

Exploring Industrial Biotech: The Series

Microorganisms

Microorganisms were the first living creatures on Earth. They are invisible to the human eye, but they are essential to life.

Microorganisms are a large family of single or multi-celled organisms including bacteria, fungi and algae. They live in oceans, forests, plants, animals, and in our bodies!

Microorganisms are like factories. With the right information and ingredients, they can efficiently produce many different kinds of products.

Microorganisms and their derived products such as enzymes are already used at large-scale to produce food (bread, beer, cheese), pharmaceuticals (insulin), consumer products (detergents, cosmetics), biofertilizers, biopesticides, and as building blocks for other industries (bioplastics, biochemicals).

Biotechnology products are alternatives to fossil-based products as they are more sustainable and environmentally friendly.



Amino acids

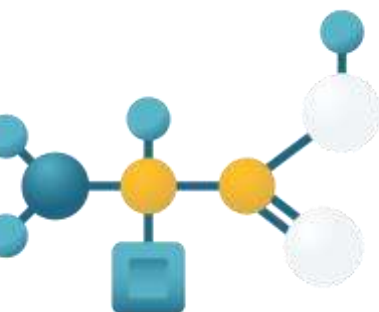
Amino acids are the basic components of proteins, which are fundamental for our body's growth

and function. Our bodies can only produce non-essential amino acids. Therefore, we must obtain the essential ones from protein-rich foods, such as grains, nuts, beans, fruits, legumes, fish, and milk.

Amino acids are relevant to industrial biotechnology because:

- They are important for animal protein production.

Not all types of animal feed have the proper



composition of amino acids for optimal nutrition, therefore supplementation with essential amino acids is important.

- As feed additives, amino acids are instrumental in lowering the number of resources needed to rear livestock and aquaculture, such as land, feed, water, and energy – that is necessary to produce healthy, nutritious food for a growing world population.
- They also contribute to saving thousands of acres of forest that would otherwise have to be transformed into cropland, as well as keeping millions of tons of fish in our oceans.

Proteins

Proteins are large biomolecules made of amino acids, the “building blocks of life”. The order of the amino acids determines the structure and function of each protein.

Proteins are relevant to industrial biotechnology because:

- they play a crucial role in biological processes; for example, the human body uses them to repair the body’s tissues, regulate its metabolism, and digestion, develop antibodies, and much more. Microorganisms can be used to produce particular proteins that are useful in specific applications. For example, spider silk is a protein that makes a durable, flexible and soft fiber. It can be produced by microorganisms instead of by spiders, and its unique properties enable use in multiple applications, including in healthcare or textiles.
- Protein production for human consumption can also be supported by industrial biotechnology. Thanks to precision fermentation, we can produce animal proteins, such as dairy proteins (casein) or egg whites without harming animals, reducing land and resource consumption.



Enzymes

The role of enzymes is to speed up the rate of biochemical processes. Enzymes are proteins that catalyze natural processes in every living organism, including animals, plants, and microorganisms. Without enzymes, the reactions in our bodies would be slow, making living difficult.

Enzymes speed up biochemical reactions by bringing together two smaller molecules to make a larger one, or splitting a large molecule into its building blocks. For example, some enzymes can put together amino acids to make proteins, while other enzymes can break proteins down into the amino acids that make them up.

Enzymes relevant to industrial biotechnology:



Today, innovative enzymes produced through biotechnology are a standard technology used in many industrial processes, specifically in the manufacturing step for the creation of environmentally friendly products, reducing the consumption of water and energy.

Enzymes are used in:

- consumer home care applications (e.g., in laundry and dish-washing products),
- food and feed production (e.g., as processing aids to prevent acrylamide formation; or in the production of food and feed additives),
- many different industrial production processes (e.g. for biochemicals, bioenergy, biomaterials, bioplastics, biopharmaceuticals, recycling, and fabric and textiles processing).