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Applications of Microbial Enzymes in Food Industry

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INTRODUCTION

Since ancient times, microorganisms have been employed to ferment food, and fermentation techniques are still utilised today to prepare a variety of foods. Due to their higher stability compared to enzymes from plants and animals, microbial enzymes are very important in the food industry. Due to their great consistency, process modification and optimization can be done relatively simply, and they can be manufactured using fermentation processes in a time and space-efficient manner at a lower cost. Many of these enzymes have extensive uses in a variety of commercial fields, such as the food, detergent, paper, and textile industries, where amylolytic enzymes are used. They are employed in the production of high fructose corn syrups, crystalline glucose, maltose syrups, and other products containing glucose. They are used as additives in the detergent business to get rid of stains that are made of starch. They are employed in the paper industry to lower starch viscosity for proper paper coating. Amylases are used in the textile industry to size the warp of the textile fibres. Proteases, lipases, and xylanases, for example, have numerous uses in the food industry. The sections that follow provide thorough and current information on several dietary enzymes with microbial origins.

The hydrolysis of 1,4-glycosidic bonds in polysaccharides by α-amylases, a starch-degrading enzyme, results in the generation of short-chain dextrins. All living things include a large number of these enzymes. The majority of metalloenzymes, such as α-amylases, depend on calcium ions for their activity, stability, and integrity. The food industry uses α-amylases extensively for starch liquefaction, baking, brewing, and as digestive aids. They are frequently employed as flavour enhancers and antistaling agents in the baking industry to enhance the quality of bread. During baking, α-amylases are incorporated into the dough to help break down starch into smaller dextrins, which yeast then ferments. It enhances the flavour, appearance, and toastability of bread.

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In order to release α-glucose, glucoamylases catalyse the hydrolysis of polysaccharide starch from the non-reducing end. They are widely dispersed in all living things and are also known as saccharifying enzymes. *Aspergillus niger* and *Aspergillus awamori* are the primary producers of these enzymes, however *Rhizopus oryzae* also produces one that is commonly employed in industrial settings. Glucoamylases are often stable at low temperatures. They become less active as a result of conformational change at higher temperatures. In the food business, glucoseamylases are used in a variety of processes, including those that result in high-glucose and high-fructose syrups. Additionally, they are used in the baking sector to enhance baked goods with high fibre content, lower dough sticking, and improve bread crust colour. The starch in the flour is changed into maltose and fermentable sugars by enzymes called glucoseamylases. The yeast fermentation process makes the dough rise. These enzymes are also employed in the synthesis of glucose, which, when fermented with Saccharomyces cerevisiae, results in the formation of ethanol. In addition to producing light beer, glucoseamylases are crucial in the manufacturing of sake and soy sauce. Dextrins are metabolised by them into fermentable sugars with a lower calorific value and alcohol content for beer.

Proteins and polypeptides include peptide bonds, which are hydrolyzed by proteases, an enzyme. The food industry comes second in their utilisation after the detergent and medicinal sectors. They account for 60% of the industrial enzymes available today. During the years 2014 to 2019, the global market for protease enzymes grew at a compound annual growth rate (CAGR) of 5.3%. As they are used in bioremediation procedures as well as the processing of leather, their demand is anticipated to rise significantly more. Animals, plants, and microbes are the primary suppliers of protease enzymes (both bacterial and fungal). Exopeptidases and endopeptidases are the two types of proteases that are separated based on where they operate on polypeptide chains. In the food business, plant proteases including bromelain, ficin, and papain are frequently used for brewing, tenderising meat, coagulating milk, and as digestive aids. Additionally, proteases are employed to alter the functional characteristics of food proteins, such as coagulation and emulsification, as well as their flavour, nutritional value, solubility, and digestibility. In the baking sector, proteases are frequently employed to make bread, baked goods, crackers, and waffles. These enzymes are used to speed up mixing, lessen dough uniformity and consistency, control the strength of the gluten in bread, and enhance texture and flavour. Successful use of the *Aspergillus usamii* acid protease for the enhancement of functional characteristics of wheat gluten. . If protease is added, the wort may have enough peptides and amino acids to support a healthy fermentation. By balancing the amino acid profile of beer, acidic fungal proteases are employed to enhance beer fermentation since they are effective even at low pH levels. Proteases have a significant role in the dairy sector, among other industries. Proteases that occur naturally play a big part in what gives cheese its flavour. They are employed to quicken the ripening of cheese, alter the functional qualities, and lessen the allergic qualities of dairy products. Proteases are also utilised in the production of cheese to hydrolyze a particular peptide bond and produce paracasein and macropeptides.

Long-chain triglycerides are hydrolyzed by lipases, which are enzymes. For the purpose of digesting fats and lipids, they are naturally present in the stomach and pancreas of both humans and other animal species. Bacteria, fungus, and yeast all produce microbial lipases. About 90% of the world's lipase market is made up of microbial enzymes. The use of this enzyme is widespread, with applications in the food, biofuel, detergent, and animal feed industries. Application areas for it include paper, leather, and textile processing. Lipases are extensively used in the dairy, bakery, fruit juice, beer, and wine sectors in the food and beverage sector. Despite having numerous uses in numerous industries, lipase only accounts for less than 10% of the worldwide industrial enzyme market.

Enzymes called pectinases catalyse the breakdown of glycosidic linkages in pectic polymers. This enzyme's natural substrates include pectic materials found in tomato, pineapple, orange, apple, lemon pulp, orange peel, and other citrus fruits. Pectin esterases

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remove the acetyl and methoxyl groups from pectin, while polygalacturonases hydrolyze glycosidic -(1-4) bonds, pectin lyases, and pectate lyases also break down pectin. Pectinases are used in a wide range of commercial processes, including bleaching paper, the food sector, remediation, etc. Pectinase-added juices seem clearer and are easier to filter than their enzyme-depleted counterparts. In order to get good outcomes, the employment of biogenic enzymes such pectinases in juices would perform roughly nine times better than mechanical maceration.