Vilius Malunavicius et al., J Bacteriol Parasitol 2017, 8:6(Suppl)
DOI: 10.4172/2155-9597-C1-041

Lipolytic enzymes of *Geobacillus* sp. 95: potential for industrial application

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Geobacillus species show high potential as biocatalysts suitable for industrial biotechnology applications. The ability of these bacteria to produce a variety of extracellular enzymes, such as amylases, xylanases, proteases, lipases, esterases and ureases has ranked them among the most important enzyme producers. Thermostable and thermoactive lipolytic enzymes have gained remarkable importance over other industrially used biocatalysts due to their versatility regarding catalytic behavior. The main advantages of performing industrial processes at higher temperatures are reduced risk of microbial contamination and lower viscosity. It was showed that *Geobacillus* sp. strain 95 produces two types of thermostable, thermoactive and organic solvent-tolerant lipolytic enzymes: lipases (named GD-95) and carboxylesterases (named GDEst-95). The main goal of this research was to investigate the potential of recombinant variant of GD-95 lipase and GDEst-95 esterase for the application in industry. It was shown that both enzymes displayed an ability to perform catalysis at temperatures ranging from 5°C to 75°C while retaining more than 50% of lipolytic activity after incubation at temperature range of 30-65°C. Both biocatalysts also possessed long-term (216 h) stability in isopropanol, methanol and hexane (25% and 50%). Our results also showed that new esters can be obtained using a mixture composed of coconut, peach, macadamia or canola oils, 1/10 (w/w) ethanol or methanol and GD-95 lipase as biocatalyst. The major ingredient of coconut oil is lauric acid which can be turned into ethyl laureate (flavour ingredient) via esterification reaction with ethanol. The results also suggested that GD-95 lipase can be a powerful tool for the production of emulsifiers (mono- or diacylglycerols). In conclusion, the present study demonstrated that lipolytic enzymes (lipase and carboxylesterase) produced by *Geobacillus* sp. strain 95 have suitable properties for industrial applications and can offer an eco-friendly alternative for chemical synthesis.

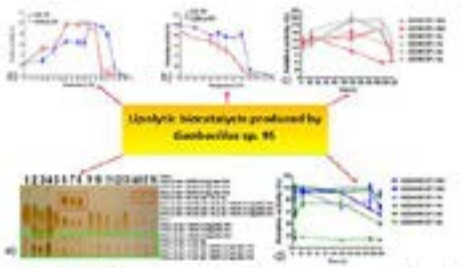

Figure 1: The potential of lipolytic enzymes produced by *Geobacillus* sp. strain 95 for industrial application. The temperature effect on the lipolytic activity (a) and stability (b) of GD-95 lipase and GDEst-95 esterase. The effect of organic solvents on lipolytic activity of GD-95 lipase (c) and GDEst-95 esterase (d). Thin layer analysis of new products obtained via esterification of canola and coconut oils with ethanol or methanol, using GD-95 lipase as biocatalyst (e). Red rectangles indicate esters; green – mono- and diacylglycerols; Ca.o – canola oil; Co.o – Coconut oil; Et – ethanol; Iso – isopropanol; Hx – hexane; Met – methanol.

Biography

Vilius Malunavicius is currently an MSc student in Microbiology and Biotechnology at the Institute of Biosciences in Vilnius University. He has 4 years of experience working in Protein Engineering field for lipolytic enzymes improvement. He is as co-author of a publication and several conference theses, associated with lipolytic enzymes from *Geobacillus* sp. 95. He has also received Prof. K Jankevicius Scholarship (2016) and worked at Greifswald University Prof. U T Bornscheuer group under the Erasmus program for 3 months (2017.02-2017.05).

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