN) SUBJECT CODE: 18CHP305B
TIME: 2 Hrs TOTAL: 50 MARKS

Part A **(20x1=20 Marks)**

ANSWER ALL THE QUESTIONS

1. Which one is stronger than steel wire?
   a) Cotton fiber b) Silk thread c) Plastic thread d) Nylon fiber

2. Which of the following is used for making gunny bags?
   a) Cotton b) Jute c) Wool d) Polyster

3. Which one of the following is not a natural fiber?
   a) Cotton b) Nylon c) Flax d) Wool

4. Kevlar is commercial name for what?
   a) Glass fibers b) Carbon fibers c) Aramid fibers d) Cermets

5. Woolen fiber is
   a) cellulose b) sericin c) polyester d) keratin

6. Synthetic fibers are made using which raw material?
   a) Woolen products b) Polymers c) cotton d) Petrochemicals

7. Polyester is referred as?
   a) Dupont b) Work horse c) Cellulose acetate d) Acrylic

8. Which is popular polyester?
   a) Plastic b) Rayon c) Polyethylene d) Terylene

9. The desizing process mainly removes
   a) Wax and tallow b) Dirt and colour c) Starch d) Natural impurities

10. *Dyeing of polyester is carried out by using*
   a) Acid dyes b) Disperse dyes c) Direct dyes d) Base dye

11. *The most important ingredient of a scouring composition is*
   a) Wetting agent b) Alkali c) Emulsifying agent d) Sodium silicate

12. *The process of burning protruding fibers to deliver a smooth fabric the surface*
   a) Singeing b) Bleaching c) Shearing d) Cropping

13. *The process of washing fleece to remove dust, dirt and grease is called*
   a) Reeling b) Scouring c) Shearing d) Grading

14. *The processes for sanforization is used for*
   a) Improvement in strength b) Dimensional stability
   c) Improvement in crease recovery d) Dimensional instability

15. Acid dyes on nylon are held by
   a) Electrostatic attraction b) hydrogen bonding
   c) Vander waal's forces d) Electrostatic repulsion

16. Mercerization of cotton is carried by using
   a) Sodium hydroxide b) Sulphuric acid c) Acetic acid d) Nitric acid

17. Chemical finishes are also called
   a) Dry finishes b) Wet finishes c) Mechanical finishes d) Durable finishes

18. Which of these fibers are non-biodegradable?
   a) Cotton b) Jute c) Wool d) Nylon

19. What is the hardness suitable for textile wet-processing?
   a) 30-40ppm b) 10-20ppm c) 40-50ppm d) 20-30ppm

20. Garment dyeing is also known as
   a) Piece dyeing b) Binding dyeing c) Resist dyeing d) Decorative dyeing

Part B **(3x2=6 Marks)**

Answer All the Questions

21. What are the different types of nylon?
22. Why is the removal of natural waxes necessary?
23. Why is it essential to remove the residual seeds?

Part C (3x8=24 Marks)

Answer All the Questions

24. a) Discuss the production, properties and uses of wool.

(OR)

b). Define fiber. What are the general properties of fibers? How will you classify?

25. a). Explain *in detail* for the removal of impurities *in* raw cotton.

(OR)

b). What kind of impurities can be removed by the following processes?

i) Scouring ii) Bleaching

26. a). Explain the process of Anti-crease and Anti-shrink finishes.

(OR)

b). How will you explain the mechanical finishes on Silk?

[18CHP305B] Reg. No………………..

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
Established Under Section 3 of UGC Act 1956

UG DEGREE EXAMINATION, OCTOBER 2019

(For the candidates admitted from 2018 onwards)

DEPARTMENT OF CHEMISTRY

II M.Sc., CHEMISTRY

INTERNAL EXAM-II

TEXTILE CHEMISTRY

Time: 2 hours **Maximum: 50 marks**
Date :

PART- A (10 x 2=20 Marks)
Answer All the Questions

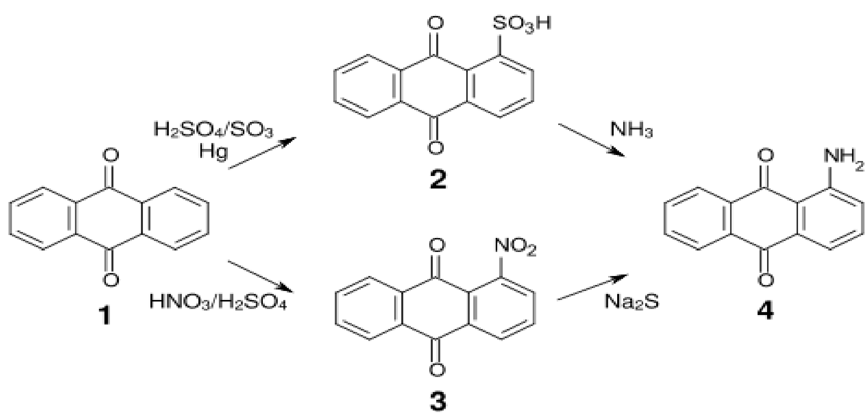
1. b) Permanent finishes
2. a) Wet Finishes
3. a) Sodium hydroxide
4. b) Polyester
5. b) Mordant dyes
6. c) Iron compounds
7. d) Eosin
8. b) Congo red
9. b) Increase in pollution
10. a) recycling
11. a) Oxygen
12. b) Recycle
13. b) mollusk shells
14. b) Malachite green
15. Xanthene dyes
16. d) skin and lungs
17. c) Aerated pond
18. a) Gas transfer
19. c) Wool industry
20. b) Acidity in water

PART- A (3 x 2=6 Marks)

Answer All the Questions

21. Finishing is the last step in fabric manufacturing and is when the final fabric properties are developed. Textile finishing refers to any process, mechanical or chemical, post dyeing, which leads to an improvement in the look, handle, or performance of the fabric, be it a woven, knitted, or nonwoven material. Generally, these processes are carried out on the textile in fabric form, but some can also be applied to fibers or yarns. Textile finishing gives a textile its final commercial character with regard to appearance, shine, handle, drape, fullness and usability.

22.



23. Diverse in Nature the process of removing the sericin, or silk gum, from silk.

Removing the gum improves the sheen, color, hand, and texture of the silk.

PART- A (3 x 8=24 Marks)

Answer All the Questions

24. a). Waterproofing in buildings is the formation of an impervious barrier over surfaces of foundations, roofs, walls and other structural members of building to prevent water penetrations through these surfaces. The building surfaces are made water-resistant and sometimes waterproof.

Commonly used materials for waterproofing in building is cementitious material, bituminous material, liquid waterproofing membrane and polyurethane liquid membrane etc. Waterproofing in buildings and structures are generally required for basement of structure, walls, bathrooms and kitchen, balconies, decks, terrace or roofs, green roofs, water tanks and swimming pools etc.

Types of Waterproofing Methods for Buildings

The following waterproofing methods are commonly used in construction:

1. Cementitious Waterproofing
2. Liquid Waterproofing Membrane
3. Bituminous Membrane
4. Bituminous Coating
5. Polyurethane Liquid Membrane

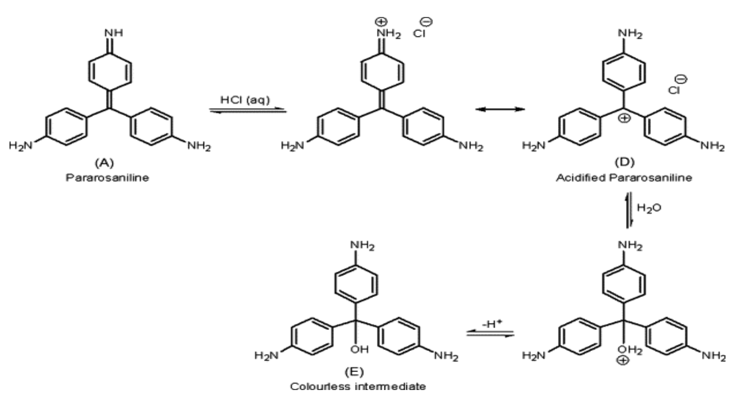
Applications of Cementitious Waterproofing

Cementitious waterproofing is used in the following type of structures:

1. Water Treatment Plants
2. Sewage Treatment Plants
3. Bridges
4. Dams
5. Railway & Subway Systems
6. Marine Cargo Ports & Docks
7. River Locks/Channels & Concrete Dykes
8. Parking Structures & Lots
9. Tunnels

(OR)

b). i) **Pararosaniline**

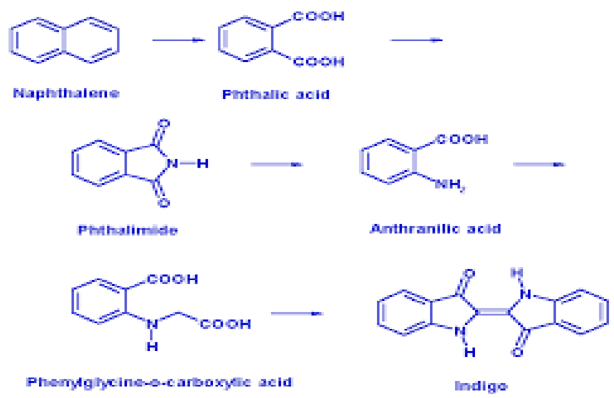


Uses

i) It is used to dye polyacrylonitrile fibers.

ii) Pararosaniline is used as a colorimetric test for aldehydes, in the Schiff test. It is the only basic fuchsine component suitable for making the aldehyde-fuchsine stain for pancreatic islet beta cells

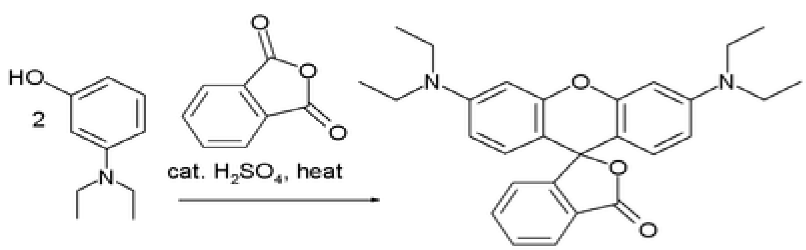
ii) indigo



Uses:

Indigo dye is an organic compound with a distinctive blue color (see indigo). Historically, indigo was a natural dye extracted from the leaves of certain plants, and this process was important economically because blue dyes were once rare. A large percentage of indigo dye produced today, several thousand tonnes each year, is synthetic. It is the blue often associated with denim cloth and blue jeans

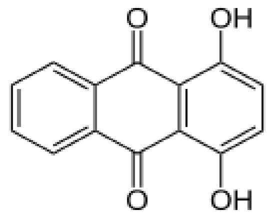
(iii) Rhodamine B.



Uses:

Rhodamine B is being tested for use as a biomarker in oral rabies vaccines for wildlife, such as raccoons, to identify animals that have eaten a vaccine bait. The rhodamine is incorporated into the animal's whiskers and teeth. It is also often mixed with herbicides to show where they have been used. Rhodamine B (BV10) is mixed with Quinacridone Magenta (PR122) to make the bright pink watercolor known as Opera Rose

25. a). Write the note on alizarin dye. Describe a method for its manufacture.



Alizarin is one of ten dihydroxyanthraquinone isomers. Its molecular structure can be viewed as being derived from anthraquinone by replacement of two neighboring hydrogen atoms (H) by hydroxyl groups (−OH). It is soluble in hexane and chloroform, and can be obtained from the latter as red-purple crystals, melting point 277–278 °C. Alizarin changes color depending on the pH of the solution it is in, thereby making it a pH indicator.

Applications

Alizarin Red is used in a biochemical assay to determine, quantitatively by colorimetry, the presence of calcific deposition by cells of an osteogenic lineage. As such it is an early stage marker (days 10–16 of in vitro culture) of matrix mineralization, a crucial step towards the formation of calcified extracellular matrix associated with true bone.

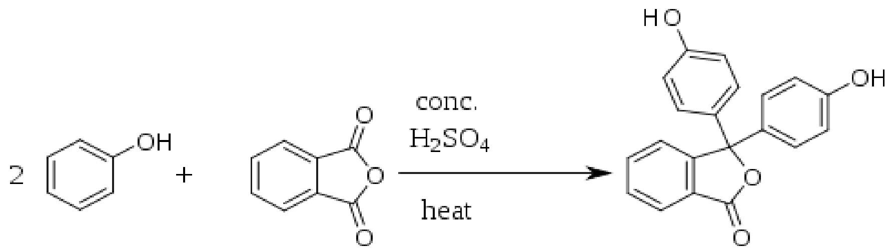
Alizarin's abilities as a biological stain were first noted in 1567, when it was observed that when fed to animals, it stained their teeth and bones red. The chemical is now commonly used in medical studies involving calcium. Free (ionic) calcium forms precipitates with alizarin, and tissue block containing calcium stain red immediately when immersed in alizarin. Thus, both pure calcium and calcium in bones and other tissues can be stained. These alizarin-stained elements can be better visualized under fluorescent lights, excited by 440–460 nm.
The process of staining calcium with alizarin works best when conducted in acidic solution (in many labs, it works better in pH 4.1 to 4.3). In clinical practice, it is used to stain synovial fluid to assess for basic calcium phosphate crystals.[15] Alizarin has also been used in studies involving bone growth, osteoporosis, bone marrow, calcium deposits in the vascular system, cellular signaling, gene expression, tissue engineering, and mesenchymal stem cells

(OR)

b). Give the methods of preparation and uses of phenolphthalene and methyl orange.

preparation of phenolphthalene

Phenolphthalein can be synthesized by condensation of phthalic anhydride with two equivalents of phenol under acidic conditions (hence the name). It was discovered in 1871 by Adolf von Baeyer.



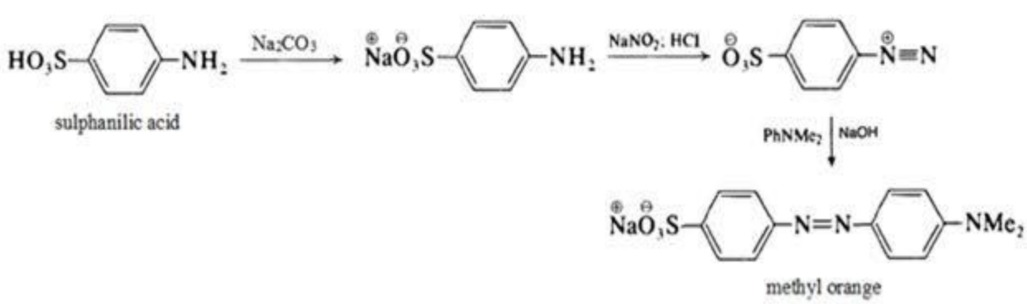
Uses

Phenolphthalein is an indicator used in chemical reactions to show when a titration reaction has gone to completion. This is because its base form is colorless and clear as distilled water while its ion form when the reaction is complete (neutral) is a bright solid pink.

It also has the simpler use of detecting excess bases in solution as it will simply turn pink when introduced to the solution.

preparation and uses of methyl orange

Methyl orange is a pH indicator frequently used in titration because of its clear and distinct color variance at different pH values. Methyl orange shows red color in acidic medium and yellow color in basic medium. Because it changes color at the pH of a mid strength acid, it is usually used in titration for acids. Unlike a universal indicator, methyl orange does not have a full spectrum of color change, but it has a sharp end point. In a solution becoming less acidic, methyl orange changes from red to orange and, finally, to yellow—with the reverse process occurring in a solution of increasing acidity.



26. a) photo oxidation process?

Aldehydes, ketones and carboxylic acids along or at the end of polymer chains are generated by oxygenated species in photolysis of photo-oxidation. The initiation of photo-oxidation reactions is due to the existence of chromophoric groups in the macromolecules. Photo-oxidation can occur simultaneously with thermal degradation and each of these effects can accelerate the other.

The photo-oxidation reactions include chain scission, cross linking and secondary oxidative reactions. The following process steps can be considered initial step, chain propagation step, chain branching and termination step. In the initial step, free radicals are formed by photon absorption. In the chain propagation step, a free radical reacts with oxygen to produce a polymer peroxy radical (POO•). This reacts with a polymer molecule to generate polymer hydroperoxide (POOH) and a new polymer alkyl radical (P•). With chain branching, polymer oxy radicals (PO•) and hydroxy radicals (HO•) are formed by photolysis. The termination step is cross linking which is a result of the reaction of different free radicals with each other.

Initial reactions

kp H2O2 + hν ↔ 2HO•

k−p H2O2 → H2O + ½O2

Propagation

HO• + H2O2 → HO2• + H2O

HO2• + H2O2 → HO• + H2O + O2

HO2• + HO2− → HO• + HO− + O2

Termination HO• + HO2• → H2O + O2

HO• + HO• → H2O2 + O2

And radicals recombine, as shown below:

2OH• → H2O2

When the water to be treated has a higher absorbance, it may compete for the radiation with the hydrogen peroxide. This is one of the drawbacks of this method. An H_2O_2/UV system can totally mineralize any organic compound, reducing it to CO_2 and water. However, generally, in real-life scenarios, such a drastic process is not necessary. The toxicity of oxidation products is not a problem since they are easily degraded. Hydrogen peroxide can be added either as a single slug dose or at multiple points in the system. The optimum dose of H_2O_2 should be determined for each water source based on bench and pilot-scale testing.

PH = Polymer

P• = Polymer alkyl radical

PO• = Polymer oxy radical (Polymer alkoxy radical)

POO• = Polymer peroxy radical (Polymer alkylperoxy radical)

POOH = Polymer hydroperoxide

OH• = hydroxy radical

(OR)

b). Effluent is an out flowing of water or gas to a natural body of water, from a structure such as a wastewater treatment plant, sewer pipe, or industrial outfall. Effluent, in engineering, is the stream exiting a chemical reactor.

Effluent is defined by the United States Environmental Protection Agency as "wastewater - treated or untreated - that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters". The Compact Oxford English Dictionary defines effluent as "liquid waste or sewage discharged into a river or the sea".

Effluent in the artificial sense is in general considered to be water pollution, such as the outflow from a sewage treatment facility or the wastewater discharge from industrial facilities. An effluent sump pump, for instance, pumps waste from toilets installed below a main sewage line. Similar to wastewater produced in different establishments, industries, and facilities, this wastewater released can also accumulate and pollute the nearby communities and bodies of water.

In the context of waste water treatment plants, effluent that has been treated is sometimes called *secondary effluent*, or *treated effluent*. This cleaner effluent is then used to feed the bacteria in biofilters. In the context of a thermal power station, the output of the cooling system may be referred to as the effluent cooling water, which is noticeably warmer than the environment. Effluent only refers to liquid discharge.

In sugar beet processing, effluent is often settled in water tanks that allow the mud-contaminated water to settle. The mud sinks to the bottom, leaving the top section of water clear, free to be pumped back into the river or be reused in the process again.

[18CHP305B] Reg. No………………..

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
Established Under Section 3 of UGC Act 1956

UG DEGREE EXAMINATION, OCTOBER 2019

(For the candidates admitted from 2018 onwards)

DEPARTMENT OF CHEMISTRY

II M.Sc., CHEMISTRY

INTERNAL EXAM-II

TEXTILE CHEMISTRY

Time: 2 hours **Maximum: 50 marks**
Date :

PART- A (10 x 2=20 Marks)
Answer All the Questions

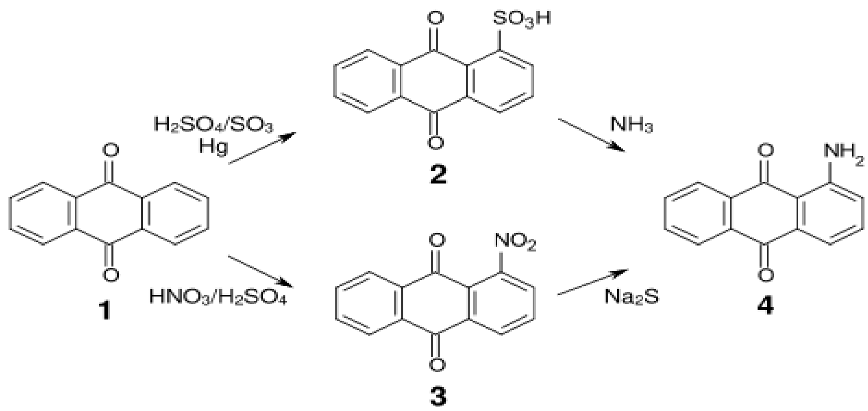
1. b) Permanent finishes
2. a) Wet Finishes
3. a) Sodium hydroxide
4. b) Polyester
5. b) Mordant dyes
6. c) Iron compounds
7. d) Eosin
8. b) Congo red
9. b) Increase in pollution
10. a) recycling
11. a) Oxygen
12. b) Recycle
13. b) mollusk shells
14. b) Malachite green
15. Xanthene dyes
16. d) skin and lungs
17. c) Aerated pond
18. a) Gas transfer
19. c) Wool industry
20. b) Acidity in water

PART- A (3 x 2=6 Marks)

Answer All the Questions

21. Finishing is the last step in fabric manufacturing and is when the final fabric properties are developed. Textile finishing refers to any process, mechanical or chemical, post dyeing, which leads to an improvement in the look, handle, or performance of the fabric, be it a woven, knitted, or nonwoven material. Generally, these processes are carried out on the textile in fabric form, but some can also be applied to fibers or yarns. Textile finishing gives a textile its final commercial character with regard to appearance, shine, handle, drape, fullness and usability.

22.



23. Diverse in Nature the process of removing the sericin, or silk gum, from silk.

Removing the gum improves the sheen, color, hand, and texture of the silk.

PART- A (3 x 8=24 Marks)

Answer All the Questions

24. a). Waterproofing in buildings is the formation of an impervious barrier over surfaces of foundations, roofs, walls and other structural members of building to prevent water penetrations through these surfaces. The building surfaces are made water-resistant and sometimes waterproof.

Commonly used materials for waterproofing in building is cementitious material, bituminous material, liquid waterproofing membrane and polyurethane liquid membrane etc. Waterproofing in buildings and structures are generally required for basement of structure, walls, bathrooms and kitchen, balconies, decks, terrace or roofs, green roofs, water tanks and swimming pools etc.

Types of Waterproofing Methods for Buildings

The following waterproofing methods are commonly used in construction:

1. Cementitious Waterproofing
2. Liquid Waterproofing Membrane
3. Bituminous Membrane
4. Bituminous Coating
5. Polyurethane Liquid Membrane

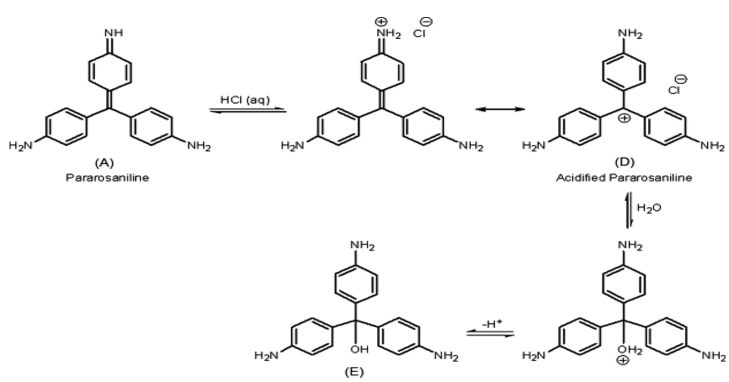
Applications of Cementitious Waterproofing

Cementitious waterproofing is used in the following type of structures:

1. Water Treatment Plants
2. Sewage Treatment Plants
3. Bridges
4. Dams
5. Railway & Subway Systems
6. Marine Cargo Ports & Docks
7. River Locks/Channels & Concrete Dykes
8. Parking Structures & Lots
9. Tunnels

(OR)

b). i) **Pararosaniline**

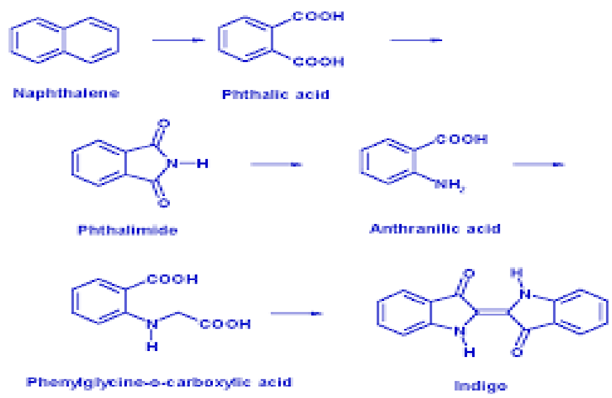


Uses

i) It is used to dye polyacrylonitrile fibers.

ii) Pararosaniline is used as a colorimetric test for aldehydes, in the Schiff test. It is the only basic fuchsine component suitable for making the aldehyde-fuchsine stain for pancreatic islet beta cells

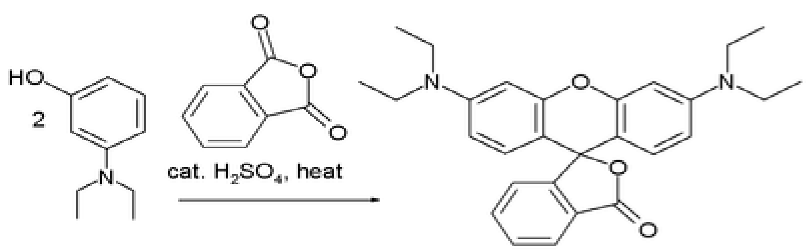
ii) indigo



Uses:

Indigo dye is an organic compound with a distinctive blue color (see indigo). Historically, indigo was a natural dye extracted from the leaves of certain plants, and this process was important economically because blue dyes were once rare. A large percentage of indigo dye produced today, several thousand tonnes each year, is synthetic. It is the blue often associated with denim cloth and blue jeans

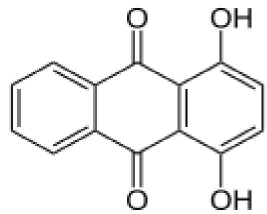
(iii) Rhodamine B.



Uses:

Rhodamine B is being tested for use as a biomarker in oral rabies vaccines for wildlife, such as raccoons, to identify animals that have eaten a vaccine bait. The rhodamine is incorporated into the animal's whiskers and teeth. It is also often mixed with herbicides to show where they have been used. Rhodamine B (BV10) is mixed with Quinacridone Magenta (PR122) to make the bright pink watercolor known as Opera Rose

25. a). Write the note on alizarin dye. Describe a method for its manufacture.



Alizarin is one of ten dihydroxyanthraquinone isomers. Its molecular structure can be viewed as being derived from anthraquinone by replacement of two neighboring hydrogen atoms (H) by hydroxyl groups (−OH). It is soluble in hexane and chloroform, and can be obtained from the latter as red-purple crystals, melting point 277–278 °C. Alizarin changes color depending on the pH of the solution it is in, thereby making it a pH indicator.

Applications

Alizarin Red is used in a biochemical assay to determine, quantitatively by colorimetry, the presence of calcific deposition by cells of an osteogenic lineage. As such it is an early stage marker (days 10–16 of in vitro culture) of matrix mineralization, a crucial step towards the formation of calcified extracellular matrix associated with true bone.

Alizarin's abilities as a biological stain were first noted in 1567, when it was observed that when fed to animals, it stained their teeth and bones red. The chemical is now commonly used in medical studies involving calcium. Free (ionic) calcium forms precipitates with alizarin, and tissue block containing calcium stain red immediately when immersed in alizarin. Thus, both pure calcium and calcium in bones and other tissues can be stained. These alizarin-stained elements can be better visualized under fluorescent lights, excited by 440–460 nm.

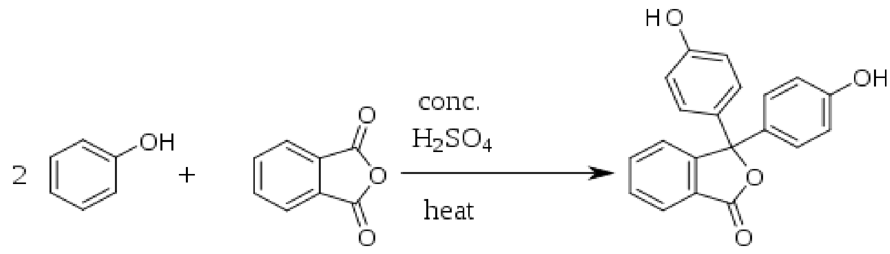
The process of staining calcium with alizarin works best when conducted in acidic solution (in many labs, it works better in pH 4.1 to 4.3). In clinical practice, it is used to stain synovial fluid to assess for basic calcium phosphate crystals.[15] Alizarin has also been used in studies involving bone growth, osteoporosis, bone marrow, calcium deposits in the vascular system, cellular signaling, gene expression, tissue engineering, and mesenchymal stem cells

(OR)

b). Give the methods of preparation and uses of phenolphthalene and methyl orange.

preparation of phenolphthalene

Phenolphthalein can be synthesized by condensation of phthalic anhydride with two equivalents of phenol under acidic conditions (hence the name). It was discovered in 1871 by Adolf von Baeyer.



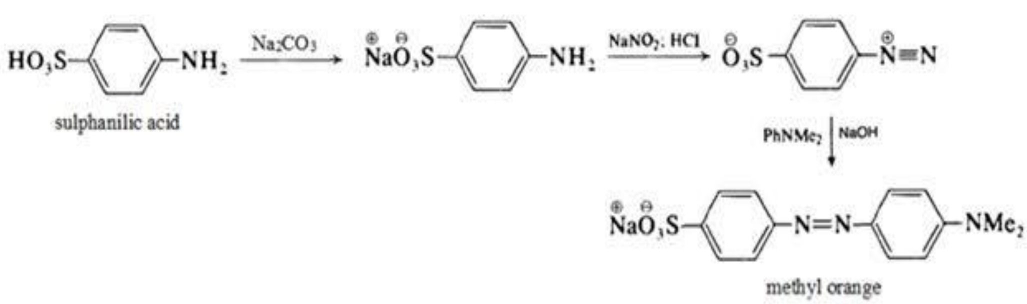
Uses

Phenolphthalein is an indicator used in chemical reactions to show when a titration reaction has gone to completion. This is because its base form is colorless and clear as distilled water while its ion form when the reaction is complete (neutral) is a bright solid pink.

It also has the simpler use of detecting excess bases in solution as it will simply turn pink when introduced to the solution.

preparation and uses of methyl orange

Methyl orange is a pH indicator frequently used in titration because of its clear and distinct color variance at different pH values. Methyl orange shows red color in acidic medium and yellow color in basic medium. Because it changes color at the pH of a mid strength acid, it is usually used in titration for acids. Unlike a universal indicator, methyl orange does not have a full spectrum of color change, but it has a sharp end point. In a solution becoming less acidic, methyl orange changes from red to orange and, finally, to yellow—with the reverse process occurring in a solution of increasing acidity.



26. a) photo oxidation process?

Aldehydes, ketones and carboxylic acids along or at the end of polymer chains are generated by oxygenated species in photolysis of photo-oxidation. The initiation of photo-oxidation reactions is due to the existence of chromophoric groups in the macromolecules. Photo-oxidation can occur simultaneously with thermal degradation and each of these effects can accelerate the other.

The photo-oxidation reactions include chain scission, cross linking and secondary oxidative reactions. The following process steps can be considered initial step, chain propagation step, chain branching and termination step. In the initial step, free radicals are formed by photon absorption. In the chain propagation step, a free radical reacts with oxygen to produce a polymer peroxy radical (POO•). This reacts with a polymer molecule to generate polymer hydroperoxide (POOH) and a new polymer alkyl radical (P•). With chain branching, polymer oxy radicals (PO•) and hydroxy radicals (HO•) are formed by photolysis. The termination step is cross linking which is a result of the reaction of different free radicals with each other.

Initial reactions

kp H2O2 + hν ↔ 2HO•

k−p H2O2 → H2O + ½O2

Propagation

HO• + H2O2 → HO2• + H2O

HO2• + H2O2 → HO• + H2O + O2

HO2• + HO2− → HO• + HO− + O2

Termination HO• + HO2• → H2O + O2

HO• + HO• → H2O2 + O2

And radicals recombine, as shown below:

2OH• → H2O2

When the water to be treated has a higher absorbance, it may compete for the radiation with the hydrogen peroxide. This is one of the drawbacks of this method. An H_2O_2/UV system can totally mineralize any organic compound, reducing it to CO_2 and water. However, generally, in real-life scenarios, such a drastic process is not necessary. The toxicity of oxidation products is not a problem since they are easily degraded. Hydrogen peroxide can be added either as a single slug dose or at multiple points in the system. The optimum dose of H_2O_2 should be determined for each water source based on bench and pilot-scale testing.

PH = Polymer

P• = Polymer alkyl radical

PO• = Polymer oxy radical (Polymer alkoxy radical)

POO• = Polymer peroxy radical (Polymer alkylperoxy radical)

POOH = Polymer hydroperoxide

OH• = hydroxy radical

(OR)

b). Effluent is an out flowing of water or gas to a natural body of water, from a structure such as a wastewater treatment plant, sewer pipe, or industrial outfall. Effluent, in engineering, is the stream exiting a chemical reactor.

Effluent is defined by the United States Environmental Protection Agency as "wastewater - treated or untreated - that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters". The Compact Oxford English Dictionary defines effluent as "liquid waste or sewage discharged into a river or the sea".

Effluent in the artificial sense is in general considered to be water pollution, such as the outflow from a sewage treatment facility or the wastewater discharge from industrial facilities. An effluent sump pump, for instance, pumps waste from toilets installed below a main sewage line. Similar to wastewater produced in different establishments, industries, and facilities, this wastewater released can also accumulate and pollute the nearby communities and bodies of water.

In the context of waste water treatment plants, effluent that has been treated is sometimes called *secondary effluent*, or *treated effluent*. This cleaner effluent is then used to feed the bacteria in biofilters. In the context of a thermal power station, the output of the cooling system may be referred to as the effluent cooling water, which is noticeably warmer than the environment. Effluent only refers to liquid discharge.

In sugar beet processing, effluent is often settled in water tanks that allow the mud-contaminated water to settle. The mud sinks to the bottom, leaving the top section of water clear, free to be pumped back into the river or be reused in the process again.