

Application of enzymes in industry and medicine



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Enzymes have enormous potential in the commercial world. Since they can catalyse specific reactions at relatively low temperatures, they are more versatile and cheaper than inorganic catalysts. Enzymes can work out a range of pH levels and normal atmospheric pressure therefore energy saving.

Enzymes are biodegradable and therefore cause less environmental pollution.

Enzymes are formed from within the cells of all living creatures, plants, fungi, bacteria and microscopic single celled organisms. They are produced commercially by fermentation under aseptic conditions. The nutrient is converted to the desired enzyme by carefully selected microorganism choice and type of conditions to yield the type of enzyme.

Enzymes are used in a wide range of industries, including the food industry, textiles, agricultural forestry, medical and the brewing industry.

Baking Enzymes are very important in the baking process. The main function of enzymes in baking is to convert starch into fermentable sugars. The carbon dioxide produced from yeast fermentation of these sugars gives bread its fluffy texture.

The enzymes used in baking include, alpha-amylase isoenzymes, beta-amylase isoenzymes, pullulanase, proteases, lipases, lipoxygenases and many more. The action of the alpha and beta amylases is to convert the starch in the flour into maltose. alpha amylase is added to the flour because it affects the dough and overall quality of the bread.

Alpha amylases are also effective in delaying the bread becoming stale. proteases are added to slacken the dough, causing it to become more stretchy and giving it greater mobility. Another common enzyme, to be

added to the dough, is lipoxxygenase which strengthens the gluten of the proteins, and also acts as a whitener by bleaching the flour. BrewingThe processes in brewing are heavily dependent on natural and added enzymes. The main processes which involve enzymes are in the mashing and conditioning stages. In mashing, amylase hydrolyses the starch to produce fermentable sugars.

Alpha and beta nzymes are used to boost the natuaral enzyme content. They give the final beer body and can reduce the amount of calories. During conditioning proteases, most commonly papain are added to prevent the formation of chill haze, a carbohydrate complex. Papain causes the beers faming and head rention. Glucoamylasecan also be added resulting in maximum alcohol content and a sweeter beer.

Food industryLipases have a tremendous advantage in the food industry, however the biggesty problem is their high cost. Lipases are priciply usd in the dairy imdustry for the enhancement of flavour and ripening of cheese. Free fatty acids in cheeses, particualary soft cheeses give them their charcteristic flavours and smells. Blue cheeses are ripened by extracelluar lipases from mould, eg penicillium roqueforti. Leather industryEnzymes are used to remove the hairs from the animal skins to produce leather. A protease enzyme is used, eg trypsin, which partly digests keratin, the main protein present in hair, allowing the hair to vbe more gently removed.

Protein digesting enzymes extraxted fro the pancreas of animals are used to diffuse into the skin and break down the proteins around the hair follicles. The use of enzymes in the leather industry has allowed a reducation of harsh

chemical substances and pollution. Enzymes offer an alternative to using calcium hydroxide and sodium sulphate which can have disastrous effects on the environment. Biological washing powders This industry is the biggest market for enzymes, with 30-40% of the total enzyme sales. Dirt on clothing consists of proteins, carbohydrates and lipids.

These stains can be removed without enzymes, however enzymes in washing powders work at lower temperatures and are more effective at removing stains. proteases and amylases are used in detergents, because they are cheap, safe and be able to withstand harsh chemicals. Biological washing powders (powders containing enzymes) are able to function at 55 C because this is the optimum temperature for the proteases, therefore they are energy saving. Textiles Enzymes such as cellulases are used to give jeans a faded, stone washed effect. Cellulases degrade cellulose a major component of cotton in denim.

By using certain cellulases ' nicks' are produced on the surface fibres, giving denim the faded, worn-in look. Animal feed Enzymes are commonly used in animal feed, to increase the digestibility and therefore the growth rate of the animal. An enzyme called Phytase is used which releases phosphate and phytate. Treatment of animal feeds with phytase has shown to increase the levels of phosphate, therefore reduce the amount of inorganic, unenvironmental; ly friendly phosphate that has to be added to the feed.

Phosphate has to be added to the feed for animals, such as pigs, with single stomachs, therefore low phosphate availability. Medicine Enzymes are tremendously useful in medicine, as well as being advantageous for

industrial processes and the commercial world. Most genetic diseases are a result of a particular enzyme deficiency. Therefore enzymes can be used in the diagnosis of disease, and therefore correct certain illnesses. The presence of enzymes where they shouldn't be , is vital for diagnosing a disease.

For example when the liver is diseased or damaged, enzymes only usually found in the liver leak into the bloodstream. Testing the blood for these activities is therefore vital for confirming liver damage. Enzymes in medicine are also used in analytical tests. For example glucose is measured by an enzyme based test utilising glucose oxidase. Biosensors are used which analyse biologically active compounds in solutions.

Biosensors are tremendously useful, in measuring blood levels.