

Biosurfactants produced from oleaginous cell lysate; Why not?

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Mannosylerythritol lipids (MELs) are one of the most promising biosurfactants because of their high production yield and many potential applications. Despite the advantages, biosurfactants and specifically MELs, are merely fermented on a limited scale. This is largely due to the production cost, which cannot yet compete with that of the chemically synthesized surfactants [1]. The high cost is to a great extent determined by the cost of the feedstock: vegetable oil, a valuable substrate that increases the pressure on fertile land use. A possible alternative to vegetable oil could be oil from oleaginous yeasts, because of the large structural similarities.

A multi-stage production system was developed where MELs are produced by *Moesziomyces aphidis* (stage 2) using oil derived from the oleaginous yeast *Cutaneotrichosporon oleaginosus* (stage 1), which is known to produce lipids from various waste streams. Crude oleaginous cell lysate derived from *C. oleaginosus* was obtained after mechanical cell disruption in a ball mill. A production culture with *M. aphidis* was set up using the raw cell lysate as substrate for MEL production. This fermentation was compared to a reference culture based on rapeseed oil as substrate.

The concentration of MELs using rapeseed oil reached 23.4 g L⁻¹ after six days while oleaginous cell lysate yielded 2.3 g L⁻¹. This low MEL titer could have been due to one or more of the following factors: a low initial lipid concentration, a repressing effect of other substrates (e.g. sugars which are present in the lysate), the absence of minor stimulating compounds such as sterols that are found in vegetable oils and an insufficient nitrogen limitation.

This research consisted of two parts: firstly, a detailed study on MEL formation using oleaginous cell lysate comprising MEL quantification, microscopic imaging and gene expression data, and secondly, the investigation of possible factors influencing MEL formation and thereby explaining the low MEL yield when using oleaginous cell lysate as substrate.

[1] Saika A., Koike H., Fukuoka T., Morita T. (2018) Tailor-made mannosylerythritol lipids: current state and perspectives. *Applied Microbiology and Biotechnology* 102:6877-6884