Revision Notes

Class- 12 Chemistry

Chapter 16 - Chemistry in Everyday Life

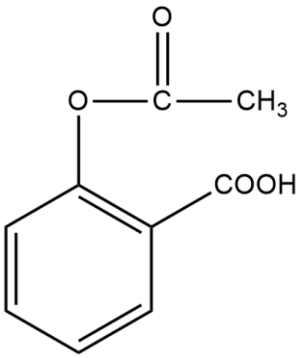
Medicine or Drugs: Those chemical substances which help the living organisms for the treatment of diseases or to reduce the pain are known as medicine or drugs. The treatment of disease with the help of drugs or chemical compounds which destroy the microorganism without causing any harm to our body is called chemotherapy and the compounds used in this process are called chemotherapeutic agents.
Various number of compounds of Medicine are shown as below:

1. Antiseptics: These are those compounds which prevent or destroy the growth of the harmful microorganism in our body. The main examples of common antiseptics are defined as Dettol, Savlon, Cetavelon, acriflavine, iodine, methylene blue, mercurochrome, etc. Dettol is defined as a mixture of chloroxylenol and terpineol. Dettol's diluted solution is generally used to clean wounds. Bithional is an important compound which is added to soap to impart antiseptic properties.

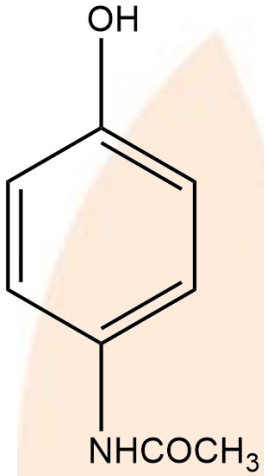
2. Disinfectants: These are the chemical compounds which have the capability to destroy the microorganism completely. These have disadvantages that they are said to be toxic to living tissues. Disinfectants have many applications but mainly it is used for sterilization of floor, sanitary and cloths. It is noted that 1% solution of phenol is disinfectant while 0.2% solution of phenol is antiseptic.

3. Analgesics: These are the substances which are used as painkillers i. used to get relief from pain. These are basically of two types:
(a) Narcotics drugs: It is a type of alkaloids which contains opium as one of the ingredients and known as habit forming drugs because it causes sleep and unconsciousness when higher dose is taken. Main example of this drug is Morphine.
(b) Non-narcotics: Analgesics are coming under the category of non-narcotics drugs, these are effectively antipyretics. Main examples of non-narcotics drugs are Aspirin, Ibuprofen, Naproxen etc.

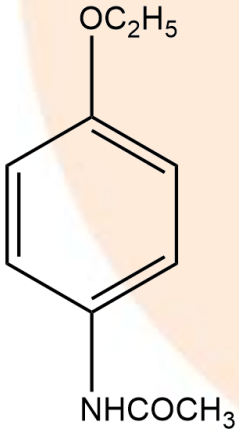
4. Antipyretics: These are used to control the fever of the human body. Main examples of this are:
Aspirin whose structure is shown as:



Paracetamol is shown as below:



Phenacetin is shown as below:



5. Antimalarials: As the name suggests this is the drug which is used to cure malaria fever. Examples of antimalarial drugs are Quinine, Chloroquine, Paraquine and Primaquine etc.

6. Tranquilizers: These are those chemical substances which act on the central nervous system. This acts as a calming effect as these are used for mental diseases which are known as psychotherapeutic drugs.

Tranquilizers are generally of two types

(a) Sedative or hypnotics Sedative: These types of drugs are used to reduce nervous tension and give relaxation. Examples of this drug are Reserpine, barbituric acid and its derivatives luminal and seconal.
(b) Mood elevators or Antidepressants: These types of drugs are used for the treatment of highly depressed patients who have lost their confidence. Main example of antidepressants is Benzedrine (amphetamine).

7. Anaesthetics: These are known as those chemical substances which help to relieve pain or used as local insensibility to pain and other sensation.
These are also of two types
(a) General: General anaesthetics produce unconsciousness to the person this is given at the time of major surgical operations. This may be in gaseous as well as in liquid form some of the examples are in gaseous form – Nitrous oxide, ethylene, cyclopropane etc. and in liquid form – Chloroform, divinyl ether and sodium pentothal etc.
(b) Local anaesthetics: This produces loss or sensation on a small portion of the body. This is used for minor operations. It is present in jelly, spray form and also used in the form of injection. Some of the examples are in jelly form oxylocain, in spray form as an Ethyl chloride and in injection form used as Procaine.

8. Antibiotics: These are the chemical substances which are produced from some microorganisms like fungi, bacteria or mold and these are used to stop or decrease the growth of other microorganisms. In infectious diseases antibiotics work very well like in the flu. The main example of antibiotics is Penicillin which is a highly effective drug for pneumonia, Bronchitis, abscesses, sore throat etc.
Synthetic antibiotics Streptomycin is used for the treatment of (Tuberculosis), Chloromycetin - (Typhoid, Meningitis, Pneumonia, diarrhoea, dysentery etc.). Tetracycline - (Acute fever, trachoma, dysentery & urinary tract infection).

9. Sulpha Drugs: These are the drugs which have great antibacterial powers. These are defined as a group of drugs which are derivatives of sulfanilamide. Some other examples of sulpha drugs are –
(a) Sulphathiazole which is used to treat severe infections.
(b) Sulpha guanidine is used in bacillary dysentery
(c) Sulpha pyridine is used in pneumonia
(d) Sulfadiazine is used to treat dysentery, urinary infection and respiratory infection.

Rocket Propellants

Introduction: Rocket propellants are used to give a correct amount of push to the

rocket satellites which enter it into space and for this purpose some chemical fuels are used which are known as rocket propellants. This can be made by the combination of two compounds
(a) An explosive compound which is known as fuel.
(b) Oxidizer
There are some conditions which have to be satisfied for being a propellent these can be defined as:
1. It should be ashless i.e. burning of fuel should not leave any ash.
2. The burning of fuel should produce a large volume of gases/g of fuel.
3. The combustion should proceed at a fast rate.

Classification: This can be classified on the basis of its physical state of fuel and oxidizer i.e., whether it is solid, liquid or gaseous nature.

1. Solid propellants: These are those propellants in which both fuel and oxidizer are solid. These are generally of two types
(a) Composite propellant: This contains polymeric binder as fuel and ammonium perchlorate as oxidizer. The main polymeric binder of fuel is Polyurethane or polybutadiene and Oxidizer is Ammonium perchlorate (II).
(b) Double base propellant: which consists of nitrocellulose and nitroglycerine. There is one main disadvantage of solid propellant that once they ignite, they will burn with a predetermined rate. These do not have the start and stop capability.

2. Liquid propellant: These are generally of two types which can be defined as (a) Mono Liquid propellant: These are single liquid propellant which acts as fuel and oxidizer. For example, Nitromethane, Methyl nitrate, etc.
(b) Biliquid propellant: This type of propellants comprises a liquid fuel and a liquid oxidizer. In this case fuel used is Kerosene, alcohol, hydrazine, monomethyl hydrazine (MMH) or liquid hydrogen and Liquid oxygen, nitrogen tetroxide or nitrous acid are used as oxidizers.
The main advantages of liquid propellants are:
a. These provide higher thrust as compared to solid propellants.
b. The thrust can be controlled by switching on and off the flow of liquid propellant.

3. Hybrid propellant: These are generally consisting of a solid fuel and a liquid oxidizer. In this case acrylic rubber is used as fuel and liquid nitrous oxide is used as oxidizer.

Specific Impulse
Specific impulse is represented by I_S which defines the superiority and performance of a propellant. It is given by the formula:

$$I_S = \sqrt{\frac{T}{M}}$$

Here T is defined as flame temperature and M is average molecular mass.
This formula defines that the performance of rocket propellant is directly proportional to flame temperature which defines that propellant will be better if flame temperature is higher and the average mass of the product gas is lower.

DYES

Introduction

Dyes are defined as coloured substances which are used in solution or used as a dispersion to a substrate as a textile fibres like cotton, wool, silk, polyester, nylon, paper, leather, hair, fur, plastic material etc. and give them a coloured and shiny appearance.
Colour of any item depends upon the absorption property of light. If any compound absorbs light in the visible region, then its colour will be the same as it gets after reflection. The main example is when a dye absorbs blue colour then it gives its complementary colour yellow. Auxochromes are defined as those groups which do not absorb light by their own like chromophores but they deepen their colour when mixed with any coloured compounds, i.e., $OH, NH_2, Cl, COOH$ etc.

Classification

It can be classified on the basis of their source:
1. Natural dyes: These are those dyes which are derived through plants i.e., by nature. Main examples of natural dyes are alizarin, indigo etc.
2. Synthetic dyes: These are man made dyes i.e., prepared in laboratory. For example: malachite green, orange-I, orange-II, aniline yellow etc.

Constitution

The main constitutions of dyes are defined as:
1. Nitro dyes contain martius yellow.
2. Azo dyes contain aniline yellow, methyl orange, orange-I, congo red etc.
3. Triphenylmethane dyes contain malachite green magenta.
4. Indigoid dyes contain Indigo, indigosol.
5. Anthraquinone dyes contain alizarin.
6. Phthalein dyes contain phenolphthalein.

Applications

A. Acid dyes: These are defined as sodium salts of azo dyes which contain sulphonic acid or carboxylic acid for example orange-I, orange-II, congo red, methyl orange and methyl red. These dyes are used to dye wool, silk, polyurethane fibres but these

cannot be used for cotton. Polycaprolactam fibres contain free amino groups in higher proportion therefore the affinity of acid dyes for nylon is higher in this case as compared to other types.

B. Basic dyes: These are defined as the salts of azo and triphenylmethane dyes which contains amino groups like auxochromes, main examples are aniline yellow, butter yellow, malachite green and chrysoidine G. These dyes are applied in their soluble acid solutions which further get attached to the anionic sites present on the fabrics. These types of dyes are used to dye polyesters and reinforced nylons.

C. Direct dyes: These dyes are generally known as water soluble dyes and have advantages that are directly applied to the fabric from an aqueous solution. These dyes are mostly useful for fabrics which can form hydrogen bonds such as cotton, wool, silk, rayon and nylon. Main examples of direct dyes are: congo red and martius yellow.

D. Fibre reactive dyes: These are those dyes which attach themselves to the fibre through an irreversible reaction. Due to its irreversible reaction, dying is very fast and its colour remains as such for longtime. These dyes contain reactive groups which combine directly with the hydroxyl or amino group of the fibre (cotton, wool, silk). The important examples of these dyes are derivatives of 2, 4-dichloro-1, 3, 5-triazine.

E. Insoluble azo dyes: These are the dyes which are obtained by coupling of phenols, naphthols, aminophenols adsorbed on the surface of a fabric with the help of polyurethanes, poly acrylonitrile and leather. These dyes constitute about 60% of the total dyes used. These types of dyes are of toxic nature so these cannot be used for food stuff but can be used to dye cosmetics, drugs, biological strains like indicators etc.

F. Ingrain dyes: These types of dyes are insoluble in water and these are produced in situ on the surface of the fabric with the help of coupling reactions. Main example of ingrained dye is para red.

G. Vat dyes: These are also known as insoluble dyes which first reduced to colourless soluble form with the help of a reducing agent like alkaline sodium hydrosulphite and then it is applied to the fabric which further get oxidized to insoluble coloured form along with the evolution of air or some oxidizing agent like chromic acid. Examples of vat dyes are indigo. Indigosol O. This type of dyes is used to dye wool.

H. Mordant dyes: This is a type of dye which is first treated with metal ion as a mordant and then applied to the fabric and this mordant acts as a binding agent between the dye and the fabric. It can give different colors to the fabric by choosing different types of metals. These dyes are also used to dye wool. The main example is alizarin which gives a rose red or turkey red colour.

Chemicals in Food

Food additives: Chemicals which are added in food items to improve its qualities, appearance, taste, odour and nutritive or food value are known by the name food additives. Food additives generally include preservatives, flavouring agents, artificial sweeteners, dyes, antioxidants, fortifiers, emulsifiers and antifoaming agents.

Antioxidants: Antioxidants are those chemicals which are used to prevent oxidation of fats in package foods like potato chips, biscuits, breakfast cereals, crackers etc. They are said to be more reactive towards oxygen and also reduce the rate of involvement of free radicals in the ageing process. The main examples of antioxidants are butylated hydroxytoluene abbreviated as BHT and butylated hydroxyanisole abbreviated as BHA.

Artificial sweetening agents: These types of items are generally used by diabetic's patients as we know that sucrose and fructose are natural sweetening agents. These add on the calories in the food in which it adds and it promotes tooth decay therefore there is need of using artificial sweeteners. The main examples of artificial sweetening agents are saccharin, aspartame, alitame, sucralose, cyclamate and L-glucose.

(i) Saccharin is used in the form of its sodium or calcium salt which is highly soluble in water. It is said to be non-biodegradable in nature and does not contain any calorific value of food. It is primarily used by diabetic patients and those persons who need to control calories.

(ii) Aspartame is used as a sugar substitute in soft drinks and cold foods in which the methyl ester of the dipeptide is derived from phenylalanine and aspartic acid.

(iii) Alitame is similar to aspartame but it is said to be more stable as compared to aspartame.

(iv) Sucralose is said to be a trichloro derivative of sucrose. This has the main advantage that it neither provides calories nor causes tooth decay.

(v) Cyclamate It is N-cyclohexyl sulfamate which is also used as a sweetening agent.

(vi) L-Glucose is similar to D-sugars, L-sugars which are also sweet in taste but do not provide any energy since our body does not have the enzymes for their metabolism.

Preservatives

These are chemical substances which are used to protect food against bacteria, yeasts and moulds are called preservatives. The most common example of preservative is sodium benzoate. Another main example of preservative is sodium or potassium metabisulphite used in jams, squashes and pickles etc. Its preservative action is due to sulphur dioxide which dissolves in water and forms sulphurous acid which inhibits the growth of yeasts, moulds and bacteria. Salts of propionic acid and sorbic acid are also used as preservatives.

Edible colours

Many types of colours are added to food items which improve the appearance of food items but it does not provide any nutrition in that food. These are also said to be dyes and like dyes it will also exist in two forms called synthetic or natural. The synthetic edible colours are those azo dyes which are harmful for young children and asthma patients. Example of synthetic azo dye is tetrazine which is shown to be harmful. Examples of natural edible colours are annatto, caramel, carotene and saffron, these are said to be safe. Some inorganic salts have also been used as an edible colour like iron oxide is used to impart red colour and titanium dioxide is used to intensify whiteness.

Detergents

Soaps

Soaps are said to be sodium or potassium salts of higher fatty acids for example lauric acid ($C_{11}H_{23}COOH$), myristic acid ($C_{13}H_{27}COOH$), palmitic acid ($C_{15}H_{31}COOH$, stearic acid ($C_{17}H_{35}COOH$), oleic acid ($C_{17}H_{33}COOH$), linoleic acid ($C_{17}H_{31}COOH$) and linolenic acid ($C_{17}H_{29}COOH$). Soaps are said to be biodegradable in nature and soap is said to be biodegradable because microorganisms present in sewage water completely oxidize them to CO_2. Due to this property, soaps do not create any water pollution problems.

But this contains two main disadvantages which can be explained as:

1. Soaps cannot be used in hard water as calcium and magnesium ions present in hard water react with soaps which form curdy white precipitates with hard water.
2. Soaps cannot be used in acidic solutions as acids precipitate the insoluble free fatty acids which adhere to the fabrics and hence prevent the process of dyeing.

Synthetic detergents

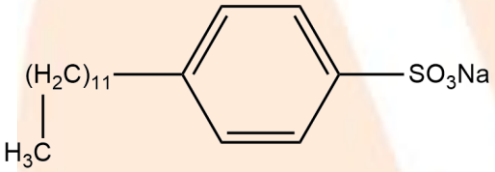
Synthetic detergents are generally known as sodium salts of alkyl hydrogen sulphates of long chain alcohols or alkylbenzene sulphonates. Detergents can be used even in hard water as it contains sodium or potassium salts and their calcium and magnesium salts are also soluble in water. Both soaps and synthetic detergents

are not completely biodegradable and they cause water-pollution. Synthetic detergents are of three types:

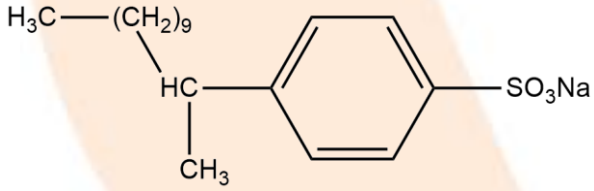
1. Anionic detergents: As their name suggested that a large part of their molecules is known as anions. These further divided into two types:
a. Sodium alkyl sulphate: These are those detergents which are obtained from long chain alcohols by reacting them with concentrated sulphuric acid by the neutralization reaction with NaOH. These sodium alkyl sulphates are said to be purely biodegradable in nature. The preparation of sodium alkyl sulphate is shown as:

$$\underset{\text{n-Lauryl alcohol}}{C_{11}H_{23}CH_2OH} \xrightarrow[-H_2O]{\text{Conc.}H_2SO_4} \underset{\text{n-lauryl hydrogen sulphate}}{C_{11}H_{23}CH_2OSO_2H} \xrightarrow[-H_2O]{NaOH} \underset{\text{Sodium lauryl sulpahte}}{C_{11}H_{23}CH_2OSO_2Na}$$

b. Alkylbenzene sulphonates: These detergents are obtained by the process called Friedel craft alkylation in which benzene with long chain alkyl halide or an alkene or an alcohol reacts through the reaction called sulphonation and neutralization with the base NaOH. The most commonly used example of this type of domestic detergent is sodium dodecylbenzenesulfonate shown as:



and another important example is sodium 2-dodecylbenzenesulfonate which is shown as:



These types of detergents are very effective in slightly acidic solutions as they can easily form corresponding alkyl hydrogen sulphates which are of soluble nature on the other hand, soaps react with acidic solutions and form insoluble fatty acids which causes pollution.

2. Cationic detergents: These are said to be quaternary ammonium salts like chlorides, bromides, acetates etc. This type of detergent contains one or more than one long chain alkyl groups. These are expensive as compared to anionic detergents therefore these have limited uses. These types of detergents have germicidal properties and are used quite extensively as germicides for example cetyltrimethylammonium chloride represented by the chemical formula $[CH_3(CH_2)_{15}N^+(CH_3)_3]Cl^-$.

3. Non-ionic detergents: Detergents which are present in the form of esters which are of high molecular mass that are obtained by reaction between polyethylene glycol and stearic acid. These can also be obtained from long chain alcohols by reacting them with excess of ethylene oxide in presence of a base.

Detergent pollution

Detergents generally contain branched hydrocarbon chains which cause pollution in lakes, ponds, rivers and other water bodies. This can be explained on the basis of the presence of side chains which stop bacteria from attacking and breaking off the chains. This results in slow degradation of detergent molecules leading to their accumulation.