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DRUGS AND MEDICINES

The association of mankind with pain and disease is probably as old as man himself. Humans have always been looking for remedies to overcome their pain and suffering. The earliest attempts at this, involved use of various plants. The knowledge was based on experience and was handed on from generation to generation. It is being used even today.

In an attempt to conquer pain and disease, a large number of synthetic chemicals have been discovered. The chemicals used as medicines are known as pharmaceuticals. Today pharmaceutical industry has grown to be one of the biggest industries in the world.

In this lesson we will try to introduce you to the area of drugs and medicines. In the process we would attempt to differentiate between drugs and medicines (though commonly used interchangeably). You will also learn about classification of medicines and other important aspects of drugs and medicines.



OBJECTIVES

After reading this lesson you will be able to :

- define drugs and medicines;
- differentiate between drugs and medicines;
- classify medicines on the basis of their action (use);
- cite examples and effects of analgesics, antipyretic, antiseptics, disinfectants, antacids, antimalarials, anaesthetics, antimicrobials (sulpha drugs and antibiotics), anti-fertility drugs, etc.;
- differentiate between analgesics and antipyretics;
- differentiate between antiseptics and disinfectants;



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- explain habit forming and non-habit forming drugs;
- differentiate between broad spectrum and narrow spectrum antibiotic;
- differentiate between local and general anaesthetics;
- describe self-medication and
- alternate systems of medicine.

30.1 WHAT ARE DRUGS AND MEDICINES?

When we fall ill we take some tablets, pills, injections or apply some ointments to get well. All these are collectively known as medicines. Some time we may use some parts of plants or some preparations made from herbs, minerals, animals, etc. All these substances used for the treatment or prevention of diseases, can also be called medicines. Medicines contain a single chemical or a number of chemicals in different amounts to have the desired effect.

The mode of action of the chemicals of a medicine is quite varied and complicated. In many a cases mode of action may not be fully known to us, but we continue to use them as they are useful to us.

Early man used several plants or parts of plants to cure diseases, without knowing of the chemical components, responsible for it. For example bark of willow tree was used for relieving pain (as analgesic). Later, it was found that its bark contained 2-hydroxy benzoic acid, which is closely related to acetyl salicylic acid (also known as aspirin). Parts of a plant *Rauwolfia serpentina* (Hindi name, sarpagandha) have been used in Ayurvedic drugs for the treatment of hypertension (high blood pressure). Later on it was discovered that a compound called reserpine was responsible for reducing blood pressure. Thus reserpine became the first modern medicine to control blood pressure.

In most of the cases nature led to the discovery of modern medicine. Thousands of chemists all over the world are constantly searching for better, efficient, cheaper and safer medicines.

As mentioned earlier the term drugs and medicines are used interchangeably, but there is a difference between the two. Let us try to understand the difference between drugs and medicines. The term drug is often used for preparations or formulation whose chemical components and their quantities are not known fully. These may be extracts of certain plants, herbs, animal parts or may be minerals.

The term medicine is used when the chemical composition and the quantities of various chemical components are known. Further, the effects of the chemical compounds present in a medicine and their side effects have been properly and extensively studied. The medicines are approved by the relevant governmental authorities like Drug Controller of India.

The term drug is also used for substances, which are habit forming and are often abused, for example, narcotics like cocaine, morphine, heroine, marijuana, etc.

As you read in newspapers terms like illegal drug trade, drug trafficking, drug mafia, drug peddler are used to refer to illegal dealing with habit forming substances, referred to as drugs.

However the difference between drug and medicine is far from clear.



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INTEXT QUESTIONS 30.1

1. Write a definition of medicines.
2. Most of the chemicals used in medicines are poisonous. Is this statement true or false?
3. What are pharmaceuticals?
4. Name the compound which is present in the plant sarpagandha and is responsible for reducing blood pressure.

30.2 CLASSIFICATION OF MEDICINES

You may be familiar with some of the common medicines used for relieving pain, reducing fever or for treating common cold, etc. The number of medicines is very large therefore medicines are classified according to their action or use. Table 30.1 provides a list of some important classes of medicines. The terms like analgesics, antibiotics, antiseptics, etc. are common household words. Let us try to understand the meaning of this classification in a little more detail.

Table 30.1 : Some Important Classes of Medicines and their Action

S.No.	Class	Action or Usage
1.	Antipyretics	Reduce body temperature
2.	Anti histamines	Reduce allergy
3.	Analgesics	Reduce pain
4.	Antimalarials	Used for treatment of malaria
5.	Germicides	Kill germs
6.	Antiseptics	Kill germs (can be safely used on living tissue)
7.	Disinfectant	Kill germs (cannot be used on living tissue)
8.	Antacids	Reduce acidity in stomach
9.	Anaesthetics	Loss of sensation
10.	Antimicrobials, Sulpha drugs and Antibiotics	Kill microorganisms
11.	Tranquilizers and hypnotics	Reduce anxiety and bring calmness
12.	Birth Control Medicines (Contraceptives)	Birth control



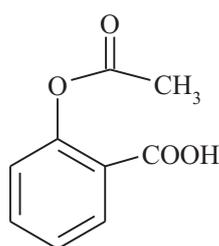
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1. Antipyretics

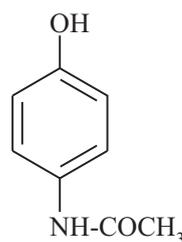
Antipyretics are the substances which are used to reduce body temperature or to control fever.

The word antipyretic is derived from pyro which means fire (means hot) anti means against. Thus antipyretic means it counteracts heat (high body temperature).

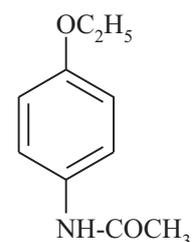
Aspirin, paracetamol and phenacetin are commonly used antipyretics. You get them in the market with different trade names like crocin, anacin, disprin, etc.



Aspirin



Paracetamol



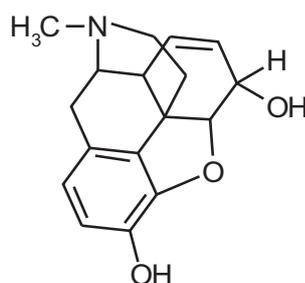
Phenacetin

Aspirin is the most popular antipyretic in use. It gets hydrolyzed in stomach and salicylic acid is released. Overdose and using it over a long time may cause side effects. It may cause bleeding in the stomach wall and even ulcers. Therefore, overdose and prolonged use should be avoided. However, calcium and sodium salts of aspirin are more soluble in water and are less harmful than aspirin.

2. Analgesics

Analgesics are the substances, that reduce pain which may be due to swelling of tissues, injury, inflammation or some other disorders. Analgesics are of two types, namely narcotic & non-narcotic.

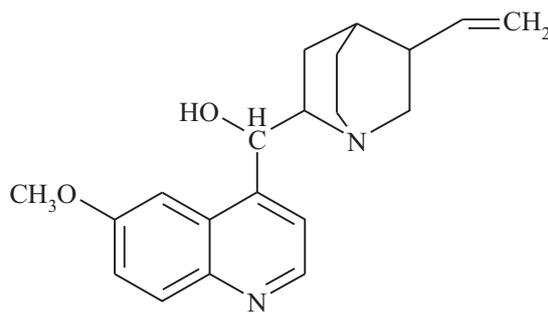
Narcotic analgesics are the ones which induce sleep and thus help to reduce the feeling of pain alkaloids present in opium, viz. morphine, codeine, etc. are common examples of narcotics. In higher doses these may cause unconsciousness. These are habit-forming and cause addiction. Due to addiction a person wants to have it regularly and in larger amounts. Such a person feels upset and uncomfortable if he does not get it. Narcotic analgesics do not induce sleep and are not habit forming. A common example of this type of narcotics is morphine.



Morphine

3. Antimalarials

Antimalarial medicines are used to treat malaria. Quinine and chloroquine are widely used antimalarials. Quinine is one of the earliest drugs, which was first obtained from the bark of a plant (cinchona) and later on synthesized in laboratories.



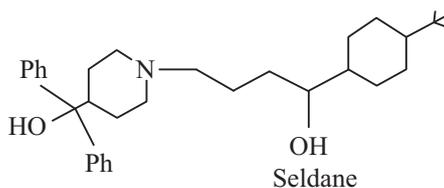
Quinine

4. Antihistamines

Some persons are hypersensitive towards some medicines like penicillin, sulpha drugs and may be sensitive to food and environment due to different sensitizing substances (antigens) derived from them. The hypersensitivity is called allergy. It is due to release of a chemical substance called histamine in the body.

“Antihistamine are the chemical substances (drugs) which control or abolish the effect of histamines released in the body.” These drugs are also called anti-allergic drugs.

Histamine is also responsible for the nasal congestion (discharge), mild asthma associated with common cold, cough, allergic response to pollen grains etc. Histamine contract the smooth muscles in bronchi and gut, relaxes other muscles present in the walls of fine blood vessels. Antihistamine are widely used for treatment of hay-fever, itching of eyes, nose and throat, conjunctivitis. Some antihistamine drugs are diphenhydramine (Benadryl) pheniramine maleate (Avil) chlorpheniramine maleate (Zect), cetirizine and terfenadine (Seldane)



Seldane



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**Notes****5. Germicides, Disinfectant and Antiseptic**

Germicides are the chemicals, which prevent growth of germs (microorganisms). Germicides are classified as antiseptic and disinfectant. Both kill microorganisms but the difference lies in the way we use them.

Antiseptics kill microorganisms and are safe to be used on living beings (tissues). Antiseptics are used on wounds, cuts or skin abrasions. These are used to dress wounds, etc. For example, iodoform (CHI_3), tincture of iodine, ethyl alcohol, a 0.2 percent aqueous solution of phenol and boric acid (H_3BO_3) are common antiseptics.

Some dyes have the ability to kill microorganisms. These dyes were the earliest compounds to be used as antiseptics. Examples are acriflavine (a yellow coloured dye), mercurochrome (a red coloured dye), methylene blue (a blue coloured dye). These dyes are still in use as antiseptics.

Iodine is a powerful antiseptic. It is used as tincture of iodine. Tincture of iodine is 2 to 3 percent solution of iodine dissolved in ethyl alcohol. Iodoform is a yellow coloured solid, which is used as an antiseptic.

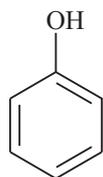
Disinfectants kill germs (microorganisms) but are used on non-living substances like surgical instruments, floors, bathrooms, lavatories, etc. Disinfectants are harsh and are not safe to be used on living beings as disinfectants can damage living tissues.

Chlorine is a powerful oxidizing agent. It is used for disinfecting water. A concentration of 0.2 to 0.4 ppm (parts per million) is enough to kill microorganisms present in water.

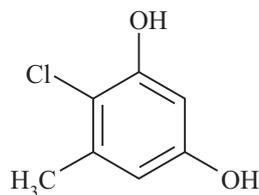
Low concentration of sulphur dioxide is used to kill microorganisms in jams, jellies and squashes. Thus it acts as a food preservative. Sulphur dioxide is used for fumigation in rooms, operation theaters, etc. to sterilize them. Bleaching powder (CaOCl_2), chlorine (Cl_2), mercuric chloride (HgCl_2), sodium hypochlorite (NaClO), sulphur dioxide (SO_2) etc. are other examples of disinfectants.

Is Phenol Antiseptic or Disinfectant?

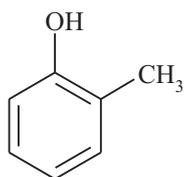
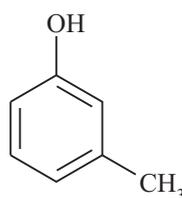
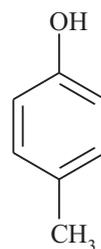
It is interesting to note that 0.2 percent aqueous solution of phenol is used as antiseptic by making. It is safe to be used on living tissues in low concentrations (less than 0.2 percent). If concentration of phenol is high then it can damage tissues. Therefore, at higher concentration (1 percent or more) phenol is used as disinfectant.



Phenol



Chloro-xyleneol

*o*-Cresol*m*-Cresol*p*-Cresol

Most antiseptics and disinfectants are powerful poisons (Table 30.2). They are able to kill microorganisms as they interfere with their metabolism. While some others are able to kill microorganisms because of their powerful oxidizing or reducing nature (Table 30.2).

Table 30.2 : Nature of Some Important Antiseptics and Disinfectants

Poisons	Oxidising agents	Reducing agents
Dyes Acriflavine (a yellow dye) Gentian violet Mercurochrome Methylene blue	Bleaching powder Chlorine Hydrogen peroxide Iodine Tincture of iodine	Sulphur dioxide
Phenols Phenol Cresols Resorcinol Chloroxylenol	Iodoform Potassium permanganate Sodium hypochlorite	
Others Formaldehyde Boric acid Mercuric chloride Silver nitrate		



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6. Antacids

Antacids are the medicines which neutralize the excess acid present in the stomach.

Stomach juice contains hydrochloric acid (HCl). This acid helps the process of digestion of food. Due to illness or anxiety or some other reasons more acid is produced in the stomach. The stomach juice becomes more acidic than necessary. This causes problems in digestion, bleeding in the lining of stomach or even ulcers. Some medicines are used to neutralise the excess acid and correct the pH of the stomach fluid.

For example, sodium bicarbonate (NaHCO_3) or a suspension of magnesium hydroxide is used to neutralize excess of acid present in the stomach. Milk of magnesia contains magnesium hydroxide, 'ENO fruit salt' contains sodium bicarbonate which helps to neutralise excess acidity in the stomach juice. Medicine like digene, gelusil, used as an antacid contain magnesium hydroxide.

7. Antimicrobials

Many diseases are caused due to infection in the body by certain microorganisms (bacteria, fungus or viruses). Some examples of diseases caused by microbes are dysentery, pneumonia, typhoid, urinary tract infection, etc.

Antimicrobials are the chemicals, which are used to kill microorganisms (which has infected the body) without causing much damage to the body of the patient.

Thus an antimicrobial is a chemical, which is capable of curing diseases caused by various microbes.

An ideal antimicrobial should kill disease-causing microbe and should not have any harmful effect on the patient. In fact there may not be any such antimicrobial which is totally safe and without any side effect.

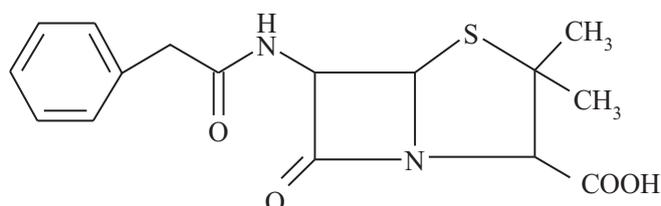
The most common antimicrobials available are the sulpha drugs and antibiotics.

8. Antibiotics

Antibiotics are the metabolic products produced by some microorganisms (mould or fungi). They inhibit growth and even kill disease causing microorganisms (like bacteria, fungi, etc) by inhibiting their life processes. Therefore they are referred to as antibiotics (anti means against and biotic means life).

Penicillin was the first antibiotic to be discovered. Alexander Fleming isolated penicillin in 1929 from a mould *Penicillium notatum*. Penicillin has been used for the treating diseases caused by several bacteria. It has been effectively used for treatment of pneumonia, bronchitis, sore throat, abscesses, etc.

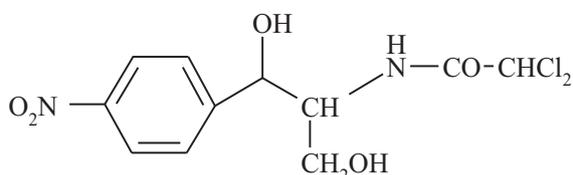
Later on attempts have been made to improve the quality of penicillin. It has led to the discovery of different varieties of penicillin. For example, Penicillin G (also known as benzyl penicillin), penicillin F, penicillin K are the more common varieties of penicillin.



Penicillin G (benzyl penicillin)

Ampicillin and amoxicillin are the semi-synthetic modifications of penicillin. In this case the metabolic product of mould is obtained and then some reactions are carried out to bring the desired changes in the antibiotic molecule to get ampicillin or amoxicillin.

Attempts are being made to discover better and better antibiotics. This search for finding better antibiotics is a never-ending process. Now a large number of antibiotics are available. Some examples are streptomycin and chloromycetin (chloroamphenicol) and tetracycline.



Chloroamphenicol

Streptomycin is used for the treatment of tuberculosis (TB). Chloromycetin is used for the treatment of typhoid. Tetracycline is used for the treatment of several diseases.

Broad-spectrum antibiotics are those antibiotics, which kill a wide range of disease-causing microorganisms.

Broad-spectrum antibiotics can be used for the treatment of several diseases. For example, streptomycin, tetracycline and chloroamphenicol are broad-spectrum antibiotics. Narrow spectrum antibiotics are effective in the treatment of a few diseases.

9. Allergic Reactions of Antibiotics

Some people may show allergic reactions to some antibiotics. These reactions may be mild like rashes appearing on the skin or may be very serious and can



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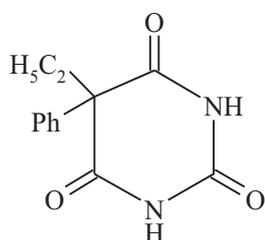


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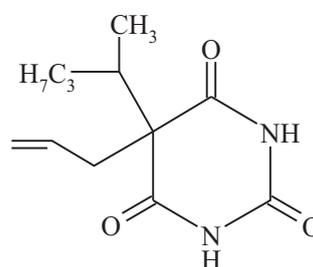
even be fatal. You might have observed that a doctor gives a small dose of antibiotic by injection and then waits for some time to watch if there is any unwanted reaction. If there is no adverse (bad) reaction, then only the doctor gives the full dose of the antibiotic.

10. Tranquilizers and Hypnotics

Tranquilizers and hypnotics are used to reduce anxiety, and they also make a person calm. Sleeping pills are made up of these compounds. Most of them are habit-forming. Their indiscriminate and over use should be avoided. Otherwise it may lead to addiction and many other complications,

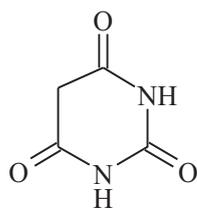


Luminal

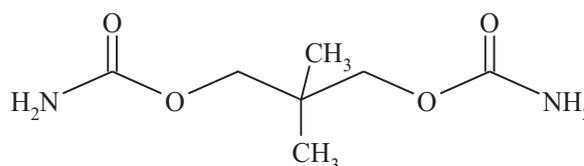


Seconal

Luminal, seconal and equanil are the most commonly used tranquilizers. Barbituric acid and some other compounds related to barbituric acid are used in making sleeping pills.



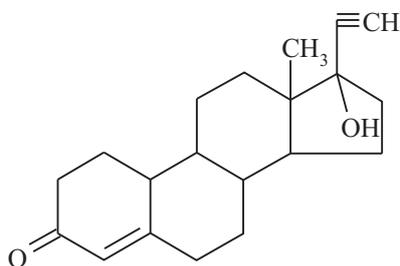
Barbituric acid



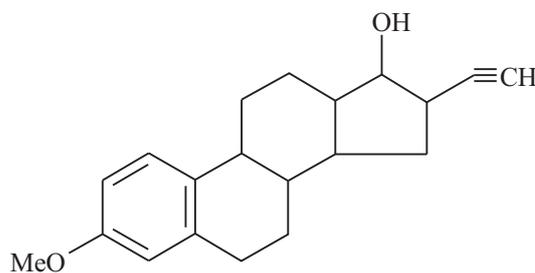
Equanil

11. Fertility Control Medicines

It is a concern of everyone to control human population. Medicines are available which help prevent pregnancy. The medicines, which help prevent pregnancy, are known as contraceptives. These are generally available in the form of tablets and are to be taken regularly by females. Chemicals like norethindrone and mestranol are used as contraceptives (birth control pills). Chemically these are similar to female sex hormones.



Norethindrone



Mestranol

The birth control pills may have some side effects in some cases. Therefore, the birth control pills should be used under the guidance of some expert.

30.3 HAZARDS OF SELF MEDICATION

When medicines are taken by a patient without the advice of a qualified doctor, it is called self-mediation.

Self-medication is very harmful and a dangerous practice. One should never try self-medication. Some of the harmful effects are:

1. A medicine, which has worked well for some one, may not be good for you and can even cause some serious harm.
2. You may take a medicine in quantity more than necessary. It may be harmful for you.
3. You may take quantity less than necessary. The disease-causing microorganisms may gain resistance to the medicine and the medicine may become ineffective.

You should avoid self-medication. Without advice of a doctor avoid use of common medicines over prolong periods. Improper use of even most common medicines, which are readily available without a prescription of a doctor, can have harmful effect.

The medicines, which you can buy without a prescription of a doctor, are called over-the-counter medicines. For example cough syrups, crocin, aspirin, etc are over the counter medicines.

The medicines, which you can buy after showing a prescription of a qualified doctor, are known as scheduled drugs. Improper use of scheduled drugs is likely to cause more serious problems. Therefore, their sale is controlled and regulated by the government.

Most of good chemists do not sell scheduled medicines without a proper prescription. Some irresponsible chemists may sell such medicines without a prescription. It is not a good practice you should not encourage it.



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INTEXT QUESTIONS 30.2

1. Give two examples of antipyretics.
2. Give one example of a narcotic type analgesic.
3. What is the difference between an antiseptic and disinfectant?
4. What are antacids? Name two chemicals commonly used as antacids.
5. What is the difference between local anaesthetic and general anaesthetic.
6. Define antibiotics. Give one example of an antibiotic.
7. Which type of medicines are used in hay-fever, itching of eyes; nose and throats.
8. What is the use of tranquilizers and hypnotics?
9. Give one example of a tranquilizer.
10. What are contraceptives?
11. What are over the counter medicines?

30.3.1 Chemicals in foods – Preservatives and artificial sweetening agents

Food Preservatives: “Chemical substances which are used to protect food materials against microorganisms (bacteria yeasts and moulds) are called preservatives.”

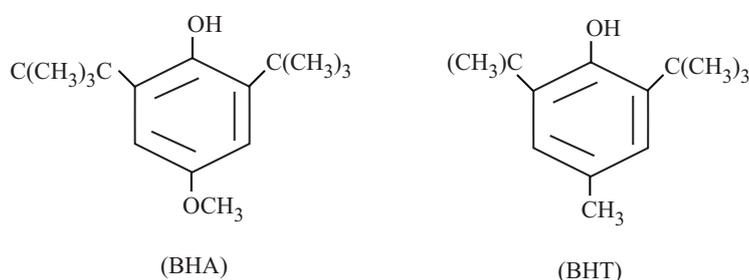
Some commonly used preservatives are

1. **Common Salt, Sugar and oils:** The sufficient amount of salt resist the activity of microorganisms in food it is called salting. It is used to preserve raw mango, bean, fish and meat, etc. Sugar syrup used for preserving like apple, mango, amla and carrot etc. Sugar, oil, vinegar & citric acid are used to preserve pickles, ketchups and jams, etc.
2. **Sodium benzoate (C_6H_5COONa):** It is used for preserving of food material like fruit juices, soft drinks, squashes and jams. It is soluble in water. It is metabolized as hippuric and which is excreted in urine.
3. **Sodium meta bisulphite ($Na_2S_2O_5$):** Its preservative action is due to SO_2 which from sulphurous acid when dissolved in water. It also inhibits the growth of yeasts, moulds and bacteria. It is used to preserve fruitams, juices, squashes, pickles, apples, etc.
4. Sodium and Potassium Salts of propionic acid, sorbic acid are also used as preservatives.

30.3.2 Antioxidants

The unsaturated fat and oils are readily oxidized on storage, the taste and smell are changed and become rancid. To prevent this oxidation, rancidity and spoilage, certain chemical substances are added, are called antioxidant (food additives).

When these are added to food items containing fats and oils retard the oxidation because they are more reactive towards oxidation than fats and oils. So the oxidation of food is prevented. Antioxidants react with free radicals and stop the oxidation of food. The most familiar antioxidants are butylated hydroxyl toluene (BHT) and butylated hydroxyl anisole (BHA)

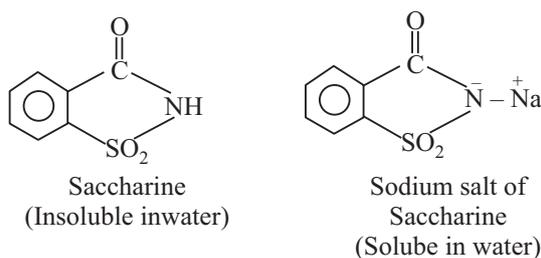


These are added to butter, meats, cereals chewing gum, snack gum, baked food and beer etc. It increases the life of food from months to years. It shows more active synergetic effect when added with Vitamin C (ascorbic acid) and citric acid.

30.2.3 Artificial Sweetening Agents

“The chemical compounds which give sweetening effect to the food are called sweetening agent.” Sucrose and Glucose are widely used as natural sweetening agent. The excess intake of natural sugar cause to obesity diabetics and tooth decay. Natural sugar is a good source of energy. While the artificial sweetening agents does not provide energy. It is excreted from the body in urine unchanged. Some commonly used artificial sweetening agents are saccharin, aspartame, alitame, sucrolose, etc.

1. Saccharin (O-Sulpho benzimide) Saccharin is insoluble in water but sodium salt is highly soluble in water. It is 550 times sweeter than sugar. It is not metabolized by our body. So it does not provide energy and has no calorific values.

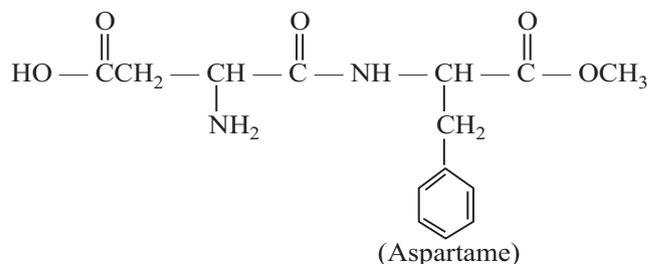


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2. **Aspartame** – It is methyl ester of dipetide derivative derived from aspartic acid and phenylalanine. It is 100 times as sweet as sugar. It is unstable at cooking temperatures. It is used in cold drinks and soft drinks. It is an exception because the body breaks it down in to amino acid and menthol.



3. **Alitame:** It is very high potency sweetener, It is about 2000 times sweeter than sugar. It is more stable at cooking temperatures. It is very difficult to control the sweetness of food.
4. **Sucrolose:** It is trichloro derivative of sucrose. It's taste is like sugar. It is also stable at cooking temperatures. It is about 600 times sweeter than sugar. Sucrolose is expected to become a great commercial artificial sweetening agent.



INTEXT QUESTIONS 30.3

1. What type of change take place on storage the fat & oil?
2. Write the name of preservative used with soft drinks.
3. What change will take inner body on taking exercise sugar (N).



WHAT YOU HAVE LEARNT

- Medicines are the chemicals or mixture of chemicals used for the prevention, cure, treatment, management of diseases and disorders or recovery of patients
- Medicines are obtained from plants or parts of plants or synthesized in laboratories.
- Medicines may contain only one chemical compound or it may be a mixture of several compounds.
- Drugs may be the crude mixtures and the identity of all the chemical components and their amount present in them may not be accurately known.
- Antipyretics are used to reduce body temperature for example aspirin and paracetamol.

- Analgesics reduce body pain for example aspirin and morphine.
- Antiseptics kill microorganisms and are safe to be used on a living tissue while disinfectants are used on inanimate objects.
- Aqueous solution (less than 0.2 percent) of phenol is used as an antiseptic. In higher concentrations phenol is used as a disinfectant.
- Antibiotics are the metabolic products produced by certain microorganisms which can kill some microorganisms. For example penicillin, streptomycin, tetracycline, etc.
- Broad spectrum antibiotics can kill several different microorganisms, therefore, can cure several diseases.
- On storage the taste and smell are changed and become rancid.
- Certain chemical substances are added to control oxidation spoilage and rancidity.
- Butylated hydroxyl toluene (BHT) and Butylated hydroxyl anisole (BHA).
- Common Salt, sugar and oils are natural food preservatives.
- Sodium benzoate is familiar food preservative.
- Aspartame is unstable at cooking temp. so used in cold drinks and soft drinks.
- Alitame is more stable at cooking temp.
- Sucralose is more stable at cooking temp and easy to control the sweetness of food.

**TERMINAL EXERCISE**

1. How are medicines classified?
2. Who isolated the first antibiotic?
3. Name a medicine, which is used as analgesic as well as antipyretic.
4. What is a non-narcotic analgesic?
5. Why is 2.0 percent aqueous solution of phenol used as a disinfectant?
6. What do you understand by allergic reactions of antibiotics?
7. What are scheduled drugs?
8. Which medicines can you purchase without the prescription from a doctor?
9. What is self-medication? Describe some of its ill effects.
10. Write the two names of chemicals which increases the life of food from months to years.
11. Which artificial sweetening agents is more suitable at cooking temperatures.
12. Which is responsible for preservation action of sodium meta bisulphite?

**Notes**



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**ANSWERS TO INTEXT QUESTIONS****30.1**

1. Medicines are all those substances or formulations which are used for cure, treatment, prevention of diseases or disorders and recovery of a patient.
2. True
3. Pharmaceuticals are the chemicals which are used as medicines.
4. Reserpine

30.2

1. Aspirin and Paracetamol.
2. Morphine.
3. Disinfectants kill germs but can damage living tissues Antiseptics are safe for living tissues and yet kill germs.
4. Medicines used to neutralise excess acid in the stomach. Magnesium hydroxides and sodium carbonate.
5. Local anesthetics cause loss of sensation of pain over a small area while general anesthetics cause loss of consciousness.
6. Metabolic products of certain microorganisms and can kill some other microorganisms. Penicillin is an example of antibiotic.
7. Anti histamines are used.
8. Tranquilizers and hypnotics are used to reduce anxiety and these also make a person calm.
9. luminal
10. Contraceptives are the medicines used for prevention of pregnancy.
11. Over-the-counter medicines are those which can be purchased without a prescription from a doctor.

30.3

1. On storage of fat and oil get oxidised, the taste and smell are changed and become rancid.
2. Sodium benzoate (C_6H_5COONa) is used as preservative with soft drinks.
3. The excess intake of natural sugar cause to obesity and tooth decay.