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Investigating expression of urethane bond hydrolyzing enzyme

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PURPOSE OF THE ABSTRACT

The abundance of industrial and domestic wastes is still neither recycled, nor used in any other profitable way. Currently, intensively promoted the Circular Economy model implicates that the generated waste has to re-enter the production line and save valuable recourses. Each waste material requires specific treatment, and a unified process may not be applied. For example, polyurethane (PU) is an excellent material that finds its way to be used in many industrial and domestic products—from insulation to sleeping mattress. Also, nearly half of the global unrecycled PU waste finds its way into landfills. PU represent 8 % of all plastics produced annually. The treatment of polyurethane waste by hydrolysis, glycolysis, pyrolysis demands a substantial amount of energy and has not been applied on a commercial level because it is economically not favourable. Biocatalysis can be foreseen as one of the alternative treatment methods to for such type of waste [1,2].

Currently, there are no biocatalytic or green chemical PU utilization technologies or methods. Some PU are susceptible to enzymatic and microbial degradation [3]. The aim of this research is to investigate enzymes that could hydrolyse urethane bond in PU. Various environmental samples have been screened and PU degrading microorganisms were isolated. Urethane bond hydrolysing enzyme urethanase (GenBank: MK757456.1) was found in Lysinibacillus sp. strain TBS 101. This bacterium was isolated from Lithuanian soil samples. Recombinant urethanase was successfully cloned and synthesized. Its ability to hydrolyse a model substrate—ethyl carbamate (urethane)—has been confirmed by Berthelot reaction. Specific enzyme activity reached up to 4.4 U/mg in E.coli. Further research is directed towards increasing the amount of urethanase by using heterologous expression systems, such as Pichia pastoris yeast, solubility enhancing partner proteins, such as maltose-binding protein (MBP), and codon optimisation. The attained results in more detail will be presented during the poster session.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Polyurethane | Recombinant expression | Urethanase | Circular Economy

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