

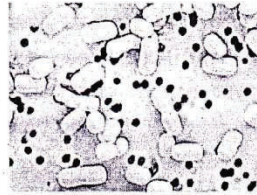
## MICROBES IN HUMAN WELFARE

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The use of micro-organisms for large scale industrial processes is not new, although it has assumed renewed emphasis in recent years. Centuries ago people in Asia and Africa learned to make wine, beer, vinegar & saki with bacteria & yeast, without knowing the scientific basis of such production. The technology related to microbial production of metabolites like ethanol, lactic acid, riboflavin and enzymes like amylase etc. was developed as early as first few decades of the 20<sup>th</sup> century. Large scale production of antibiotic penicillin, was perfected during world war II and the production of many other antibiotics, amino acids, enzymes etc. had been successfully accomplished in the 1950's and later.



*Lactobacillus sp.*

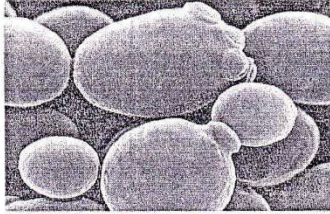
You would be surprised to know that we use microbes or products derived from them everyday. A common example is the production of curd from milk. Microbes such as *Lactobacillus* and others commonly called Lactic Acid Bacteria (LAB) grow in milk and convert it to curd. During growth, the LAB produce acids that coagulate milk & partially digest milk products, improve nutritional quality by increasing vitamin B<sub>12</sub>. These LAB play beneficial role in checking disease causing micro-organisms in our stomach too.

Microbes are also being used to meet effectively the crisis in both environment & energy sectors and provides cheap & cost effective methods of mining and metallurgy etc.

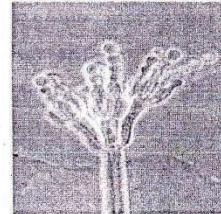
In this discussion we will look at some aspects of microbes with relation to its application in various fields for human welfare.

### Microbes in Industry

In industry, microbes are used to synthesize a number of products valuable to human beings like beverages & antibiotics. Production on an industrial scale requires growing microbes in very large vessels called fermentors.



*Common Yeast*



*Penicillium sp.*

Microbes especially have been used from time immemorial for beverages like wine, whisky etc. depending on the type of raw material used for fermentation and the type of processing i.e., with or without distillation, different type of alcoholic beverages are obtained.

Today we cannot imagine a world without antibiotics. Antibiotics obtained from various microbes have greatly improved our capacity to treat deadly disease like plague, whooping cough, leprosy etc.

Even in the production of important enzymes & bioactive molecules microbes are essential. Lipases obtained from microbes are helpful in removing oily stains in laundry or pectinases and proteases are used for clarifying bottled fruit juices.

A very important bioactive molecule Cyclosporine –A is used as an immunosuppressant in organ transplant patients, produced by *Trichoderma polysporum*, (a fungus).

### Microbes in Sewage Treatment

We know that large quantities of waste water are generated everyday in cities & towns. Such municipal waste water is also called sewage containing huge amount of organic matter and harmful microbes. Before disposal of such waste water into natural water bodies like river or stream it is treated in sewage treatment plants (STPs) to make it less polluting by using various physical & microbial treatments.

### Microbes in Biogas Production

Certain bacteria grow anaerobically on cellulose material, produce large amount of methane and commonly known as methanogens. These bacteria are used in biogas plants and production of biogas depends on the type of bacteria & substrate they utilize. Similarly dung of cattle is utilized for production of 'GOBAR GAS' in many village areas of our country such biogas is a very efficient, clean & environment friendly non conventional source of energy.

### Microbes as Biocontrol agents

In modern society control of various diseases & pests are often controlled by the use of many chemicals which are extremely toxic & harmful to animals, human being & have been polluting our environment for years.

In agriculture, there is method of controlling pests that relies on natural predation rather than introduction of chemicals commonly called as biocontrol and is a nature friendly approach.

One of such biocontrol agent is *Trichoderma*, a soil fungi and very common in root system of plants. They are effective against a number of plant pathogenic fungi.

Similarly, Baculovirus, a common pathogen that attack insects and other arthropods, are commonly used to control a number of insect pests.

*Bacillus thuringiensis*, *Agrobacterium radiobacter* are some other examples.

Some of the active ingredients found in microbial fertilizers



#### *Rhizobium*

- A bacterium.
- Lives in soil, around and inside of the roots of legumes.
- Forms a symbiosis with leguminous plants.
- Fixes atmospheric nitrogen.



#### *Azotobacter*

- A bacterium.
- Lives free in the soil.
- Can fix nitrogen.



#### *Azospirillum*

- A bacterium.
- Lives in soil.
- Is able to live on its own in soil, or in close associations with plant roots.
- *A. brasilense* is able to fix nitrogen.



#### *Pseudomonas*

- A diverse group of bacteria.
- Can use a wide range of compounds that plants give off when their roots leak or die.
- Various functions: e.g. solubilizing phosphorus and making it available.



#### *Mycorrhiza*

- A fungus-root symbiosis.
- Lives with the roots of nearly all plants.
- Lives in the root and extends itself into the soil.
- Helps the plant by gathering water and nutrients.
- Improves soil structure.

### Microbes as Biofertilizers

With our present day life styles environmental pollution is a major cause of concern. The continuous use of chemical fertilizer for increasing demand of agricultural produce has contributed significantly to this pollution. After realization of the negative impacts chemical practices there is a large pressure to switch to organic farming, i.e., the use of biofertilizers. Nitrogen fixing bacteria like *Azotobacter*, *Azospirillum* are often used as biofertilizers nowadays.

In paddy fields many cyanobacteria like *Anabaena*, *Nostoc* etc are used as biofertilizers to increase its fertility. In our country a number of biofertilizers are available commercially & farmers use these regularly in their fields to replenish soil nutrients and to reduce dependence to chemical fertilizers.

Role of micro-organisms in the biodegradation of xenobiotics, restoration of 'usar' (unutilizable) lands, removal of oil pollution from ocean, in the production of single cell protein (SCP) etc. are some of other contributions of microbes for the betterment of human civilization and the list is extending everyday.

It is obvious from diverse uses human being have put microbes to that they play important in the welfare of human society.