

The Use of Enzymes in Industrial Processes

An enzyme is a substance that acts as a catalyst in living organisms, regulating the rate at which chemical reactions proceed without itself being altered in the process. Enzymes are used in industrial processes such as: Baking, Brewing, Detergents, Fermented products, Pharmaceuticals, Textiles, Starch processing. Here are a range of processes showing how enzymes are used.

Use in Baking

The wheat flour used to make bread contains naturally occurring enzymes that change the starch, protein and fibre in the flour when water is added. Yeast added to the mixture also contains enzymes, which ferment the maltose over time, to make the dough rise. The interaction between different enzymes is complex and the wrong mixture of enzymes can be damaging, for example, too much enzyme usually results in the failure of the bread to rise properly. The advantages of using enzymes is that they can improve consistency and efficiency and they enable better handling of the dough and the control of certain characteristics in the finished bread. The use of enzymes in bread making shows their value in quality control and efficiency of production.

Use in Alcohol Production

In the alcohol industry, fermentation depends on the action of enzymes helped by the yeasts and bacteria used in the production process. Beer brewing essentially involves the yeast action on barley, maize, sorghum, hops or rice. However the traditional malting process is an expensive inefficient way of manufacturing enzymes. So nowadays industrial enzymes such as amylases, glucanases and proteases are added to unmalted barley to produce the same products that malting would produce by more controlled means. The advantages of using enzymes in the beverage industry allow it to be more economic and have consistent quality.

Use in Fruit Juices

Enzymes are used in the processing of fruit juices to maximize the production of clear or cloudy juice. Nearly all fruits contain pectin. The presence of soluble pectin in squeezed juice causes cloudiness. The addition of pectin degrading enzymes- pectin methyl esterase (enzymes that corrupt pectin) at the pressing stage increases the amount of juice produced and can reduce cloudiness. The desired flavour and colour of citrus juices depends on the insoluble, cloudy materials of the pressed juice. The pectin component is manipulated requiring a balance between pectin methyl esterase, to promote cloudiness by increasing the pectin/calcium complex formation and polygalacturonase to break cloudiness by depolymerisation of the pectin. The application of enzymes in these processes is superficial. The advantages of using enzymes in fruit juices is you can get a desired flavour and colour in a certain fruit juice.

Use in Washing Powders

Protease digests on organic stains such as grass, blood, egg and human sweat and lipases are effective on stains resulting from fatty products and amylases are effective on removing starchy food deposits. Some powders contain cellulase to brighten colours and soften fabrics. Protease and amylase are also effective in dishwasher detergents, to remove food particles. The advantages of using enzymes in washing powders is that they are environmentally friendly with fewer bleaching agents and phosphates, and have beneficial effects on public and environmental health.

Use in the Textile Industry

Enzymes are used in the leather and the textile industries in finishing processes. Proteases help in the de-hairing of the animal hides and lipases are used for de-greasing. The correct application of a cellulase enzyme can give a smoother, glossier brighter fabric to cellulose fibres like cotton. This technique is known as bio-polishing. In the denim industry, cloth was traditionally stonewashed with pumice stones to fade the fabric. A small application of cellulase minimises damage to the garments and also to machinery. This technique is known as bio-stoning and can ensure greater fading without high abrasive damage to fabric and accessories. The advantage of using enzymes in this area of industry illustrates their valuable technological contribution as you have a lot of control on the final result of the material.

Use in Medicine

Uses of enzymes in medicine include:

- Analytical tests: Diabetics use strips of paper impregnated with glucose oxidase to monitor their blood sugar.
- The presence of enzymes where they should not be present can also help to diagnose disease. For example when the liver is diseased or damaged, enzymes leak into the bloodstream. Testing the blood for these enzymes can confirm liver damage.
- Therapeutic enzymes: Enzymes are sometimes used as medicines to replace enzyme deficiencies in patients like is the use of blood clotting factors to treat haemophilia, or the opposite where proteases are used to degrade fibrin; to prevent the formation of dangerous blood clots. Nuclease is a possible therapy for cystic fibrosis, but it is not clear how commercialized and therapeutically successful this has been.
- Proteases are used to clean wounds and therefore accelerate the healing process.
- Drug manufacture: The chemical synthesis of complex drugs is often difficult and companies turn to enzymes to perform chemical conversions

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