

Read the text below and choose the appropriate heading for A, B, C and D passages.

- 1) BIOTECHNOLOGY IN EVERYDAY LIFE
- 2) DETERGENTS
- 3) TEXTILES
- 4) FOODS AND BEVERAGES
- 5) PHYTOTECHNOLOGY

Biotechnology has applications in four major industrial areas, including health care (medical), crop production and agriculture, non food (industrial) uses of crops and other products (e.g. biodegradable plastics, vegetable oil, biofuels), and environmental uses.

A

For example, one application of biotechnology is the directed use of organisms for the manufacture of organic products (examples include beer and milk products). Another example is using naturally present bacteria by the mining industry in bioleaching. Biotechnology is also used to recycle, treat waste, clean up sites contaminated by industrial activities (bioremediation), also to produce biological weapons.

This list contains some of products of enzyme biotechnology you might use every-day in your own home. In many cases, the commercial processes first exploited naturally occurring enzymes. However, this does not mean the enzyme(s) being used were as efficient as they could be. With time, research, and improved protein engineering methods, many enzymes have been genetically modified to be more effective at the desired temperatures, pH, or under other manufacturing conditions typically inhibitory to enzyme activity (eg. harsh chemicals), making them more suitable and efficient for industrial or home applications.

B

Enzymes have been used in many kinds of detergents for over 30 years, since they were first introduced by Novozymes. Traditional use of enzymes in laundry detergents involved those that degrade proteins causing stains, such as those found in grass stains, red wine and soil. Lipases are another useful class of enzymes that can be used to dissolve fat stains and clean grease traps or other fat-based cleaning applications. Currently, a popular area of research is the investigation of enzymes that can tolerate, or even have higher activities, in hot and cold temperatures. The search for thermotolerant and cryotolerant enzymes has spanned the globe. These enzymes are especially desirable for improving laundry processes in hot water cycles and/or at low temperatures for washing colors and darks. They are also useful for industrial processes where high temperatures are required, or for bioremediation under harsh conditions (eg. in the arctic). Recombinant enzymes (engineered proteins) are being sought using different DNA technologies such as site-directed mutagenesis and DNA shuffling.

C

Enzymes are now widely used to prepare the fabrics that your clothing, furniture and other household items are made of. Increasing demands to reduce pollution caused by the textile industry has fueled biotechnological advances that have replaced harsh chemicals with enzymes in nearly all textile manufacturing processes. Enzymes are used to enhance the preparation of cotton for weaving, reduce impurities, minimize “pulls” in fabric, or as pre-treatment before dyeing to reduce rinsing time and improve colour quality. All of these steps not only make the process less toxic and eco-friendly, they reduce costs associated with the production process, and consumption of natural resources (water, electricity, fuels), while also improving the quality of the final textile product.

D

This is the domestic application for enzyme technology that most people are already familiar with. Historically, humans have been using enzymes for centuries, in early biotechnological practices, to produce foods, without really knowing it. It was possible to make wine, beer, vinegar and cheeses, for example, because of the enzymes in the yeasts and bacteria that were utilized.

Biotechnology has made it possible to isolate and characterize the specific enzymes responsible for these processes. It has allowed the development of specialized strains for specific uses that improve the flavour and quality of each product. Enzymes can also be used to make the process cheaper and more predictable, so a quality product is ensured with every batch brewed. Other enzymes reduce the length of time required for aging, help clarify or stabilize the product, or help control alcohol and sugar contents. For years, enzymes have also been used to turn starch into sugar. Corn and wheat syrups are used throughout the food industry as sweeteners. Using enzyme technology, the production of these sweeteners can be less expensive than using sugarcane sugar. Enzymes have been developed and enhanced using biotechnological methods, for every step of the process.