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Microbes in Industries (Part 1)

Industrial microbiology includes the use of microorganisms to manufacture food or industrial products in large quantities. Numerous microorganisms are used within industrial microbiology; these include naturally occurring organisms, laboratory selected mutants, or even genetically modified organisms (GMOs). Currently, the debate in the use of genetically modified organisms (GMOs) in food sources is gaining both momentum, with more and more supporters on both sides. However, the use of microorganisms at an industrial level is deeply rooted into today's society. The following is a brief overview of the various microorganisms that have industrial uses, and of the roles they play.

Archaea are specific types of prokaryotic microbes that exhibit the ability to sustain populations in unusual and typically harsh environments. Those suriving in the most hostile and extreme settings are known as **extremophile archaea**. The isolation and identification of various types of *Archaea*, particularly the extremophile archaea, have allowed for analysis of their metabolic processes, which have then been manipulated and utilized for industrial purposes.

Extremophile archaea species are of particular interest due to the enzymes and molecules they produce that allow them to sustain life in extreme climates, including very high or low temperatures, extremely acid or base solutions, or when exposed to other harmful factors, including radiation. Specific enzymes which have been isolated and used for industrial purposes include thermostable DNA polymerases from the *Pyrococcus furiosus*. This type of polymerase is a common tool in molecular biology; it is capable of withstanding the high temperatures that are necessary to complete polymerase chain reactions. Additional enzymes isolated from *Pyrococcus* species include specific types of amylases and galactosidases which allow food processing to occur at high temperatrues as well.

Corynebacteria are characterized by their diverse origins. They are found in numerous ecological niches and are most often used in industry for the mass production of amino acids and nutritional factors. In particular, the amino acids produced by *Corynebacterium glutamicum* include the amino acid glutamic acid. Glutamic acid is used as a common additive in food production, where it is known as *monosodium glutamate* (MSG). *Corynebacterium* can also be used in steroid conversion and in the degradation of hydrocarbons. Steroid conversion is an important process in the development of pharmaceuticals. Degradation of hydrocarbons is key in the breakdown and elimination of environmental toxins. Items such as plastics and oils are hydrocarbons; the use of microorganisms which exhibit the ability to breakdown these compounds is critical for environmental protection.

Xanthomonas, a type of Proteobacteria, is known for its ability to cause disease in plants. The bacterial species which are classified under *Xanthomonas* exhibit the ability to produce the acidic exopolysaccharide commonly marketed as xanthan gum, used as a thickening and stabilizing agent in foods and in cosmetic ingredients to prevent separation.

Another type of microorganism utilized by industry includes various species of Aspergillus. This genus includes several hundred types of mold. *Aspergillus* has become a key component in industrial microbiology, where it is used in the production of alcoholic beverages and pharmaceutical development. *Aspergillus niger* is most commonly used to produce citric acid, which is used in numerous products ranging from household cleaners, pharmaceuticals, foods, cosmetics, photography and construction. Aspergillus is also commonly used in large-scale fermentation in the production of alcoholic beverages such as Japanese sake.

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