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BRINGING NEW-TO-NATURE SURFACTANTS TO THE MARKET

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Biosurfactants (BS) are a family of very diverse secondary metabolites produced by a wide variety of microorganisms. They have been described to find (potential) applications in the medical world, personal care sector, mining processes, food industry, cosmetics, crop protection, pharmaceuticals, bio-remediation, household detergents, paper and pulp industry, textiles, paint industries, etc. [1].

Their biodegradability and the fact that they can be produced from renewable resources gives them an advantage over their chemical counterparts and may therefore make them suitable to partly replace chemicals [2]. Growing environmental awareness and rising oil prices, combined with the fact that our dependency on this finite source of energy and chemical compounds could lead to a catastrophe once we run out of oil, has resulted in renewed interest in these molecules in the last ten years.

The major two factors currently limiting the penetration of biosurfactants into the market are firstly the limited structural variety and secondly the high production price due to rather low productivities. A solution for both drawbacks can be identified in the genetic engineering of natural BS producers. The latter has thus been the subject of a lot of research effort and offers (for certain strains) a real industrial potential [3]. Furthermore the development of production processes (fermentation and purification) for newly developed strains and hence products in combination with a determination of the properties of the new molecules is indispensable for the commercialization thereof.

Several tools were developed to generate new BS producing yeast strains (*S. bombicola*) and for four of them the fermentation and purification process was investigated. Stability and CMC values were determined and characterized samples are currently available to provide to all relevant sectors of the market and academia (currently on a limited scale, which will be expanded in the future). These efforts will enable the penetration of these new biosurfactant products in the market in the near future.

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ZYGOSACCHAROMYCES BAILII STRAIN TALF1 INULINASES / INVERTASES TOWARDS ENHANCED BIOPROCESSES

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Zygosaccharomyces bailii strain Talf1, a yeast recently isolated in our laboratory, produces a crude enzymatic extract that was determined to have both inulinase/ invertase activities. The properties of these activities were characterized and the crude extract was applied towards bioprocesses.

The extracellular crude enzymatic extract presents activity in a range of temperatures from 20 to 60°C and pH from 4.5 to 7. Optimal pH and temperature was 5.5 and 50°C for both activities, with long-term thermostability at 25-30°C and pH 5.5. Maximal activities on crude were obtained when Jerusalem artichoke (JA) was used as inducer, attaining 18 and 156 U/ml of inulinase and invertase activities, respectively.

Z. bailii Talf1 was used for bioethanol production through consolidated bioprocessing using JA juice as the only nutrients medium (~130 g/l total hydrolysable sugars), producing 67 g/l of ethanol and attaining the maximum theoretical yield (0.51 g/g hydrolysable sugars). Moreover, the crude enzymatic extract was applied for fossil fuels biodesulfurization. Thus, two renewable agro-materials, sugar beet molasses (SBM) and JA, were exploited as cheaper carbon sources for a cost-effective dibenzothiophene desulfurization process by *Gordonia alkanivorans* strain 1B through simultaneous saccharification and fermentation (SSF) approach. SSF with invertases/ inulinases permitted an increase in 2-hydroxybiphenyl specific production rate of 19.5% from SBM (2.61 to 3.12 $\mu\text{mol g}^{-1}\text{DCW h}^{-1}$) and 64.6% (5.06 to 8.33 $\mu\text{mol g}^{-1}\text{DCW h}^{-1}$) from JA juice in comparison to acidic hydrolysis. These results highlight the potential of Talf1 as a CBP strain towards bioethanol and of its enzymatic crude towards enhanced biodesulfurization.

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PRODUCTION OF POLYHYDROXYALKANOATES BY HALOMONAS BOLIVIENSIS FROM FIRST GENERATION BIOETHANOL STREAMS

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It is expected that bioethanol, or biofuels in general, will be the future substitutes of petrol. Moreover, there is also a necessity to create new biobased products to substitute those produced by the petrochemical industry like plastics or solvents. Polyhydroxyalkanoates (PHA) present similar physical characteristics to the petroleum-derived plastics, nevertheless, they are biobased and biodegradable materials.