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ENZYMATIC ACTIVITY OF FUNGI FOR HYDROLYSIS OF WHEAT BRAN AND CULTIVATION OF OLEAGINOUS YEASTS

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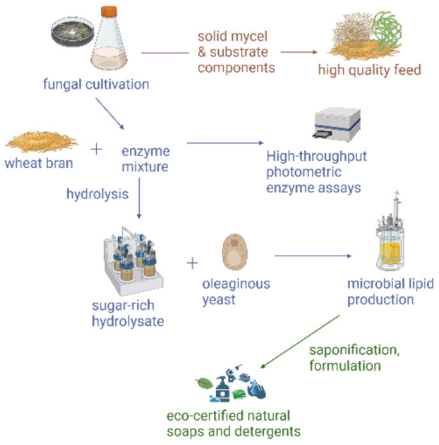
Abstract – Sustainable alternatives to petrochemical raw materials in oleochemical, laundry detergent and personal care industry need to be implemented. Presently, palm oil is the predominant cost-efficient option. While it is a renewable source, it has negative environmental and socioeconomic implications. Therefore, the request for ecologically certified and palm oil-free cleaning agents and household care products is rapidly growing, supported by concepts of waste-free biorefinery. Oleaginous yeasts are currently the most promising source for microbial lipid production. Additionally, wheat bran is a cereal milling by-product, which is available in high quantities and provides an excellent feedstock. Enzymatically generated wheat bran hydrolysate provides an excellent microbial cultivation medium for the sustainable production of high value biological additives. Indeed, wheat bran consists predominantly of lignocellulose, and therefore, of cellulose, hemicellulose and lignin, which can be hydrolyzed by established enzyme systems. Currently, such enzymatic systems are mainly obtained for the market from genetically modified organisms (GMO). This represents a problem because GMO products or process components cannot be included in eco-certified household care formulations. Therefore, innovative GMO-free biotechnological processes need to be implemented, as well as the isolation of novel GMO-free hydrolase enzyme systems. Fungal strains are an interesting source for the efficient screening and isolation GMO-free hydrolases (see the figure). This contribution is part of a project, which aims to use a holistic biotechnological approach to convert mill residues into customized specialty ingredients of eco-certified detergents. The project focuses on three main tasks:



Ideal development of an industrial process producing clean detergents from wheat bran. Created with *BioRender.com*.

1. Investigation of a microbial group of eight Ascomycete fungi.
2. Production of enzymes for hydrolysis of wheat bran.
3. Use of the resulting biomass hydrolysate to cultivate oleaginous yeasts.

Hydrolase producing fungal strains were cultivated on different substrates to investigate their ability to generate specific enzyme systems capable of hydrolyzing wheat bran. The activity of the enzymes was qualitatively and quantitatively characterized to determine the optimal strains for the degradation of wheat bran and suited to implement a large-scale process. Supernatants of different fungal strains cultivations were tested in the hydrolysis step to compare the hydrolysis performances of differently active enzyme mixes. The biomass hydrolysate was used to cultivate lipid generating yeasts to investigate their ability to grow on the microbial cultivation medium.

Keywords – Biomass hydrolysate; cleaning agents; enzymes for hydrolysis; fungal strains; laundry detergents; microbial lipids; oleochemicals; saponification