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Exopolysaccharides as bio-based rheology modifiers from microalgae produced on dairy industry waste: Towards a circular bioeconomy approach

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ABSTRACT

The feasibility of exopolysaccharides (EPS) production from cheese whey using *Chlorella vulgaris* was investigated as an example of circular bioeconomy application. The effects of dairy waste utilization in EPS biosynthesis and rheological properties were evaluated, comparing with both control conditions and commercial xanthan gum (CXG). A twofold increase in yield, up to 0.32 g L^{-1}, was observed when *Chlorella vulgaris* was used for EPS production from whey rather than conventional fertilizers. Additionally, the EPS produced using cheese whey exhibited superior pseudoplasticity in the 0.4–1.0 (w/v) range compared to the control. The EPS from the whey wastewater contained functional groups similar to those of the 0.4 % CXG. Moreover, the solutions containing 1 % biopolymer showed rheological profiles similar to those of CXG (82.7 %). The molecular weight averages predominantly fell within the range of 284 to 324 kDa, as deduced using diffusion NMR, an innovative and rapid determination method for estimating EPS size. The potential applications of EPS notably extend beyond the dairy industry, reaching diverse market sectors, and thereby enhancing the competitiveness of microalgal biorefineries while contributing to the achievement of Sustainable Development Goals.