



Process Intensification using a Meso-scale Oscillatory Flow Reactor

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Meso-technologies are currently triggering a paradigm change in the design of chemical and biochemical processes. Mass and heat transfer rates can readily be maximised in smaller, sustainable, cheaper and safer plants, whilst virtually reducing the design of (bio) process unit operations to the intrinsic kinetics of the system.

A novel meso-scale reactor running with oscillatory flow mixing was recently developed in the University of Minho in collaboration with the University of Cambridge, UK. The oscillatory meso-reactor (OMR) has shown an outstanding performance for gas-liquid contacting [1] and particles suspension, and a fine control of the residence time distribution due to a superior combination of the internal reactor geometry (OMR is composed of 5 mm internal diameter tube provided with smooth periodic constrictions) and a well-proved mixing technology (i.e. oscillatory flow).

Proof-of-concept experiments were carried out demonstrating the potential of the OMR in the bioprocess intensification. The time scale for the production of γ -decalactone by *Yarrowia lipolytica* in a gas-liquid-liquid system was halved and the yield of biomass on glucose nearly doubled for the aerobic growth of *Saccharomyces cerevisiae* in comparison with parallel trials in an aerated stirred tank fermentor [2].

The OMR is currently finding potential applications in the kg-per-day production of value-added pharmaceutical and biopharmaceuticals. Commercial computational fluid dynamics tools have shown capable of predicting the flow patterns within the OMR, thus being valuable tools in the design of unit operations based on this new technology.

References

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- [2] Reis N, Gonçalves CN, Vicente AA, Teixeira JÁ, "Proof-of-concept of a novel micro-bioreactor for fast development of industrial bioprocesses", *Biotec Bioeng* (2006) **95**(4):744-753.