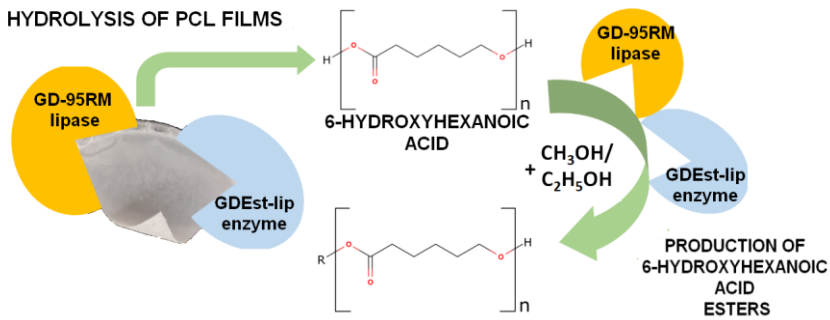
Engineered *Geobacillus* lipolytic enzymes for decomposition of polyester plastics

BRIEF DESCRIPTION OF A TECHNOLOGY

GD-95RM lipase and GDEst-lip fused lipolytic enzyme are new microbial lipolytic biocatalyst evolved through protein engineering, using directed evolution or enzyme fusion. Both biocatalyst are successfully produced by heterologous protein expression in *E. coli* BL21 (DE3) and purified by using native IMAC conditions. It has been shown that GD-95RM lipase and GDEst-lip successfully perform hydrolysis of different mollecular mass Polycaprolactone (PCL) films (Mn 45000 and 80000) at 30 °C, pH 8. The degradation of PCL films was significantly enhanced by the addition of short chain alcohols: the addition of ethanol (25%) improves the degradation efficiency ~2.5 fold in the case of GD95RM, while methanol (50%) improved ability of GDEst-lip perform degradation PCL films by ~3.25 times. Based on our calculations at optimal conditions >500 mg of PCL can be degraded by 1 mg of catalyst in 24 hours. Both enzymes can also perform esterification by forming 6-hydroxyhexanoic acid methyl and ethyl esters.



ADVANTAGES

GD-95RM and GDEst-lip enzymes can be applied for **decomposition of polycaprolactones** and transesterification of the resulting 6-hydroxyhexonic acid to produce 6-hydroxyhexonic acid esters.
The main attractive physicochemical and kinetic properties for industry are:

- thermostability,
- tolerance to organic solvents,
- high yield,
- simple purification,
- ability toward short, medium and long acyl-chain length esters and different molecular weight polycaprolactone films.
- storage at room temperature until 3-months is possible

TECHNOLOGY READINESS LEVEL

Validated in laboratory.

INVENTORS

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PUBLICATIONS

Malunavicius, V., Padaiga, A., Stankeviciute, J. Pakalniskis, A., Gudiukaite, R. Engineered Geobacillus lipolytic enzymes – attractive polyesterases that degrade polycaprolactones and simultaneously produce esters. Int J Biol Macromol. 2023. https://doi.org/10.1016/j.ijbiomac.2023.127656

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APPLICATION

- Decomposition of polyester plastics
- Production of fatty acid esters
- Tools for fundamental enzyme research
- Hydrolysis of different lipidic wastes

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