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(i) ROLES OF BACTERIA
IN INDUSTRY

Roles of bacteria in Industry

The metabolic processes and their products of bacteria have been utilized in many industries. In their metabolic activities bacteria excrete waste products some of which have exceedingly important commercial uses. The large scale production of valuable substances from bacterial metabolism is a relatively new field in the economic utilization of bacteria and as such is one in which new discoveries are frequent and often very startling.

(1) Sources of Antibiotics → Soil is perhaps the most important source of micro-organisms which produce antibiotics substances. These include filamentous bacteria (actinomycetes). Some of the antibiotic substances is secreted outside the cell and into the environment; others are retained largely within cells and must be separated by extraction. The modern period of antibiotic began in 1929 with the binding of 'penicillin', produced by

a soil bacterium. Prominent among the antibiotics from actinomycetes are: (i) Streptomycin, discovered in 1944 and obtained from *Streptomyces griseus*.

(ii) Streptothricin obtained from *S. lavendulae*.

(iii) Chloromycetin, discovered in 1949 obtained from *S. venezuelae*.

(iv) Aureomycin, discovered in 1948 obtained from *S. aureofaciens*.

(v) Neomycin, discovered in 1949 obtained from *S. fradiae*.

(vi) Terramycin, discovered in 1950 obtained from *S. rimosus*.

(vii) Bacitracin, produced by *Bacillus subtilis*.

(viii) Polymyxin, produced by *Bacillus polymyxa*.

(2) Fermentation - its industrial application → The process of bacterial fermentation and its products have been utilized in various industries. Some of them are *Clostridium acetobutylicum* ferments carbohydrates producing acetone, methyl alcohol and n-butyl alcohol, which have important industrial uses. Very recently Vitamin B₂, a commercially important product has been discovered as a product of fermentation of carbohydrates by this species of *Clostridium*.

The manufacture of vinegar

is one of the oldest process in human history which involves bacterial metabolism. Vinegar production begins with the fermentation of sugars in apple juice to alcohol by yeasts. In presence of oxygen, the vinegar bacterium *Acetobacter aceti* oxidizes alcohol to acetic acid, which is responsible for the characteristic odour and flavour of vinegar.

Lactic acid is one of the products resulting from the souring of milk, has many uses in the processing of foods, in pharmaceutical and in the chemical industry. It is named after the milk constituent lactose or milk sugar. It is probably the oldest known acid having been discovered by Scheele in 1780. A group of bacteria designated as LAB (Lactic acid bacteria) ferment lactose of milk to lactic acid. All these bacteria are classified in the family *Lactobacteriaceae* which includes the genera *Lactobacillus*, *Leuconostoc* and *Streptococcus*.

The dairy industry finds bacteria an essential aid in a number of processes. Butter is sometimes made from cream which had been allowed to undergo 'ripening' - that is a lactic acid fermentation, causing it to become sour.

This cream is ~~characterized~~ pasteurized, incubated and then churned. This fermentation eventually resulting in the formation of substances responsible for the characteristic odour of butter. The process of pasteurization was named after Louis Pasteur, the French Scientist, who developed it to prevent the spoilage of wines.

③ Retting of fibres → Bacteria play an important role in retting of jute, flax and hemp fibres. They hydrolyze the pectic substances which act as cement like substances that bind the fibres together. Bacteria responsible for retting of fibres are: *Bacillus subtilis*, *B. polymyxa*, *Clostridium tertium* and *Clostridium felsinium*.

④ Other fermentation processes → Certain *Streptococci* and *Lactobacilli* are used for the preparation of silage for the consumption of cows.

Tobacco is cured and fermented its colour, texture and aroma. Bacteria of *Bacillus megatherium* group are used for the curing process. A stationary fermentation is associated with rapid increase in number of the *Micrococcus condidans* and *Bacillus subtilis* types.