BIOLOGICAL IMPORTANCE OF SODIUM, POTASSIUM, MAGNESIUM AND CALCIUM

An adult body contains 90 grams Na, 170 grams K, 25 grams Mg and 1200 grams Ca as compared to 5 grams Fe and 0.06 grams Cu. Sodium and potassium ions play an important role in transmission of nerve signals in regulating the flow of water across the cell membranes and in the transport of sugars and amino acids into cells. Sodium ions are found primarily on the outside of the cells. Sodium and potassium are chemically similar but differ in the ability to penetrate cell membrane, transport mechanism and efficiency to activate enzymes.

So potassium ions are most abundant ions inside the cell and there they activate enzymes, participate in the oxidation of glucose to produce ATP (adenosine triphosphate is considered as energy currency of life by biologist: a high energy molecule which stores energy needed to do everyday activities). There is considerable variation in the concentration of Na^+ and K^+ ions on the opposite sides of the cell membranes.

These gradients are responsible for SODIUM POTASSIUM PUMP. The process of moving Na+ and K+ ions across the cell membranes in an active transport process involving the hydrolysis of ATP. This process is responsible for maintaining the large excess of Na^+ ions outside the cell and large excess of K^+ ions inside the cell. It involves an enzyme referred as Na^+/K^+ ATPase. Sodium potassium pump (Na^+/K^+ pump) also known as Na^+/K^+ ATPase (Sodium-Potassium adenosine triphosphate), discovered by a Danish scientist , Jens

Christian Skou. Calcium is also an essential element for all organisms. It forms solid skeletal materials such as bones. Most of the Ca is present in bones and teeth. Ca plays an important role in neuromuscular function, interneuronal transmission and blood coagulation. All enzymes that utilise ATP in phosphate transfer require Mg as the cofactor. The main pigment for absorption of light in plants is chlorophyll which contains magnesium. Daily requirements for an adult boy are K (3500 mg), Na (2400 mg), Ca (1000 mg) and Mg (400 mg).

CHEMOTHERPY

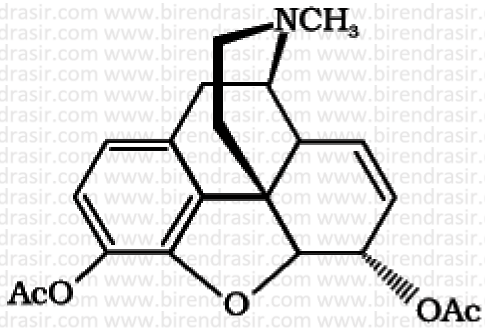
Chemical substances of natural or synthetic origin which are used for curing diseases and reducing suffering from pain are called medicines or drugs. The branch of science which deals with the treatment of diseases using suitable chemicals is known as chemotherapy.

Analgesics Medicines used for getting relief from pain are called analgesics. These are of two types narcotics and non – narcotics

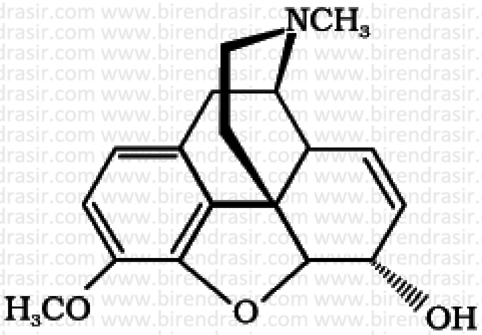
Narcotics Drugs which produce sleep and unconsciousness are called narcotics. Morphine, codeine, marijuana etc.

Morphine

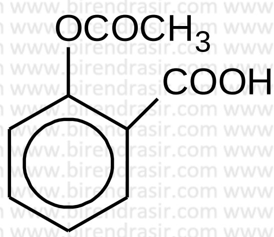
Heroin



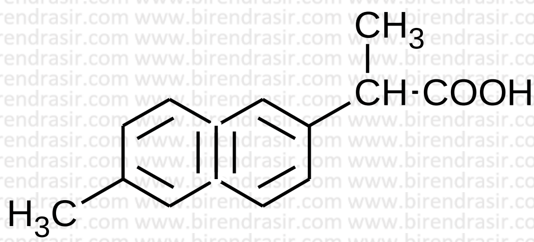
Codeine



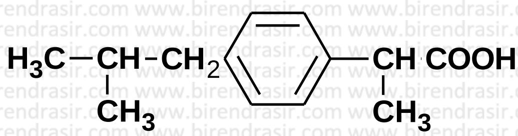
Non-narcotics Aspirin (2-acetoxybenzoic acid) is the most commonly used analgesic with antipyretic (temperature lowering) properties. Now a days because of its antiblood clotting action, aspirin is widely used to prevent heart attacks. Other examples are Ibuprofen, Naproxen etc.



2-Acetoxybenzoic acid (acetoxybenzoic acid) or acetylasalicylic acid (asprin)



naproxen



Ibuprofen

TRANQUILLIZERS OR HYPNOTICS

The drugs which act on the central nervous systems (CNS) and help in reducing stress and fatigue by inducing a sense of well being are called tranquillizers.

The most commonly used tranquillizers are barbituric acid and its 5, 5 – disubstituted derivatives such as veronal, luminal, seconal amytal and Nembutal. Cleordiazepoxide and meprobante are relatively mild tranquillizers and hence are used for relieving tension. Equanil is used for reducing depression and hypertension. Reserpine isolated from the Indian plant Rauwolfia serpentine is also a powerful tranquillizer. It also slows down the pulse rate and lowers the blood pressure.

ANTISEPTIC

Antiseptics are the chemicals substances which prevent the growth of micro – organisms and may even kill them.

DISINFECTANTS

Disinfectants are chemical substances which kill micro – organisms but are not safe to be applied to the living tissues. They are generally used to kill the micro – organisms present in drains, toilets, floors etc.

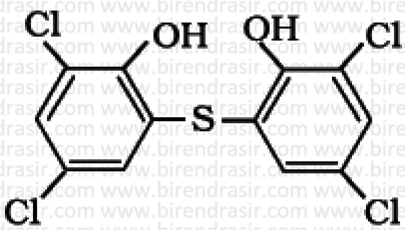
EXAMPLES OF ANTISEPTIC AND DISINFECTANTS

Chlorine A low concentration of chlorine i.e. 0.2 to 0.4 parts per million (ppm) is used for sterilization of water to make it fit for drinking purposes.

Iodine is a powerful antiseptic, it is used as tincture of iodine (which is 2-3% solution of iodine in alcohol and water).

Dettol Antiseptic is a mixture of chloroxylenol and Tripineol or in a suitable solvent.

Bithional is added to good quality soaps to reduce the odours produced by bacterial decomposition of organic matter on the skin. Structure of bithional is given below:



Dyes Some organic dyes are effective antiseptics and are used for treatment of infectious disease. For example two well known antiseptic dyes are gentian violet and methylene blue.

Iodoform (CHI_3) Which produces iodine on coming in contact with skin is used as antiseptic powder for wounds.

Hydrogen peroxide

Hydrogen peroxide is also used as an antiseptic under the name perhydrol for washing wounds, teeth and ears.

Mercurochrome solution (2 – 5%)

Mercurochrome solution is used as an antiseptic for skin, mucous surfaces and wounds.

Cresols (Lysol)

A solution of cresols (i.e. m and p – methyl phenols) in soapy water in called lysol and is used as disinfectant.

Boric acid

Boric acid in the form of dilute aqueous solution is a mild antiseptic and used for eye wash. It also forms part of antiseptic baby powders.

Salol (Phenyl salicylate)

Salol is used as an intestinal antiseptic for throat ailments.

ANTIMICROBIALS

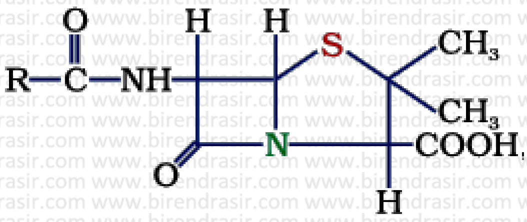
Diseases in human beings and animals may be caused by a variety of microorganisms such as bacteria, virus, fungi and other pathogens. An antimicrobial tends to destroy/prevent development or inhibit the pathogenic action of microbes such as bacteria (antibacterial drugs), fungi (antifungal agents), virus (antiviral agents), or other parasites (antiparasitic drugs) selectively. Antibiotics, antiseptics and disinfectants are antimicrobial drugs.

ANTIBIOTICS

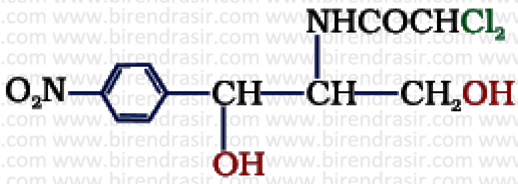
These are used as drugs to treat infections because of their low toxicity for humans and animals. Initially antibiotics were classified as chemical substances produced by microorganisms (bacteria, fungi and molds) that inhibit the growth or even destroy microorganisms. The development of synthetic methods has helped in synthesising some of the compounds that were originally discovered as products of microorganisms. Also, some purely synthetic compounds have antibacterial activity, and therefore, definition of antibiotic has been modified. An antibiotic now refers to a substance produced wholly or partly by chemical synthesis, which in low concentrations inhibits the growth or destroys microorganisms by intervening in their metabolic processes.

The antibiotics can be either Bactericidal (Penicillin, Aminoglycosiders, Ofloxacin) or bacteriostatic (Erythromycin, Tetracydine, Chlroamphenicol).

Penicillin



Chlroamphenicol

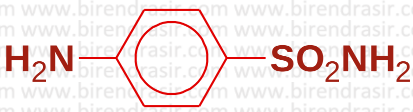


The full range of micro organisms attacked by an antibiotic is called its spectrum. Broad spectrum antibiotics are effective against several different types of harmful bacteria (e.g. Tetracycline, Vancomycin and Ofloxacin and a mixture of potent antibiotics Chlroamphenicol).

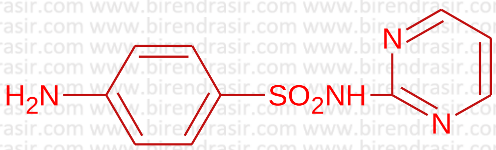
Sulpha Drugs

A group of drugs which are derivatives of sulphanilamide are called sulpha drugs.

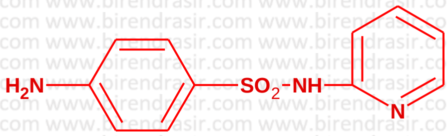
Sulphanilamide



Sulphadiazine



Sulphapyridine



Sulphaguanidine

These have great antibacterial powers and have been widely used against diseases (such as diphtheria, dysentery, tuberculosis etc) caused by CoCCi infections, streptococci, gonococci and pneumococcal e.g. Sulphanilamide, Sulphadiazine, Sulphapyridine, Sulphaguanidine.

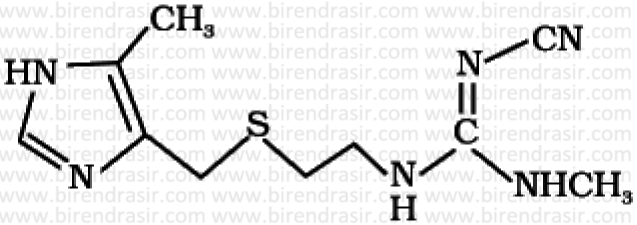
ANTIHISTAMINES

These drugs are also anti allergic drugs since they are used to treat allergy i.e. skin rashes, inflammation of tissues, asthma (Breathing difficulties) and itching of hives. Science allergy is caused due to release of histamine in the body, therefore these drugs are also called antihistamines.

e.g. Diphenythydramine, cetrizine, chlorpheniramine, promethanzine etc.

Histamine

Cimetidine



Cetrizine

ANTACIDS

Over production of acid in the stomach causes irritation and pain. In severe cases, ulcers are developed in the stomach. Until 1970, only treatment for acidity was administration of antacids, such as sodium hydrogencarbonate or a mixture of aluminium and magnesium hydroxide. However, excessive hydrogencarbonate can make the stomach alkaline and trigger the production of even more acid. Metal hydroxides are better alternatives because of being insoluble, these do not increase the pH above neutrality. These treatments control only symptoms, and not the cause. Therefore, with these metal salts, the patients cannot be treated easily. In advanced stages, ulcers become life threatening and its only treatment is removal of the affected part of the stomach.

DYES

A dye is a coloured substance, which can be applied in solution or dispersion to a substance such as textile fibres (cotton, wool, silk, polyester, nylon) paper, leather, hairs fur, plastic materials, wax, a cosmetic base, giving it a coloured appearance.

PERFUMES

Perfumes are the materials used to provide fragrance. Several requirements have to be fulfilled to make a good perfume and any material, which just gives good smell, may not be a perfume. A perfume invariably consists of three ingredients - a vehicle, fixative and odour producing substance.

TALCUM POWDER

Talcum powder is used to reduce irritation of the skin. Talcum powder like face powders contain talk ($Mg_3(OH)_2Si_4O_{10}$). Chalk, zinc oxide, zinc sterate and suitable perfume act as the other main constituents of talcum powder. Often specific ingredients like antiseptic and cooling agents are added. The role of the talk is to act as a powder base and to make skin smooth. Chalk absorbs secretion (perspiration) without showing any evidence of such absorption. Zinc oxide masks enlarged pores and mirror blemishes, whereas zinc makes powder adhere to skin. Baby talcum powder contain considerable amounts of zinc sterate for adhesiveness and boric acid, for antiseptic purposes. Talcum powders need to be dusted with care to prevent inhalation of the fine particles which irritate the lungs.

DEODARENTS

As the name suggests, deodorants are applied primary to mask the body odour. The body odour results from the bacterial action following perspiration. A deodorant must therefore, possess antibacterial properties. Aluminium salts have been found to possess excellent antibacterial properties. In addition to aluminium salts, ZnO and $(C_{17}H_{35}COO)_2Zn$ also find use in deodorants preparation because they are astringents as well as antiseptics.

CERAMICS

Ceramics are inorganic non-metallic, covalent network solids that can be made into a paste and shaped at normal temperature which when fired at high temperature gain strength e.g. clays, aluminium oxide, silicon nitride, silicon carbide and crystalline and amorphous silicon dioxide. Ceramics are lighter, stiffer and much more resistant to corrosion, most ceramics are electrical insulators. Ceramics tend to have thermal expansion but low thermal conductivity as a result sudden local temperature charge causes cracking. Sialon, a ceramic alloy is almost as hand as diamond, as strong as steels and as light as aluminium such alloys can be used at temperature of up to 1300^{o}C and require no lubrication.

CARBON FIBRE

Carbon fibres are a new breed of high performance materials. Which have attracted worldwide attention and hold great promise for the future? This is because of the fact that these fibres are stronger than steel, stiffer than titanium and lighter than aluminium. These qualities have placed carbon fibres on top of the list of many moved materials available today. Carbon fibres are produced in number of ways and form a variety of starting materials or precursors such as viscose rayon, polyacrylonitrile, pitch, resins, gases such as (methane, and benzene). Their characteristics are strongly influenced by the manufacturing techniques employed. Carbon fibres reinforced in a right weight matrix, generally on epoxy resin, polyester resin or polyamide are called carbon fibre reinforced plastics (CFRP). When the carbon fibre are reinforced in a carbon matrix, they are known as carbon fibre reinforced carbon (CFRC), commonly known as carbon–carbon composites.

SMOG

This word smog is derived from two words smoke and fog. This is the most common example of air pollution that occurs in many areas throughout the world. There are two types of smog-

(a) Classical smog occurs in cool humid climate. It is a mixture of smoke, fog and sulphur dioxide. Chemically it is a reducing mixture and so it is also called as reducing smog.

(b) Photochemical smog occurs in warm, dry and sunny climate. The main components of the photochemical smog result from the action of sunlight on unsaturated hydrocarbons and nitrogen oxides produced by automobiles and factories. Photochemical smog has high concentration of oxidising agents and is, therefore, called as oxidising smog. The common components of photochemical smog are ozone, nitric oxide, acrolein, formaldehyde and peroxyacetyl nitrate (PAN)

. Photochemical smog causes serious health problems. Both ozone and PAN act as powerful eye irritants. Ozone and nitric oxide irritate the nose and throat and their high concentration causes headache, chest pain, dryness of the throat, cough and difficulty in breathing. Photochemical smog leads to cracking of rubber and extensive damage to plant life. It also causes corrosion of metals, stones, building materials, rubber and painted surfaces. Usually catalytic converters are used in the automobiles, which prevent the release of nitrogen oxide and hydrocarbons to the atmosphere. Certain plants e.g., Pinups, Juniparus, Quercus, Pyrus and Vitis can metabolise nitrogen oxide and therefore, their plantation could help in this matter.

GREEN HOUSE EFFECT & GLOBAL WARMING

About 75 % of the solar energy reaching the earth is absorbed by the earth's surface, which increases its temperature. The rest of the heat radiates back to the atmosphere. Some of the heat is trapped by gases such as carbon dioxide, oxides of nitrogen, methane, ozone, chlorofluorocarbon compounds (CFCs) and water vapour in the atmosphere. Thus, they add to the heating of the atmosphere. This causes global warming. Atmosphere around the earth acts like a glass of the green house chamber. The gases present in the atmosphere which cause green house effect are referred to as green house gases.

The green house gases in the atmosphere form a thick cover around the earth. The earth receives a large amount of energy from the sun. The IR radiations coming from sun are not absorbed by atmospheric gases. The earth absorbs these IR radiations of short wavelength. As a result of this the temperature of earth stands rising. Eventually, earth starts emitting infrared radiations of longer wavelengths. The partially radiated infrared radiations from the earth are absorbed by CO_2 This results in excessive heating of earth's atmosphere.

The heating of atmosphere due to absorption of infrared radiations by CO_2 and other gases is called green house effect.

The presence of CO_2 and other gases in the atmosphere produce green house effect, which in turn keeps the atmosphere warm. The warm atmosphere is very essential for survival of life on earth in the following ways:

(i)It is necessary for evaporation of water, formation of clouds, rainfall etc.

(ii) The warm atmosphere helps in rapid growth of plants, trees etc.

The disastrous effects of green house effect are

(i) High temperature of atmosphere may melt polar ice caps which is likely to raise the level of sea thereby sinking most of the coastal areas and causing large scale destruction.

(ii) The high temperature may reduce crop product.

(iii) The high temperature will reduce work efficiency of human being.

(iv) Tropical rains and hurricane will become more frequent and also more stronger causing more devastation.

(v) The change in ocean temperature will adversely affect the warm life.

BIOCHEMICAL OXYGEN DEMAND (BOD) and CHEMICAL OXYGEN DEMAND (COD)

The polluted water may contain large amounts of inorganic and organic compounds. Some of these can be oxidised by dissolved oxygen in the presence of microorganisms.

Biochemical oxygen demand (BOD) is a measure of the dissolved oxygen that would be needed by the microorganisms to oxidise these compounds. BOD, therefore is a measure of the total contamination caused by compounds which can be oxidised in the presence of microorganisms. The BOD is taken as a realistic measure of water quality – clean water would have a BOD value of less than 5 ppm whereas highly polluted river water could have a BOD value of 17 ppm or more.

In order to find out BOD, the water sample is first saturated with oxygen. It is then incubated at constant temperature. This allows time for microorganisms in water sample to oxidise pollutants. The remaining amount of dissolved oxygen is determined and BOD is obtained by subtraction BOD measurements takes a few days, so another parameter called the chemical oxygen demand (COD) is sometimes measured.

In chemical oxygen demand (COD) determination the water sample is treated with a known quantity of an oxidising agent, usually $K_2Cr_2O_7$ in acidic medium. This reagent oxidises most of the polluting substances, including those which are resistant to microbial oxidation. The remaining $K_2Cr_2O_7$ is determined by back titration with a suitable reducing agent. From the concentration of $K_2Cr_2O_7$ consumed, the amount of oxygen used in oxidation may be calculated using the following chemical equation:

$$K_2Cr_2O_7(aq)+H_2SO_4(aq)\longrightarrow K_2SO_4(aq)+Cr_2(SO_4)_3(aq)+4H_2O(\ell)+3O$$

The results are expressed in terms of amounts of oxygen in ppm, that would be required to oxidise the contaminants. This is COD.

ACID RAIN

We know that normal rain water has a pH of 5.6 due to the presence of H^+ ions formed by the reaction of rain water with carbon dioxide present in the atmosphere. When the pH of the rain water drops below 5.6, it is called acid rain. Acid rain refers to the ways in which acid from the atmosphere is deposited on the earth’s surface. Oxides of nitrogen and sulphur which are acidic in nature can be blown by wind along with solid particles in the atmosphere and finally settle down either on the ground as dry deposition or in water, fog and snow as wet deposition. Acid rain is a by product of a variety of human activities that emit the oxides of sulphur and nitrogen in the atmosphere. As mentioned earlier, burning of fossil fuels (which contain sulphur and nitrogenous matter) such as coal and oil in power stations and furnaces or petrol and diesel in motor engines produce sulphur dioxide and nitrogen oxides. SO_2 and NO_2 after oxidation and reaction with water are major contributors to acid rain, because polluted air usually contains particulate matter that catalyse the oxidation.

OZONE DEPLETION

Ozone layer in atmosphere is very significant because it protect us from the harmful effect of U.V. radiations of sun.

The stratosphere or ozonosphere plays a significant role in protecting earth from the UV radiation coming from the sun. Ozone absorbs UV radiation & prevent most of them in reaching the earth's surface.

$$O_3 \xrightarrow{h\upsilon} O + O_2$$

$$O_3 + O \longrightarrow O_2 + O_2$$

$$O_2 \xrightarrow{h\upsilon} O + O$$

$$O_2 + O \longrightarrow O_3$$

Ozone is simultaneously being formed & destroyed by naturally occupying chemical reactions.

The equilibrium between formation & destruction of ozone has been upset by influx of several substances into the atmosphere which react with ozone to destroy it. The rate at which ozone is being destroyed is much faster than the rate at which it is being formed. The factors which accelerate the ozone depletion are given below-

(1) Effect of chlorofluoro carbons (freons)

A very serious threat to the existence of ozone in the stratosphere comes from the use of chlorofluorocarbons (CFC). CFC's find a wide & varied applications.

Once they enter the atmosphere, they do not react with any substance due to their chemical inertness & thus cannot be eliminated from the atmosphere.

In stratosphere they absorb the UV radiations and break up liberating free chloride atoms. The chlorine atoms react with O_3 to form a species, chlorine monoxide (ClO) which further combines with O to give O_2.

(2) Use of Halons

Halons are bromo-fluorocarbons which are also used as fire extinguishers & pesticides. Halons produce bromine atoms by the similar process which further results in consumption of very large number of ozone molecules.

(3) Oxides of Nitrogen

The sources of oxides of nitrogen are mainly explosion of thermonuclear weapons in the atmosphere, industrial emission & agricultural fertilizers. Like Cl & Br atoms NO molecules also catalytically converts O_3 to O_2.

Depletion of ozone layer poses severe threat to mankind. As a result of decreased concentration of ozone in stratosphere, the influx of UV radiation reaching the surface of earth would increase which would increase in risk to skin cancer due to exposure to UV radiation, UV radiations also tend to damage the immune system.

GREEN CHEMISTRY IN DAY TO DAY LIFE

(1) Dry Cleaning of Clothes Tetra chlroroethene ($Cl_2C=CCl_2$) was earlier used as solvent for dry cleaning. The compound

contaminates the ground water and is also a suspected carcinogen. The process using this compound is now being replaced by a process, where liquefied CO_2, with a suitable detergent is used. Replacement of halogenated solvent by liquid CO_2 will result in less harm to ground water. These days hydrogen peroxide (H_2O_2) is used for the purpose of bleaching clothes in the process of laundry, which gives better results and makes use of lesser amount of water.

(2) Bleaching of Paper Chlorine gas was used earlier for bleaching paper. These days, hydrogen peroxide (H_2O_2) with suitable catalyst, which promotes the bleaching action of hydrogen peroxide, is used.

(3) Synthesis of Chemicals Ethanal (CH_3CHO) is now commercially prepared by one step oxidation of ethene in the presence of ionic catalyst in aqueous medium with an yield of 90%.

INTERNATIONAL STANDARDS FOR DRINKING WATER

(1) Fluoride For drinking purposes, water should be tested for fluoride ion concentration. Its deficiency in drinking water is harmful to man and causes diseases such as tooth decay etc. Soluble fluoride is often added to drinking water to bring its concentration up to 1 ppm or 1 mg dm^{-3}. The Fluoride F^- ions make the enamel on teeth much harder by converting hydroxyapatite, $[3(Ca_3(PO_4)_2.Ca(OH)_2]$, the enamel on the surface of the teeth, into much harder fluorapatite, $[3(Ca_3(PO_4)_2.CaF_2]$.

But fluoride F^- ions concentration above 2 ppm causes brown mottling of teeth. At the same time, excess fluoride (over 10 ppm) causes harmful effect to bones and teeth.

(2) Lead (Pb) Drinking water gets contaminated with lead when lead pipes are used for transportation of water. The prescribed upper limit concentration of lead in drinking water is about 50 ppb. Lead can damage kidney, liver, reproductive system etc.

(3) Sulphate (SO_4^{2-}) Excessive sulphate (>500 ppm) in drinking water causes laxative effect, otherwise at moderate levels it is harmless.

(4) Nitrate(NO_3^-) The maximum limit of nitrate in drinking water is 50 ppm. Excess nitrate in drinking water can cause disease such as methemoglobinemia ('blue baby' syndrome).

MAXIMUM PRESCRIBED CONCENTRATION OF SOME METALS IN DRINKING WATER

Metal	Maximum concentration (ppm or mg dm^{-3})
Fe	0.2
Mn	0.05
Al	0.2
Cu	3.0
Zn	5.0
Cd	0.005

PRESERVATIVES

Palatability and wholesomeness of many foods reach a peak at harvest time. Often food is most appetizing when it comes from the production lime in the food processing plant. However, during storage and distribution. Undesirable changes occur in flavour, colour, texture and appetite appeal.

The food producers use various preservative to delay these changes. The preservative prevent spoilage of food due to microbial growth. The most common preservative used is sodium benzoate, C_6H_5COONa. It is metabolized by conversion to hipuric acid, $C_6H_5CONHCH_2COOH$ which ultimately is excreted in the urine. Salt of Propionic acid and sorbic acid are also used as preservatives. Potassium metal bisulphite is used for this preservation of colourless food material such as fruit juice, squashes etc.

ARTIFICIAL SWEETEENERS

The artificial sweeteners are another type of food additives. The first popular artificial sweetener was saccharin. It was marketed as its water soluble sodium or calcium salt. Saccharin is approximately 300 times sweeter than cane sugar. It has proved to be a lifesaver for countless diabetics and is so great value to people who need to control intake of calories. Besides saccharin, the other commonly marketed artificial sweeteners are described here. Aspartame is unstable at cooking temperatures, limiting its use as sugar substitute to cold foods and soft drinks. Alitame is more stable than aspartame during cooking. Sucralose is predicted to become a great commercial successes.

EDIBLE COLOURS

Edible colours used for good food are essentially dyes. The use of dyes is extremely wide spread. They are used to colour everything from meat to fruit. For example dyes are used to dye orange peels so that oranges retain their colours. Colours is one of the ingredients in fruits juices. Tetrazine a very widely used dye. Natural dyes like carotene are safe food edible colours. Antioxidants are added to the food to retard the action of oxygen on the food. e.g. butylated hydroxy toluene (BHT). Butylated hydroxyanisole (BHA) is a widely used antioxidants used to preserve oil, fats, butter etc. Vitamin E is a natural antioxidant. Antioxidants are added to the food to retard the action of oxygen on the food. In order to prevent rancidity antioxidants are added to oils and fats. Butyrate hydroxyanisole (BHA) is a widely used antioxidants used to preserve edible oils, fats, better etc. Vitamin E is a natural antioxidants another antioxidants which is commonly used is butylated hydroxytotunce (BHI). Potassium metabisulphite or sodium metabisulphite is used for the preservation of colourless food materials such as fruits juices, so washes, apples, litchis.

ROCKET PROPELLANTS

The fuels used for launching rockets are called rocket propellants. In general, a rocket propellant consists of a fuel and an oxidiser. Depending upon the physical state of the propellant, these are classified into the following categories:

Solid propellants

Solid propellants use a solid fuel and a solid oxidiser. These are further divided into the following two classes.

(i) Composite propellants

These propellants use polymeric binder such as polyurethane or polybutadiene as a fuel and ammonium perchlorate as the oxidiser. Some additives such as finely divided magnesium or aluminium metal along with the fuel.

(ii) Double base propellants

These propellants use nitro-glycerine (liquid) and nitro cellulose (solid) constituting a gel.

Liquid propellants

Liquid propellants are usually classified as either storable or cryogenic. The cryogenic systems generally show high performance. However, on the basis of number of liquid used in the fuel. The liquid propellants are usually classified into the following two types

(i) Monopropellants

Liquid propellants in which a single chemical substance acts both as a fuel as well as an oxidizer are called monopropellant. These propellants on ignition or decomposition produce a very large volume of gases. Some examples of monopropellants are: Methyl nitrate (CH_3ONH_2), nitromethane (CH_3NO_2) and hydrogen peroxide (H_2O_2).

(ii) Bi-liquid propellants

These consist of two liquids one of which acts as a fuel while the other acts as the oxidiser. Most commonly used liquid fuels are kerosene, alcohol, hydrazine, monomethyl hydrazine (MMH), unsymmetrical dimethyl hydrazine (UDMH) or liquid hydrogen while the most commonly used oxidizers are liquid oxygen, liquid nitrogen tetraoxide (N_2O_4) or nitric acid.

Hybrid propellants

Hybrid propellants consist of a solid fuel and a liquid oxidizer e.g. a mixture of acrylic rubber and liquid dinitrogen tetraoxide.

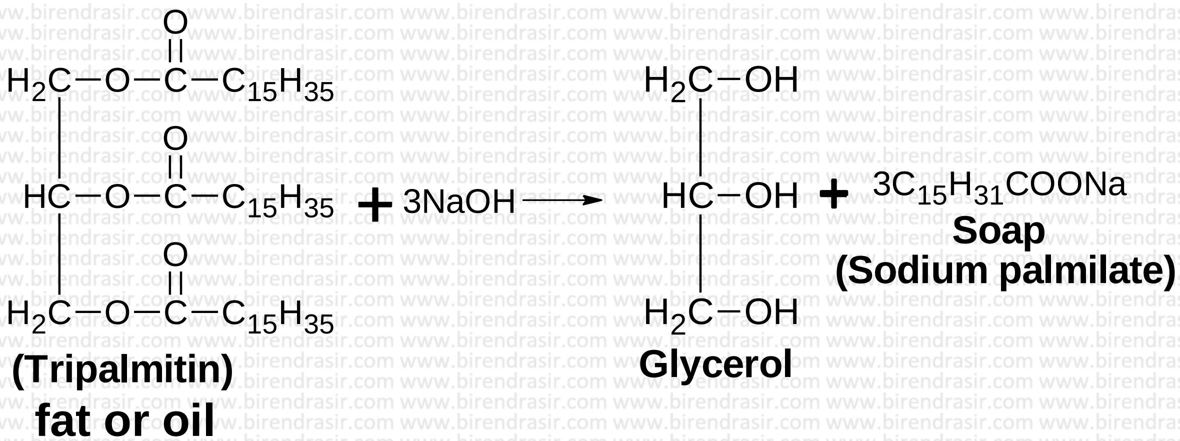
NOTE Bi-liquid propellants have two advantages over the solid propellants. They are: (i) Bi-liquid propellants give higher thrust than solid propellants. (ii) Their thrust can be controlled by regulating the flow of propellants. (iii) Hybrid propellants: It consist of a solid fuel and a liquid oxidizer e.g. a mixture of acrylic rubber and liquid dinitrogen tetraoxide.

DETERGENTS

Detergents are substances which remove dirt and have cleansing action in water. There are two types of detergents (i) Soapy detergents or soaps (ii) Non-soapy detergents or soapless soaps.

Soap A soap is a sodium or potassium salt of some long chain carboxylic acids (fatty acids). Sodium salts of fatty acids are known as hard soaps and potassium salts of fatty acids are known as soft soaps. Hard soaps are used for washing purpose and soft soaps are used as toilet soaps, shaving creams and shampoos. Some examples of soap are sodium stearate, $C_{17}H_{35}COO^{-}Na^{+}$, sodium palmitate, $C_{15}H_{31}COO^{-}Na^{+}$ and sodium oleate $C_{17}H_{33}COO^{-}Na^{+}$.

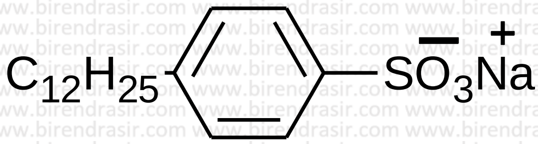
Soap is prepared by heating oil or fat of vegetable or animal origin with concentrated sodium hydroxide solution.



Non-soapy detergent or synthetic detergents

This is the sodium salt of a long chair benzene sulphuric acid or the sodium salt of a long chain alkyl hydrogen sulphate, synthetic detergents are prepared by reacting hydrocarbons from petroleum with concentration. Sulphuric acid and converting the product into its sodium salts. e.g.

Anionic detergents

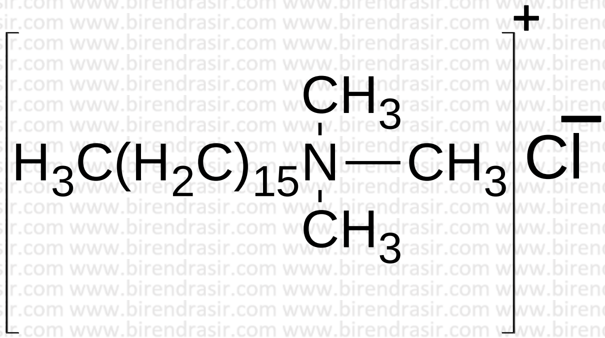


Sodium p- dodecylbenzene sulphonate

$$C_{12}H_{25}O-SO_2\bar{O}\overset{+}{N}a$$

Sodium lauryl sulphate

Cationic detergents



Cetyltrimethyl ammonium chloride

Non–ionic detergent

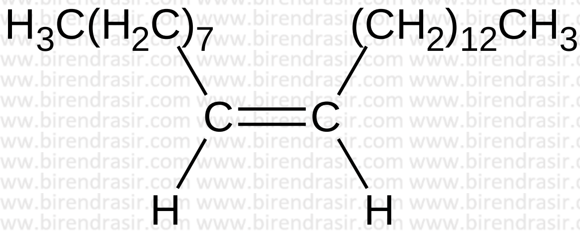
$(CH_3(CH_2)_{16}COO(CH_2CH_2O)_n.CH_2CH_2OH$

NOTE Synthetic detergents can be used even in hard water whereas some of the soap gets wasted if water is hard. Synthetic detergents have a strong cleansing action than soaps.

INSECT SEX ATTRACTANTS (PHEROMONES)

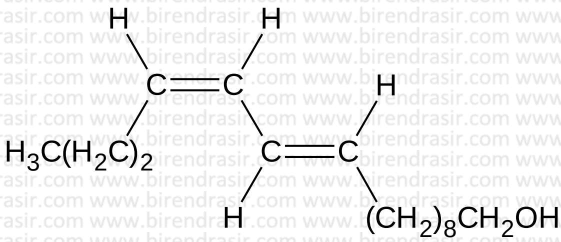
Pheromones are compounds produced by organism for the propose of communicating with the other members of the same species. To attract members of the opposite sex, to spread an alarm, to marks the trail to food, to send the message to congregate.

- the pheromones muscular in the sex pheromones of common housefly



Musculur

- Bomloykol is the sex hormone of natural silk worm



Bomloykol

- Heptan-2-one is a component of alane pheromones of bees.

Heptan-2-one

- Cockroach under cave as an aggregation pheromones

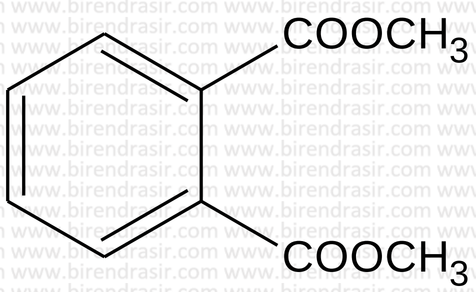
$$CH_3(CH_2)_9CH_3$$

Undercave

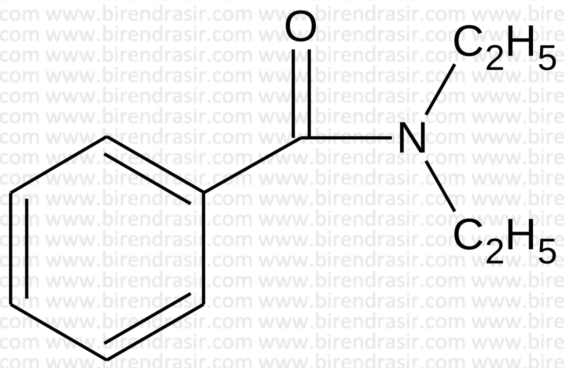
NOTE Many sex attractants have been synthesized and are used to attract the insects into traps. As a means of insect control.

INSECT REPPELENT

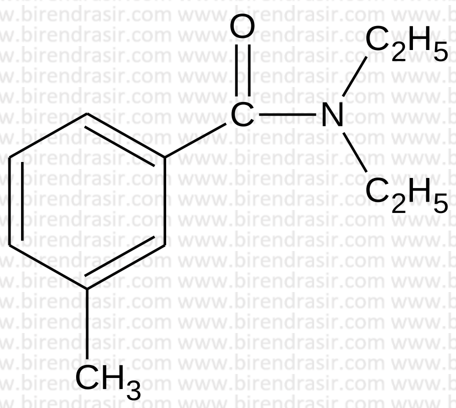
Dimethylphthalate is a good mosquito repellent, N, N-diethyl-meta-toluamide (dect) is active against flies, mosquitoes and many other insects, N,N-diethylbenzamide in the active component of many mosquito repellants creams.



Dimethylphthalate



N,N- diethylbenzamide



N,N- diethyl-meta-toluamide

(dect)