

Techno-economic evaluation of an integrated biorefinery using dairy and winery by-products for the production of microbial oil

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Wine lees and cheese whey are by-product streams from wineries and dairy industries that could be used for the development of novel biorefinery concepts. This study presents the techno-economic evaluation of novel biorefinery concepts leading to the production of various value-added products such as ethanol, antioxidants, tartaric acid and yeast cells, whey protein concentrate and nutrient-rich fermentation media for the production of microbial oil. Process design and techno-economic evaluation was carried out using appropriate process design software. The discounted cash flow method was employed in order to estimate the minimum selling price (MSP) of selected end-products leading to zero net present value (NPV) at the end of the life cycle of the project.

The MSP of the antioxidants-rich fraction extracted from wine lees was calculated at 122 \$/kg when the utilization of wine lees is 500 kg per hour of plant operation. The MSP was decreased to 11.06 \$/kg in the case that 5000 kg/h of wine lees are processed. The proposed biorefining concept could be applied in the case of wine lees in countries which are producing large quantities of wine lees such as France, Italy and Spain. The yeast cells could be subsequently converted into yeast extract as nutrient supplement in fermentation processes for the production of microbial oil. Lactose from cheese whey could be used as carbon source. At a selling price for microbial oil of 1 \$/kg, the MSP of whey protein concentrate will be 3 \$/kg in the case that the plant produces 10,000 t of microbial oil per year.

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