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## Motivation

Anaerobic treatment of wastewaters offers several advantages over aerobic treatment, including the production of methane that serves as a renewable energy source. However, the retention of slow growing biomass and of the slowly biodegradable wastewater solids (to give them enough time to be biodegraded) can be troublesome [1]. Thus, a good retention system is essential and one of the methods that can be applied for this purpose is a microfiltration membrane.

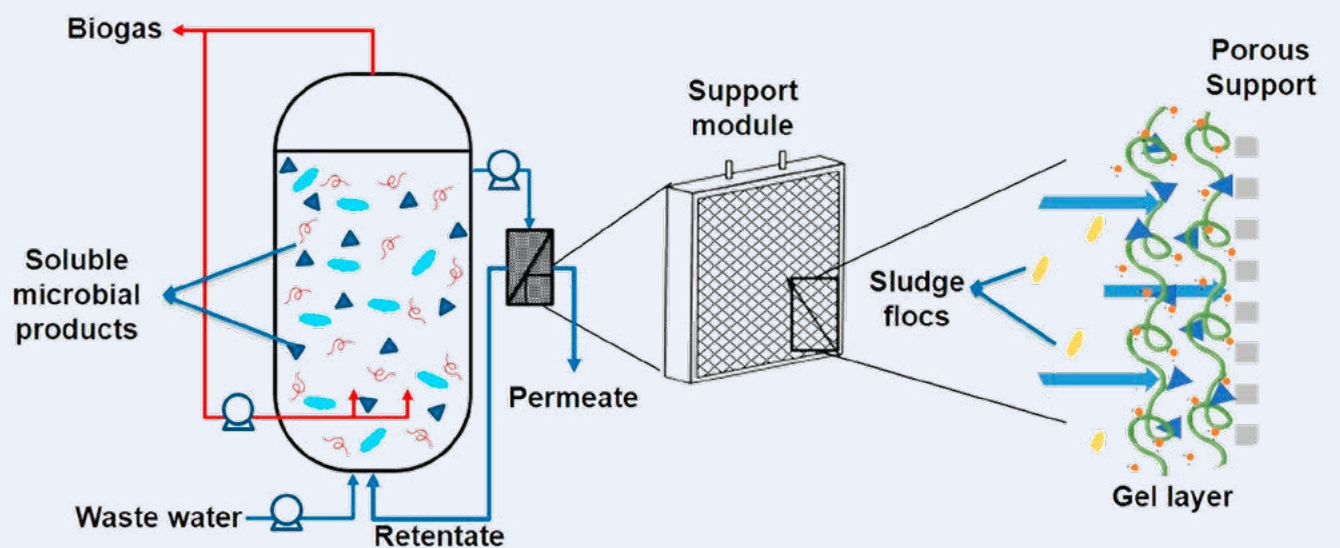


Fig 3. Graphical abstract: Anaerobic bioreactor coupled with a support module where the EPS gel layer is developed

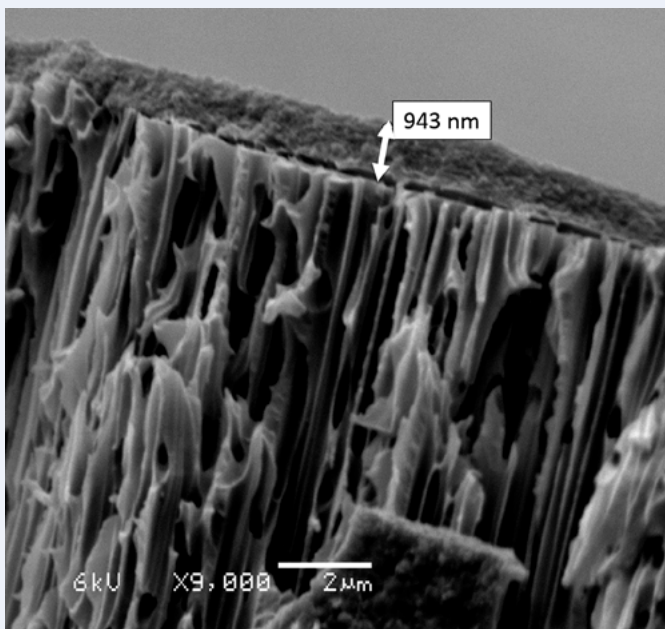


Fig 1. SEM image of the sEPS layer formed on top of a membrane (adapted from Kanwal Shahid)

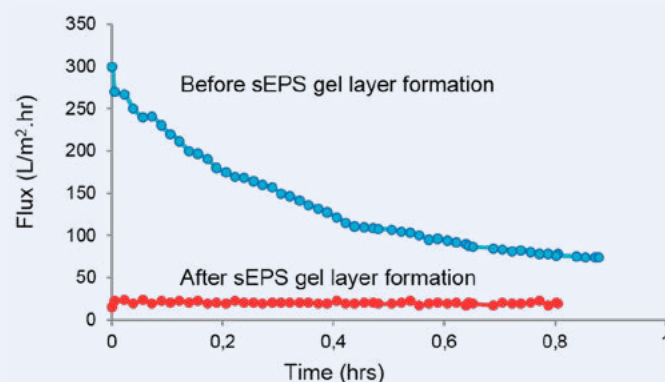


Fig 2. MiliQ water flux profile of polycarbonate (PC) 0.2 μm membrane, applying constant TMP of 0.2 bar in a dead-end mode, before and after the formation of sEPS layer (adapted from Kanwal Shahid)

## Technological challenge

The treatment costs are high because the membranes are expensive and suffer from fouling.

In aerobic membrane bioreactors, a gel layer is formed on the surface of the membrane [2]. This is caused by gelation of extracellular polymeric substances (EPS) such as polysaccharides and proteins excreted by microorganisms. It is generally accepted that this gel layer (Fig 1.) dictates the filtration process, i.e. determines the retention of compounds and the permeability (Fig 2.).

## Research goals

The objective of this project is to create a gel layer of anaerobic EPS on a porous support as a cheap alternative for expensive membranes. This is accompanied by several challenges and research questions:

- Can a suitable gel layer be formed from anaerobic EPS, what is the composition and structure of this gel layer and what is the effect of environmental conditions such as temperature and cation concentrations?
- Under which operational conditions and with what type of porous carrier material is the performance of this layer optimal with respect to solids retention and permeability?
- How can a gel layer be formed in-situ and what is its long-term stability?

[1] Lin, H., et al. "A review on anaerobic membrane bioreactors: Applications, membrane fouling and future perspectives" *Desalination* 314 (2013): 169-188.  
 [2] Van den Brink, P., et al. "Potential of mechanical cleaning of membranes from a membrane bioreactor." *Journal of Membrane Science* 429 (2013): 259-267.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 665874