Role of Fungi in Industry.

The industrial uses of fungi are many and varied. In fact, the fungi form the basis of many important industries. There are a number of industrial processes in which the biochemical activities of certain fungi are harnessed to good account. A brief sketch of some of the most important of these processes is given below: -

(i) Alcoholic fermentation. It is the basis of two important industries in India or rather all over the world. These are brewing and baking. Both are dependent on the fact that the fermentation of sugar solutions by yeasts produces ethyl alcohol and carbon dioxide. In brewing or wine making industry alcohol is the important product. The other by-product which is carbon dioxide was formerly allowed to escape as a useless thing. Now carbon dioxide is also considered a valuable by-product. It is collected, solidified and sold as "**dry ice**". In the baking or bread-making industry CO, is the useful product. It serves two purposes: -

(i) causes the dough to rise.

(ii) makes the bread light.

The other by-product, which is alcohol, is incidental. The yeasts secrete the enzyme complex called **zymase** which brings about conversion of sugar into alcohol. Many excellent yeast strains are now available. The yeasts lack diastase. So, they cannot break starch into sugar. There are a number of fungi popularly known as the **moulds**. They secrete a whole range of enzymes and thus bring about fermentation of complex carbohydrates. In producing industrial alcohol moulds are employed as starters to bring about saccharification of the starch. At the second stage, yeast is employed to act on the sugar. Although mould can complete the conversion to sugar but the yield is better if yeast is employed for the second stage. The moulds commonly used for purpose of Saccharification are ***Mucor racemosus. M, rouxii*** and some species of *Rhizopus. Aspergillus flavus* is used in the production of African native beer.

(ii) **Enzyme preparations.** Takamine on the basis of his intensive study of the enzymes produced by ***Aspergillus flavus-oryzae*** series has introduced in the market a few products of high enzymic activity. These are **Digestin, Polyzime, Taka diastase,** etc.

Cultures of *Aspergillus niger* and *A. Oryzae* on trays of moist, sterile bran yield a well known

Amylase which contains two starch splitting components. Invertase is extracted from *Saccharoymces cerevisiae*. It has many industrial uses. It hydrolyses Sucrose to a mixture of glucose and fructose.

(iii) **Preparation of organic acids.** The important organic acids produced commercially

as the result of the biochemical activities of moulds are oxalic acid, citric acid, gluconic acid, gallic acid, fumaric acid, etc. Oxalic acid is the fermentation product of *Aspergillus niger*. Citric acid is made by mould fermentation. Many species of *Penicillium* are used for the

purpose. The acid is produced on a commercial scale and is cheaper than the acid made from the citrus fruits. The Gluconic acid is prepared from sugars. The moulds chiefly employed for this purpose are some species of *Penicillium* and *Aspergillus*.

Gallic acid is prepared on a commercial scale in Europe and America. The details of the Method employed, however, are not known. It may be a modification of Calmete's process.

Calmette (1902) obtained the gallic acid as the fermentation product of an extract of tannin by *Aspergillus gallomyces*.

(iv) **Gibberellins.** These are plant hormones produced by the fungus *Gibberella fujikuroi* which causes a disease of rice accompanied by abnormal elongation. Gibberellin is used to accelerate growth of several horticultural crops.

(v) **Cheese Industry.** Certain fungi popularly known as the cheese moulds play an important role in the refining of cheese. They give cheese a characteristic texture and flavour. The two chief Kinds of mould refined cheese are: -

(a) **Camembert and Brie types.** They are soft.

(b) **Roquefort Gorgonzola and Stilton types**. They are green or blue veined cheese. The Moulds concerned are *Penicillium camemberti* and *P. Caseicolum* in the first type and *P. roqueforti* in the second type.

(vi) **Manufacture of Proteins.** as a supplement to the normal diet, some fungi particularly the yeasts are employed to synthesize proteins. The yeast (*Saccharomyces cerevisiae* and *Candida utilis*) contain high percentage of protein of great nutritive value. They are grown with ammonia as the source of nitrogen and molasses as the source of carbon. The manufactured product is called ***Food Yeast***. It contains 15% protein and B group of vitamins.

(vii) **Vitamins.** The yeasts, are the best source of vitamin B complex. A number of preparations of high potency have been made from the dried yeast or yeast extracts and sold in the market. A number of moulds and yeasts are utilised in the synthesis of **Ergosterol** which contains **Vitamin D.**

Riboflavin another vitamin useful both in human and animal food-is obtained from a filamentous yeast, *Ashby gossypii*.

(viii) **A good many fungi synthesize fat from carbohydrates**. *Endomyces vernalis*, *Penicillium Javanicum* and *Oidium lactis* have a high fat content. The microbiological production of fat is, however, too costly for use.

• Certain fungi form an important basis of fermentation of Cocao beans. Mention must also be made here of the use of Lichens in yielding certain dyes and reagents. An Important substance is extracted from Roccella lichen. It forms the basis of litmus Paper which is used as an indicator to determine the acidity or alkalinity of a Solution.

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