CHARACTERIZATION OF HOLLOW FIBER MEMBRANE MODULE FOR H_2 TRANSFER IN BIOREACTORS

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Introduction

Greenhouse gases such as CO_2 can be directly used as feedstocks in microbial gaseous fermentations[1]. One of the most attractive and well-studied microorganisms able to grow on CO_2 is *Cupriavidus necator*, which also needs H_2 as a source of reducing power and O_2 as a final electron acceptor[2]. However, the gas mixture of H_2 and O_2 can be explosive and, among the possible ways to tackle this issue[3,4], supplementing hydrogen to the cultivation broth through a membrane is a promising approach, since it allows to keep the gaseous H_2 concentration below the explosive limit[5]. *C. necator* can then use the gaseous substrates to produce value-added products, such as isopropanol[4].

Two membrane modules, a commercial one from PermSelect® and a custom-made one from Polymem, were used to feed H_2 to an autotrophic cultivation of an isopropanol-producing *C. necator* strain, and their performances were compared in terms of biomass growth and isopropanol and acetone production, acetone being the main byproduct of isopropanol production.

Conclusions

In both cases the recirculation through the membrane module didn't impose a too high shear stress to the cells, as shown by the percentage of PI-Non-Permeabilized cells, close to 100%. The PermSelect® membrane allowed to reach a final biomass concentration of 6,26 g/L, and an isopropanol concentration of 1,38 g/L, The Polymem membrane, which had a 10x lower surface but was operated at a 5x higher trans-membrane pressure, achieved a similar final isopropanol concentration, at 1,33 g/L, but higher yields of isopropanol over acetone and over biomass, whose final concentration was 2,85 g/L.

References

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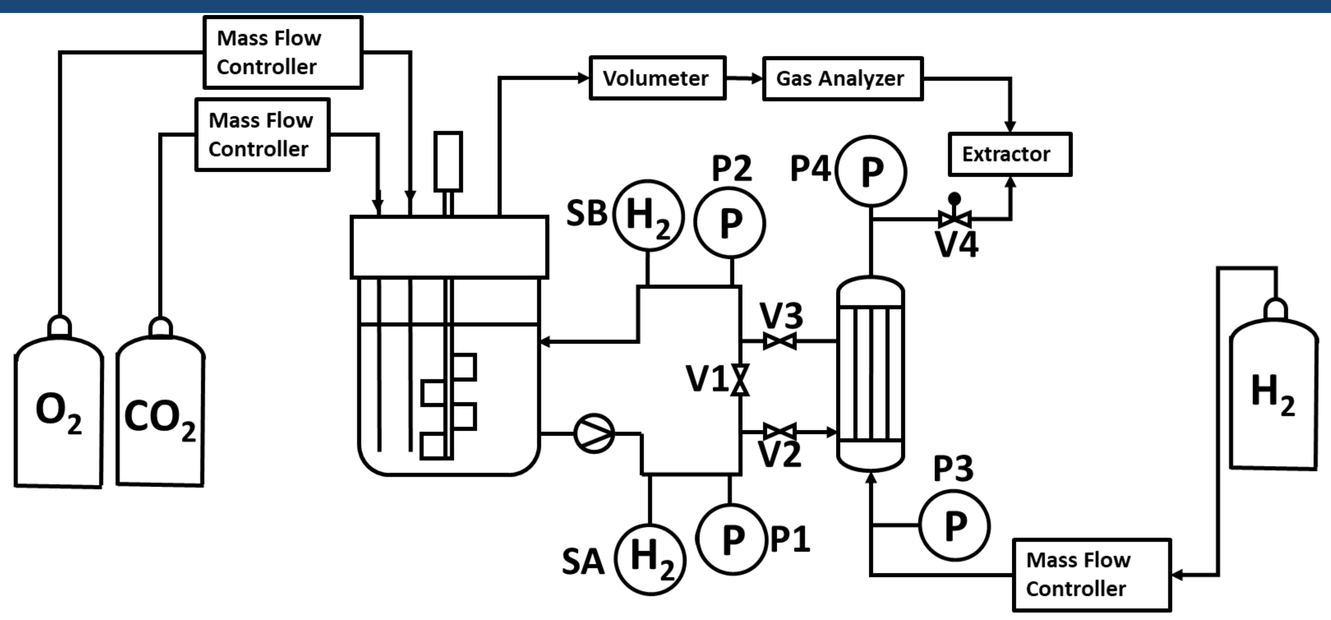
Methods



Results

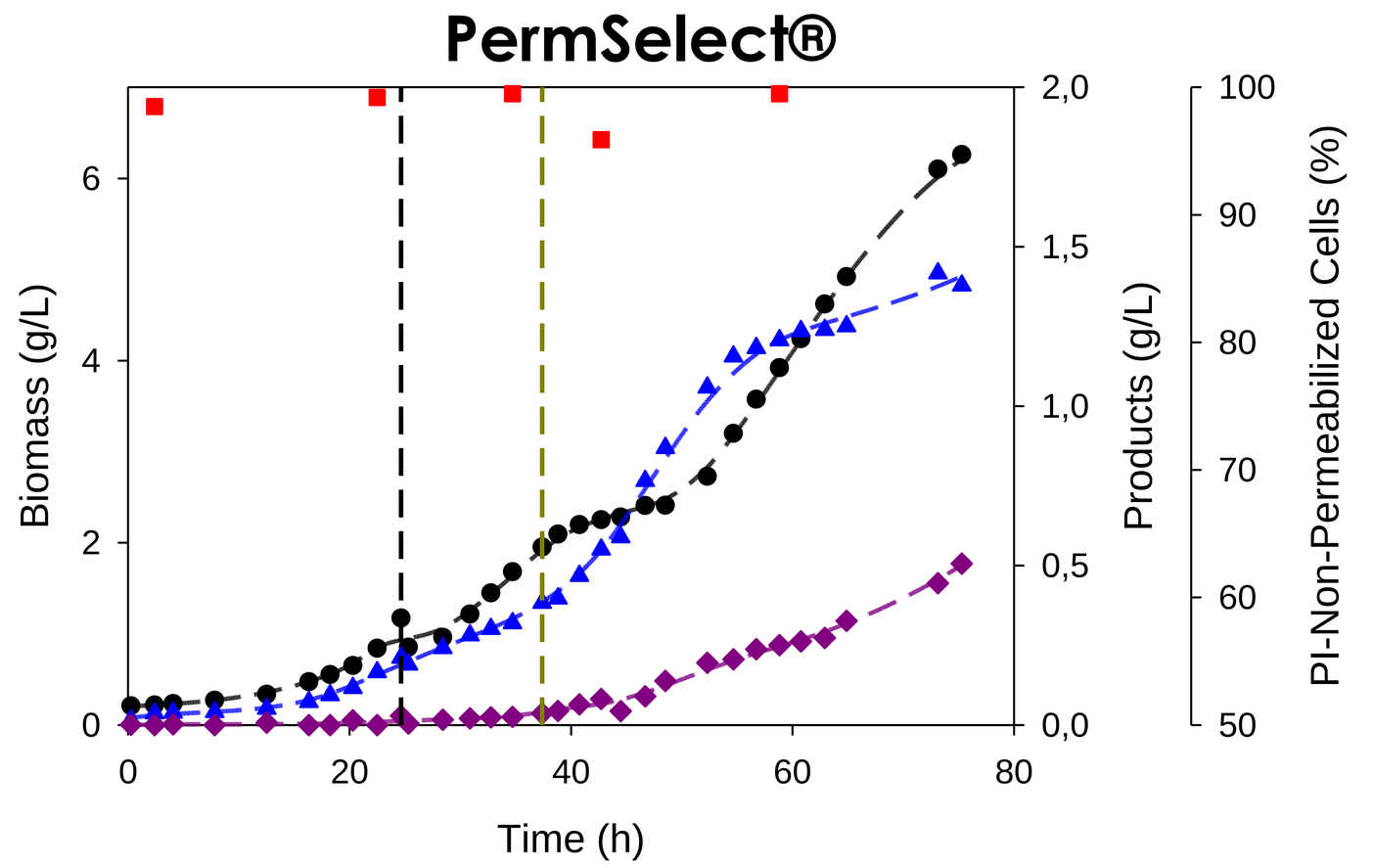


Figure 1: Profiles of biomass concentration (black circles), percentage of PI-Non-Permeabilized cells (red squares), isopropanol concentration (blue triangles) and acetone concentration (purple diamonds) throughout the isopropanol producing cultivation of *C. necator* Re2133/pEG7c with the PermSelect model PDMSXA-2.1. Membrane connection time is indicated with a vertical dotted black line, isopropanol induction time indicated with a vertical yellow line

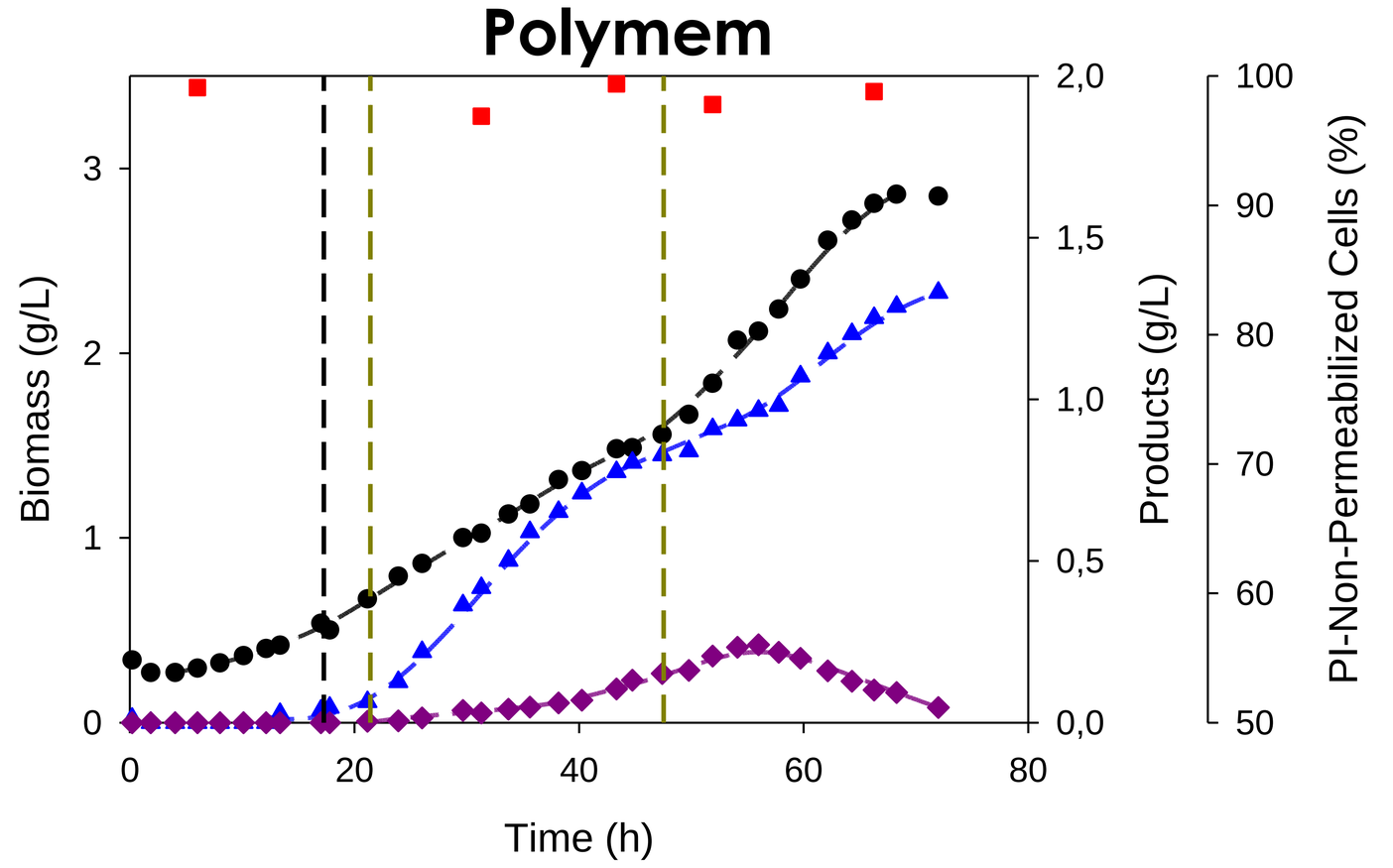


Figure 2: Profiles of biomass concentration (black circles), percentage of PI-Non-Permeabilized cells (red squares), isopropanol concentration (blue triangles) and acetone concentration (purple diamonds) throughout the isopropanol producing cultivation of *C. necator* Re2133/pEG7c with Polymem-produced composite membrane. Membrane connection time is indicated with a vertical dotted black line, isopropanol induction time indicated with a vertical yellow line

ConCO₂rde

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