Lactic acid unchained: enabling the LA platform with lactic acid production with high selectivity and titer

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The LA (lactic acid) platform is an attractive biorefinery concept whereby organic wastes are converted into high-added value products. The first step is an open-culture fermentation to selectively convert sugar-rich wastes into concentrated LA streams (>40 g/L), followed by its transformation into different industrially relevant products such as bioplastics (i.e. PLA), biochemicals (e.g. medium chain carboxylic acids) or marketable green solvents (e.g. ethyl lactate). As nowadays LA is produced in pure-culture fermentations, we cannot apply the current know-how to develop the LA platform. Thus, our research focused on optimising LA production in mixed-culture fermentations using cheese whey permeate as model waste stream. We evaluated the effect of different operational parameters (temperature, pH and hydraulic retention time) to optimise jointly productivity, yield, concentration and community. Our findings revealed that operating at mildly thermophilic conditions (45°C) resulted in highly selective LA production, and significantly augmented the LA yield and productivity, compared to more typical higher temperatures (50-55°C). Also, circumneutral pH conditions (6.0-6.5) led to an improved performance compared to the conventional acid pH conditions (≤5.5), leading to an unprecedented LA productivity of 27.4 g/L/h (70.0% yield), which is over 2.5 times the previous maximum reported value in a CSTR (Sakarika et al., 2021). The process was composed at all conditions by a very lean microbial community, which underlies its stability. Overall, we showed that LA production with the requirements of a biorefinery scheme is feasible, setting the first stone of the LA platform path.

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