

Valorisation of underutilised dairy waste residues: production of lactic acid through microbial fermentation

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Annually, approximately 190 million tonnes of liquid waste or co-products is generated by the dairy sector across the globe. These waste streams are nutrient-rich and currently underutilised which gives scope to transform them through microbial fermentation to produce economically valuable products and reduce their negative environmental impact. Such an approach can contribute to the circular bioeconomy by making food production systems more sustainable.

In this study, whey from acid casein hydrolysis (acid whey) and salty whey from Cheddar cheese manufacture were evaluated as feedstocks for production of lactic acid. A total of 466 lactic acid bacteria strains were screened on differential agar for homofermentative production of lactate, which was observed in 263 strains. HPLC quantification revealed a lactate yield of > 18 g/L for 40 of these strains in MRS, with the highest yield (26.48 g/L) observed for *Lacticaseibacillus paracasei* DPC6583. Eleven high-lactate producing strains grew well ($OD_{600} > 1$) in salty whey but lactate yields were substantially lower in salty whey (7.29 g/L) compared to MRS (24.44 g/L) in a controlled batch fermentation. Evaluation of acid whey suggests it is better substrate for growth than salty whey. Higher lactate yield was observed for some strains, such as *L. paracasei* DPC 2021, with a yield of 9.25 g/L lactate in an uncontrolled batch fermentation. LC-MS analysis of acid whey and salty whey fermentates has been conducted revealing other potential high-value end-products.

Harnessing the power of microorganisms is an approach that shows great potential for biotransformation of waste streams and co-products.

Keywords: Biotransformation, dairy waste-stream, lactic acid