

CHEMISTRY IN EVERY DAY LIFE:PART-I

Rijoy Kodiyan Jacob

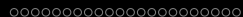
April 16, 2020



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When the biological response of a drug is healing and beneficial, it is called a medicine and is used in diagnosis, prevention and treatment of diseases.



CHEMOTHERAPY

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Every drug has a chemical name, a generic name and a trade name.

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1. PARACETAMOL

- N-(4-hydroxyphenyl)ethanamide [or N-(4-hydroxyphenyl)acetamide], also commonly called 4-acetamidophenol, is a drug widely used for relieving fever(Antipyretic)and also for relieving pain(analgesic).
- The above names are chemical name where as generic name is 'Paracetamol'or 'Acetaminophen'.

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- The above names are chemical name where as generic name is 'Paracetamol'or 'Acetaminophen'.
- Different manufacturers sell it under different trade names like Crocin, Calpol, Metacin, Dolo, etc

RIJC



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- '2-acetoxybenzoic acid' or 'acetyl salicylic acid' is a chemical name.
- Its generic name is 'Aspirin'.

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 - sensitivity.
 - poor membrane permeability.
 - bad taste.
 - short duration of action.
 - toxicity of the parent drugs.
- Several prodrugs have also been developed to be site specific so that the active drugs are released only after reaching the targets of their action.



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- By masking the phenolic group as an ester group through acetylation, the prodrug 'aspirin' can be formed.
- Hence absorption is improved, stomach irritation is reduced.
- It is because aspirin is mainly converted into salicylic acid by esterases after absorption from gastrointestinal tract.

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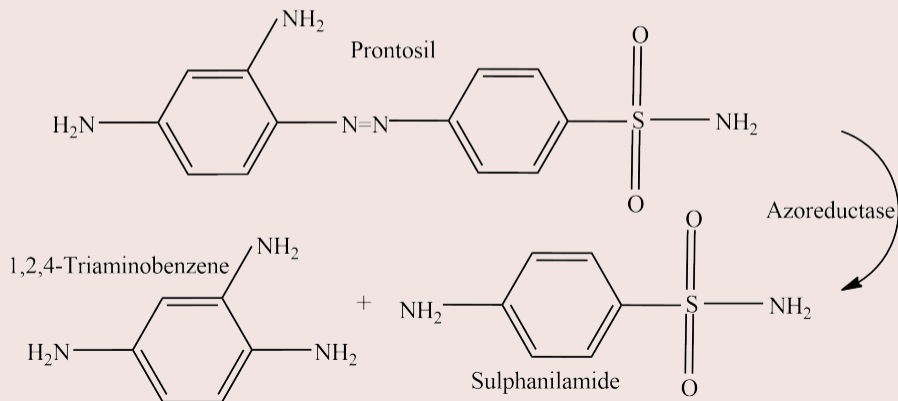


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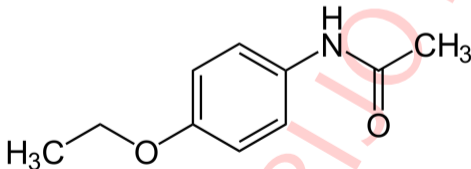


FIGURE: Phenacetin



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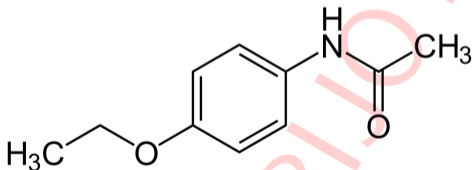
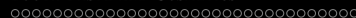
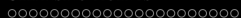


FIGURE: Phenacetin

Examples are :

- Aspirin
- Paracetamol
- Phenacetin
- Ibuprofen
- Naproxen





ANALGESICS

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Aspirin, Paracetamol and other nonsteroidal anti inflammatory drugs like ibuprofen, etoricoxib, diclofenac, aceclofenac and naproxen belong to the class of non-narcotic analgesics.



2. NARCOTIC ANALGESICS

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In higher doses, these analgesics produce unconsciousness; in much higher doses these produce stupor, coma, seizures and ultimately death.



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Penicillin, Ampicillin, amoxycillin, chloramphenicol, azithromycin, erythromycin, roxithromycin, tetracycline, ciprofloxacin, ofloxacin, vancomycin, streptomycin, neomycin, tobramycin, etc.



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ANTACIDS

Antacids are drugs, that provide relief from the ailment symptoms of hyper acidity.



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- ⑤ Rabeprazole (Trade names: Paricit, Rabicip, Rabiloc, Rabium, etc.) etc.



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There are two types of tranquilizers.

- Major.
- Minor.



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DYES

Dyes are coloured organic compounds having the property of firmly imparting colour to other substances such as textile fibres, wool, silk, leather, paper, inks, toys, hair, foodstuff, etc.

EXAMPLES

Malachite green, Orange-I, Orange-II, martius yellow, congo red, para red, etc,



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REQUIREMENTS OF A DYE

- It must have a suitable colour.
- It must be capable of fitting itself with the material being dyed.
- It must be fasting towards light, heat, washing and dry cleaning.



- In a dye, there must be two components, namely chromophore and auxochrome.

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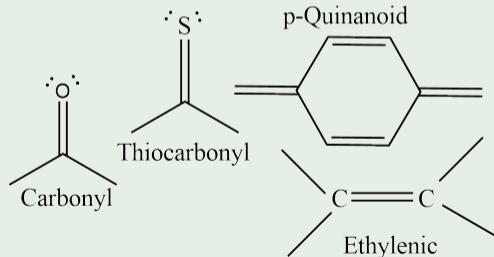
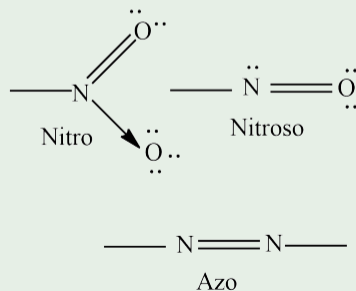
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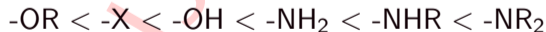
CHROMOPHORIC GROUPS



- The greater the number of chromophoric groups in a chromogen, the greater the intensity of its colour. The colour intensity also increases with increase in the extent of conjugation. For e.g. Ethene ($\text{CH}_2=\text{CH}_2$) is colourless, but the compound $\text{CH}_3-(\text{CH}_2=\text{CH}_2)_6-\text{CH}_3$ is yellow in colour, nitrobenzene, ($\text{C}_6\text{H}_5-\text{NO}_2$) is pale yellow and azobenzene ($\text{C}_6\text{H}_5-\text{N}=\text{N}-\text{C}_6\text{H}_5$) is orange red.
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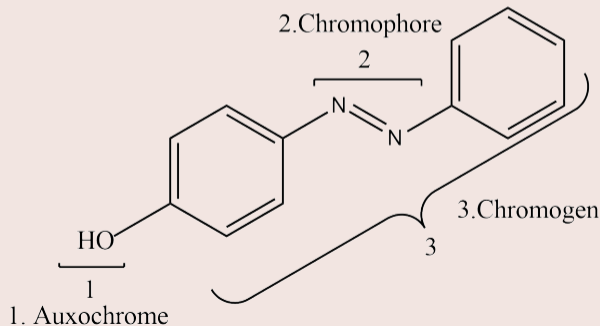


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- The auxochrome is essential for a chromogen to function as a dye. e.g. The chromogen azobenzene ($C_6H_5-N=N-C_6H_5$) is orange red in colour but it is not dye.
- On the other hand , the compound p-hydroxyazobenzene is a bright red dye. Here, hydroxy froup is **auxochrome** and azo group is the **chromophore**.



MARTIUS YELLOW

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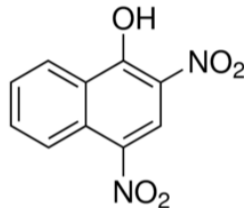


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- It belongs to nitro dye.
- It is 2,4-dinitro-1-naphthol.
- It is a direct dye; a dye which can be directly applied to the fabric directly from aqueous solution.

Uses:

- Martius yellow is used to dye silk and wool.

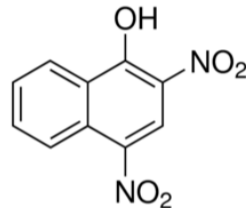


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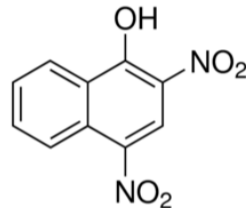
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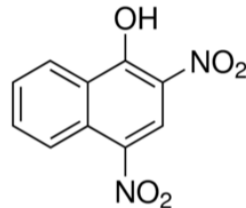
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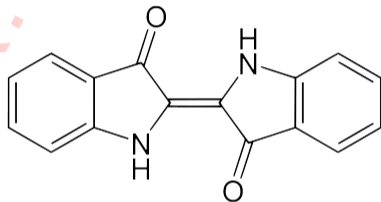


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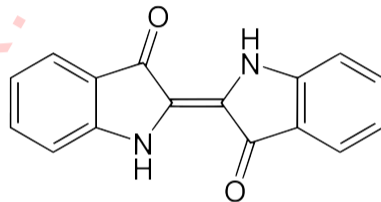


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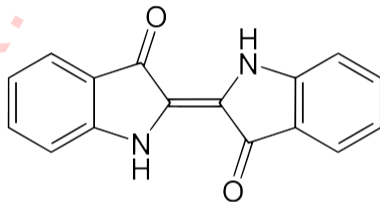


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- It is used in the manufacture of indigo carmine, a food colourant.



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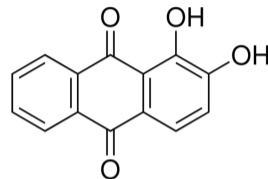


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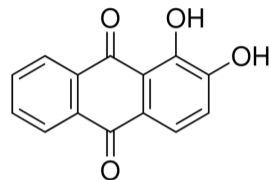


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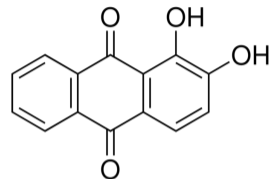


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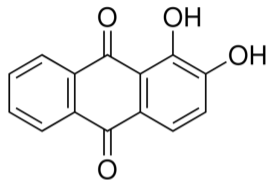


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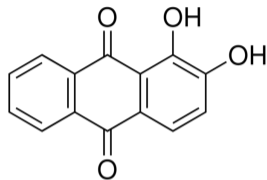


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- It is used as spot test reagent in chemical analysis.



DETERGENTS

Detergents are substances which remove dirt by virtue of their cleansing action in water.

The most familiar classes of detergents are of two category :

- ① Soaps and
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They are also known as **Surfactants**.



SURFACTANTS

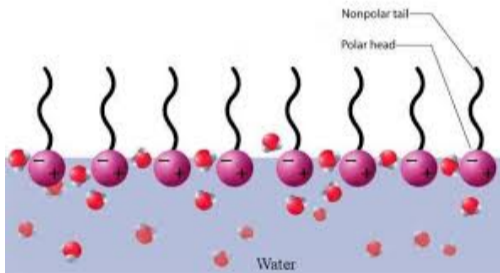
DEFINITION

Surfactants or Surface active substances which cause a marked reduction in the inter facial tension between water and a phase immiscible with it (like air, oil or a solid) by forming an oriented inter facial mono layer.

The structure of a surfactant consists of a hydrophilic part(water soluble) and a hydrophobic (water repelling) part. In an inter facial mono layer formed by a surfactant, its hydrophilic part points towards water while hydrophobic part points away from water.



INTERFACIAL MONOLAYER



SAPONIFICATION - MANUFACTURING OF SOAP

FATS AND OILS

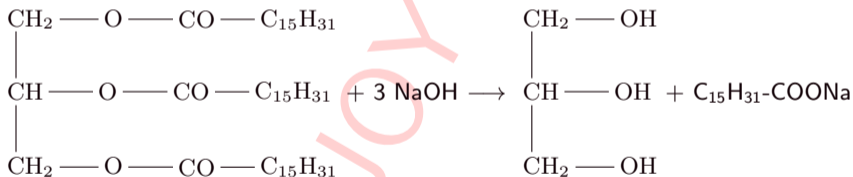
Fats and Oils are esters of fatty acids like palmitic acid ($C_{15}H_{31}-COOH$), stearic acid ($C_{17}H_{35}-COOH$), etc. and glycerol. They are known as triglycerides. Oils are liquids at $20^{\circ}C$, where as fats are solids at $20^{\circ}C$.

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SAPONIFICATION - CONTD...

Triglycerides present in an oil or fat undergoes hydrolysis by NaOH solution to yield sodium salt of fatty acids (soap) and glycerol.



SAPONIFICATION - CONTD....

Soap (which remains in the colloidal state in the solution) is 'salted out' from the solution ('lye') by adding sodium chloride. The solution left after removing the soap ('spent lye') contains glycerol, which can be recovered by fractional distillation.

The fat or oil may be of animal or vegetable origin. Hydrolysis of oils and fats with NaOH solution gives sodium soap (sodium salts of fatty acids i.e sodium stearate, sodium palmitate, etc) where as hydrolysis with potassium gives potassium soaps (potassium salts of fatty acids, i.e. potassium stearate, potassium palmitate etc.).



LAUNDRY SOAPS

Laundry soaps are generally prepared from hard sodium soaps by adding several suitable additives and fillers to bring scrubbing and lathering characteristics

TOILET SOAPS

Toilet soaps are prepared from better grades of fats and oils and without excess alkali. Suitable additives are added to provide attractive colour, fragrance and other functions

Soft potassium soaps are used to make more expensive shaving soaps shaving creams, liquid soaps, shampoos, high grade toilet soaps.



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- Cationic
- Non-ionic



TYPES OF DETERGENTS.

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Anionic detergents are those which ionise in water to yield surface active anions. Long chain alkyl sulphates and alkyl benzene sulphonates belong to this class.
e.g..

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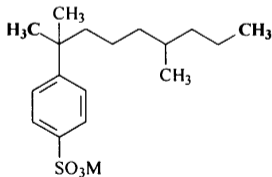


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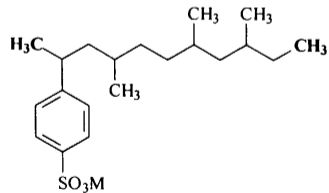
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(aa)



(bb)



CLASSIFICATION- CONTD...

CATIONIC DETERGENTS

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CLASSIFICATION- CONTD...

CATIONIC DETERGENTS

Cationic detergents are those which ionise in water to yield surface active cations. Quarternary ammonium salts, alkyl pyridinium halide, etc. are examples.

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CLASSIFICATION

EXAMPLE 2

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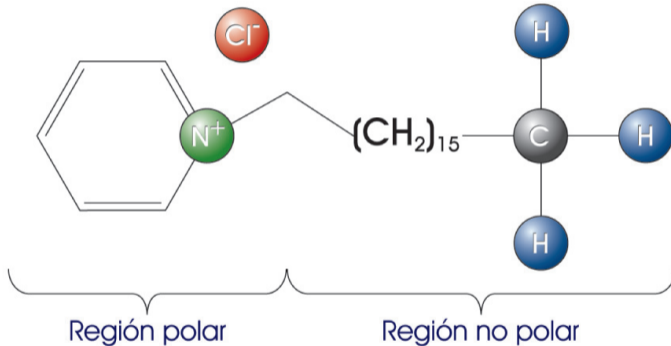


FIGURE: Cetyl Pyridinium Chloride





CLASSIFICATION

CLASSIFICATION- CONTD...

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CLASSIFICATION- CONTD...

NON-IONIC DETERGENTS

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CLASSIFICATION- CONTD...

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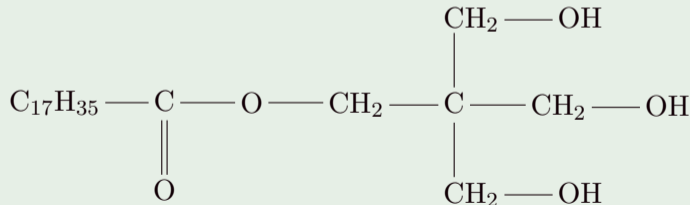


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- 3 Soaps are from renewable resources; so their production does not contribute towards non renewable material of the Earth getting exhausted.



DISADVANTAGES

- ① Soaps does not function well in hard water and do not form much lather. This undesirable property of soaps is because of their tendency to form precipitates (hard water scum) with the Ca^{2+} and Mg^{2+} ions found in hard water.

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These insoluble soaps do not possess the property of lathering and appear as a scum that sticks as a gummy mass to laundry and bathtubs as well as skin and hair, often containing trapped dirt which makes them useless as cleansing agents.



DISADVANTAGES - CONTD....

- ② The alkali content of bathing soaps is harmful to the skin and that in washing soaps is harmful to the fabrics being washed.



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- 2 The alkali content of bathing soaps is harmful to the skin and that in washing soaps is harmful to the fabrics being washed.
- 3 Soaps cannot function well in acidic solutions. i.e. If the water used is slightly acidic, soaps become less effective in their cleansing action. This is because, in acid medium, the hydroxylate anions of the soap may get protonated into the corresponding carboxylic acids with consequent loss of cleansing property. Without the ionised carboxylic group under such a condition, the fatty acid floats to the top as a greasy acid scum precipitate.



ADVANTAGES OF DETERGENTS

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- 3 They tend to inhibit oxidation of organic substances present in waste waters because they form a sort of envelope around them.



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Tooth Paste



TOOTH PASTE

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E.g. Sodium lauryl sulphate(SLS), Ammonium lauryl sulphate(ALS), etc.

COMPONENTS - CONTD...

3. ABRASIVES (15 - 50%)

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RIJO



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4. HUMECTANTS(10 - 30%)

The function is to retain moisture and prevent the toothpaste from hardening on exposure to air. E.g. Glycerol, sorbitol, etc.

COMPONENTS - CONTD...

5. BINDING AGENTS (1 - 5%)

For preventing the separation of solid and liquid ingredients during storage. e.g. Sodium carboxymethylcellulose, xanthum gums, carrageenans (seaweed derived), etc..

6. ADDITIVES (1 - 5%)

For making the mixture palatable and appeal to the senses of the user, several additives like flavourings, sweeteners, thickeners, colouring agents are added to it. E.g. peppermint, cinnamon, saccharin, wintergreen, menthol, etc.



7. FLUORIDE

For preventing tooth decay and cavity formation fluoride ions in an optimum amounts (0.2 - 1.2%) in the form of stannous fluoride, sodium fluoride, sodiummonoflourophosphate is added. Fluoride limits and inhibits caries formation and development and strengthens tooth surface against caries.



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8. PRESERVATIVES

For the purpose of preventing bacterial growth on the organic binders and humectants preservatives like alcohols, benzoates, formaldehyde, dichlorinated phenols etc. are used.



HEALTH EFFECTS - BENEFITS

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- 5 keeps them looking healthy and attractive.
- 6 It helps in keeping bad breath away.



BENEFITS OF FLUORIDE

Presence of fluoride in toothpaste is responsible for significant reduction in dental decay in the past decades.

According to national and international agencies, use of toothpaste containing 1000 - 1100 ppm of fluoride is a safe and effective way to reduce tooth decay in adults.



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Sodium Lauryl Sulphate(SLS) is a well known skin irritant and when used in toothpastes causes oral ulcers in some people.



Hair Dyes

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HAIR DYES

Hair dyes are hair colourants that add colour to the hair, which can be lighter or darker depending upon the product used.



COMPOSITION OF THE HAIR DYE

Most commercial hair dye products are complex, with several ingredients, and the formulas differ considerably from manufacturer to manufacturer. Further the types of ingredients vary depending upon the types of dyes (whether temporary, semi permanent, demi permanent or permanent.),



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Most commercial hair dye products are complex, with several ingredients, and the formulas differ considerably from manufacturer to manufacturer.

Further the types of ingredients vary depending upon the types of dyes (whether temporary, semi permanent, demi permanent or permanent.),

For example, a typical permanent hair dye essentially include:

- 1 A primary dye intermediate.
- 2 A coupling reagent.
- 3 An oxidant.
- 4 An alkaliser.



COMPOSITION - CONTD..

1. PRIMARY DYE INTERMEDIATE

It is usually an aromatic para compound.

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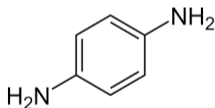


FIGURE: PPD



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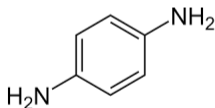


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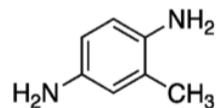


FIGURE: PTD



COMPOSITION - CONTD..

2. COUPLING AGENT

Coupling agent or coupler defines the colour of the dye. e.g. resorcinol, or 2-methylresorcinol or 2,7-naphthalenediol or 1-naphthol.

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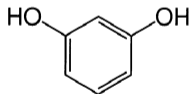


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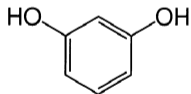


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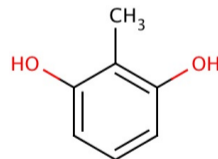


FIGURE: 2-methyl
resorcinol



COMPOSITION - CONTD...

3. AN OXIDANT

Oxidant is usually hydrogen peroxide.



COMPOSITION - CONTD...

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4. ALKALISER

Alkaliser is usually ammonia, which provides the required alkaline environment for the reaction.



CHEMISTRY OF DYES

The chemistry involved in the action of such dye involves initial oxidation of the 1,4-diamine to a quinonediimine and then its reaction with the coupler in the basic medium, followed by oxidation of the resulting compound to give the final dye. e.g. The combination of PTD with the coupler resorcinol gives a greenish brown dye.

A variety of other chemicals are also added to hair dyes to impart certain special characteristics. e.g. iron oxides as pigments, sodium sulphite as antioxidant, glycerol as vehicle etc.



HEALTH AFFECTS

Some of the components of hair dyes have potential allergic and potential carcinogenic characteristics.

Allergic reactions are seen in several users; but yet the carcinogenic effects are to be proved. The major are:

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- Arylamine dye intermediates of oxidative hair dyes are known human carcinogens. The carcinogenic potential of hair dye ingredients is indeed a major concern.



Talcum Powder

RIJOY K. J.



TALCUM POWDER

Talcum powder is made from talc, a mineral, which is magnesium silicate hydroxide ($\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$) or hydrated magnesium silicate ($3\text{MgO} \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$)

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Most talcum powders, including medicated powders, depend on talc ($\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$) to provide lubricity and a matte finish on the skin. The major ingredient talc is blended with other ingredients like:

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For e.g. a typical baby powder may contain talc and a perfume having ingredients such as coumarin, citronella oil, geraniol, limonene, linalool, benzyl benzoate, benzyl alcohol, and benzyl salicylate.



HEALTH EFFECTS

In earlier days, asbestos present in talc caused some health problems since it is a pulmonary irritant and carcinogen; nowadays it is made free from asbestos. Some of the important health effects are given by:

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- 2 Talcum powder particles applied directly to genital area of women can cause ovarian cancer and uterus cancer.
- 3 Can cause allergy in some people who are sensitive towards talc and some components of talcum powder.



Perfumes



PERFUMES

Perfumes are mixtures created to generate fragrance to the body, foods, living spaces, etc. and used in a wide variety of applications, including cosmetics, personal grooming products, laundry products, household cleaning products, and many others.

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COMPOSITION

A perfume is a mixture of fragrant essential oils and/or synthetic aroma compounds, fixatives, and solvents.



COMPOSITION - CONTD...

ESSENTIAL OILS

Widely used essential oils(plant extracts or terpenes) are orange, grapefruit, eucalyptus, rosemary, mint, geranium, lavender. and damask rose. The components of these include phenethyl alcohol(with floral fragrance), limonene(with orange fragrance), geraniol(with rose/ flowery fragrance), citronellal(with lemon fragrance), menthol(with menthol fragrance) etc..

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SYBTHETIC AROMA CHEMICALS

Sybthetic aroma chemicals widely used in perfumes include benzyl acetate(with floral /jasmine fragrance), amyl salicylate(with floral /jasmine fragrance), benzyl salicylate(balsamic fragrance), ortho t-butylcyclohexyl acetate(with jasmine fragrance), etc.

COMPOSITION - CONTD..

FIXATIVES

Fixatives include natural ones like, benzoin, tolu balsam, musk, civet, etc., and synthetic ones like diphenylmethane, dipropylene glycol, diethyl phthalate, etc.

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OTHER ADDITIVES

Several other additives are added by the manufacturer to increase the appeal of their perfumes and the fragrance formulas are held as trade secrets.



HEALTH EFFECTS

Health effects of perfumes are still uncertain because only a few manufacturers reveal the exact composition of the perfumes as they are protected as trade secrets. The major health effects are:

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- ❸ Use of perfumes cause release of volatile organic chemicals that contributes to environmental pollution.
- ❹ Components of perfumes may be absorbed in the fatty tissues of the body and their removal is very difficult.





Deodorants

RIJOY K. J.



DEODORANTS

WHAT DOES IT MEAN?

Deodorants are topically applied cosmetic products designed to reduce or mask unpleasant body odours by deodorisation and/or by antibacterial action.

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A deodorant reduces body odour by inhibiting or deactivating the bacteria that metabolise the proteins and fatty acids present in sweat and are responsible for producing bad odour.

They have the following characteristics:

- 1 They do not interfere with the perspiration process.
- 2 Do not have any therapeutic effects.



COMPOSITION

A deodorant product generally contains the following ingredients:

RIJOY K



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1. **Fragrance** :- It is a mixture of sweet smelling 'essential oils' and / or synthetic aroma compounds, designed to blend with the body odour and thus act as a masking agent. It may additionally have antimicrobial benefits. The exact formula is kept secret by the manufacturers.



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- 2 **Antibacterial agent** :- It brings about a drastic reduction in the population of odour causing bacteria. A popular antibacterial agent is triclosan which is a broad spectrum antimicrobial agent against gram positive and gram negative bacteria.



COMPOSITION - CONTD...

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COMPOSITION - CONTD...

3. Fixative :- It controls the volatilities of the components of the 'fragrance' and thereby "fix" its smell. e.g. dipropylene glycol, diethyl phthalate which also have solvent properties.



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5. Solvent :- A very popular solvent used in deodorant is ethanol which also possess antimicrobial characteristics. Propylene glycol is also a common solvent which can function as fixative.



COMPOSITION - CONTD...

- 6 Preservatives :- They prevent the growth of the fungus, bacteria and other microbes in the deodorant upon keeping. The most common used ones are the esters of p-hydroxybenzoic acid (methyl, ethyl, propyl, butyl, isobutyl etc. esters of parahydroxy benzoic acid) which are commonly known as parabens.



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HEALTH EFFECTS

Even though deodorants are considered as safe chemicals, as in the case of perfumes, they raise following health concerns:



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- 1 Some of the chemicals present in fragrance incorporated into deodorants could trigger headaches, allergies, skin irritation and respiration problems in some people.
- 2 Exposure to propylene glycol (a compound generally recognised as safe), can cause skin irritation.



RIJOY K. J.



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