Applying adverse environment enzymes for industrial biotechnology.

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Abstract

Enzymatic processes have been implemented in a broad range of industries in recent decades. They are specific, fast in action and often save raw materials, energy, chemicals and/or water compared to conventional processes. Use of the 'carbon footprint' concept and Environmental Impact Assessment is limited to a few studies. For a green, sustainable, biobased economy, biocatalysis is essential. The majority of commercially available enzymes are active and stable only in a small number of circumstances. Microorganisms that are extremophiles survive in harsh environments and produce powerful enzymes. An overview of extremozymes and their biotechnological uses will be provided in this review.

Keywords: Environment Enzymes, Biocatalysis, Biobased economy, Microorganisms, Biotechnology.

Introduction

The manufacture of goods used in daily life, such as paper, textiles, food, feed, chemicals, and pharmaceuticals, uses a lot of energy and raw resources, produces a lot of waste, and has a negative influence on our environment and quality of life. It is widely acknowledged that there is an urgent need to reduce the impact per produced unit of product in order to sustain human needs without compromising the foundation of natural resource availability. The world's population is growing, many countries' economies are improving, and this increases global consumption and, consequently, the pressure on the environment. Therefore, businesses all over the world are searching for other technologies that can meet the rising demand for products while using fewer resources and having a smaller negative impact on the environment. Enzymes are proteins produced by all living organisms; they act as a catalyst for numerous biochemical reactions. There are currently around 5500 known enzymes, classified based on the type of reaction they catalyze (oxidoreductases, transferases, hydrolases, lyases, isomerases, and ligases). Enzymes are highly specific and they usually act under milder reaction conditions than traditional chemicals [1, 2]. They are also biodegradable and lead to reduced or no toxicity when they reach the environment after use in industrial production. These properties allow manufacturers to produce products with less raw material, chemical, water and/or energy consumption. LCA and EIA are versatile tools for quantitatively assessing the environmental impacts of products and systems. They were developed in the late 1990s and have been used extensively since then. The purpose of this review is to provide an overview of studies comparing enzymatic processes with conventional ones. Wood can be used as a virgin resource to manufacture paper and paperboard, or it can be recycled. The traditional method of producing pulp and paper relies on chemical and mechanical processing, which uses a lot of energy and raw materials and puts a lot of strain on the environment. The following sections provide an overview of many enzyme uses in the pulp and paper sector that have been the focus of LCA research. The foundation of bioprocess technology is biocatalysis, which makes it possible to produce things in large quantities by using enzymes. Enzymes are more environmentally friendly and long-lasting alternatives to chemicals in industrial processes [3, 4]. Many of these processes occur under harsh conditions, such as high temperature and extremes of pH. The ideal biocatalyst must be stable and active under processing conditions. Enzymes derived from extremophiles overcome these limitations. Extreme environments can be natural, such as hypersaline lakes, hydrothermal vents, volcanos, arid deserts or the deep ocean. Extremozymes are robust biocatalytic tools and catalyze various degradation, synthesis, redox and transformation reactions. The numerous limitations on culturing extremophiles for extremozyme production necessitate development of novel molecular technologies. DNA and RNA sequence analysis is an enormous step forward in exploration of unknown bacterial and archaeal communities of extreme environments [5].

Conclusion

Numerous businesses, including those in domestic care, food, animal feed, technical industries, fine chemicals, and pharmaceuticals, use enzymes in a variety of ways. 28 comparative environmental assessments completed during the previous 15 years are summarised in this review. According to the findings, switching to enzymatic processing instead of traditional procedures generally results in lower contributions to global warming.

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