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# OPTIMIZED BIOREACTOR SETUP FOR SCALE-UP STUDIES OF EXTREME HALOPHILIC CULTURES

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## HIGHLIGHTS

- A customized bioreactor for continuous cultivation of halophilic organisms in pilot scale is proposed.
- The bubble column reactor design ensures more energy efficient processing than a conventional stirred tank reactor.
- Cell retention with a tangential flow filter enables high volumetric productivities that exceed the growth rate of the organisms.
- Saline industrial waste streams can be recycled and be used as source for salt in halophilic processing without pretreatment.

## ABSTRACT

Adaptation to highly saline conditions required halophilic organisms to develop unique features. The mounting interest in those features has resulted in a number of potential applications for moderate and extreme halophiles. However, industrial exploitation has been reported only for few instances. With the aim to bring concepts from laboratory to pilot-scale a customized bioreactor for halophilic cultures was developed. The setup combined a bubble column reactor (BCR) with a membrane module for cell retention. The BCR was compared to a conventional stirred tank reactor (STR) in terms of physiological and hydro-dynamical parameters. The results showed that the BCR is preferable in terms of energy efficiency. The BCR reached a maximum  $k_La$  of  $84 \text{ h}^{-1}$  at ambient pressure, which equals an oxygen transfer rate (OTR) of  $6 \text{ mmol}/(\text{L}\cdot\text{h})$  in medium with  $150 \text{ g/L NaCl}$ . To reach this mass transfer a STR required more than 3-fold the amount of energy. Cultivation of the extreme halophilic archaeon *Haloferax mediterranei* showed suitability of the BCR for continuous halophilic processes.

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