Feasibility and Viability of Regeneration and Reuse of CIP Chemicals

Yujing Zhao, John Michael Woodley (DTU), Keld Nicolai Jensen (NNE A/S)

Introduction

Cleaning in place (CIP)

- Necessity in pharmaceutical industry
- High consumption of water and chemicals

Circular for Zero Initiative

Global shortage of resources & growing need for sustainable development

Characterization of samples from production facility

The technology and its reproducibility

Regulatory constraints

Process design & business case evaluation

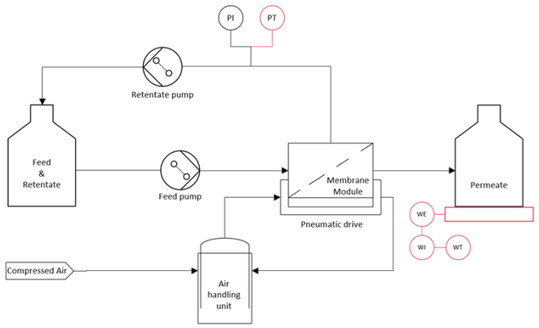
Methods

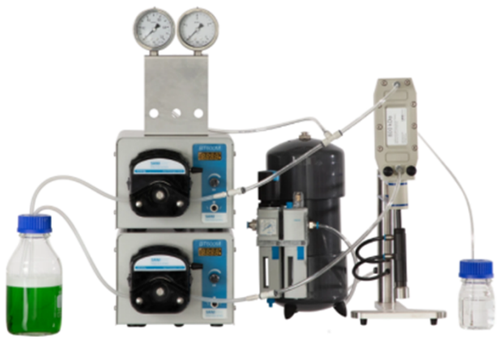
Membrane filtration

- Choice of membrane
- Process parameters

Analytical tests

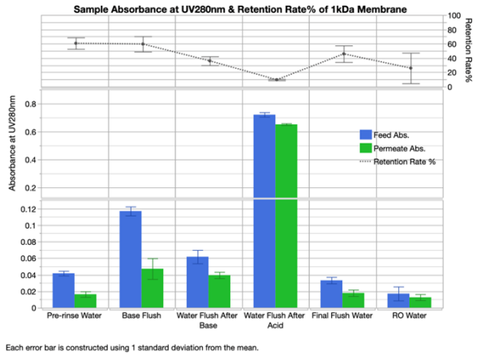
- pH, Conductivity, TOC, UV-spectroscopy, Endotoxin, CFU



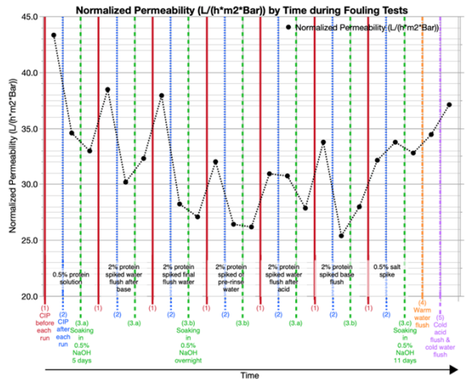


Outcome

Efficient removal of protein residues from the CIP wastes with a stable and acceptable flux level.



Proved cleanability of the membrane after multiple fouling processes.



Perspectives

Further investigation with samples from multiple production facilities & different types of CIP distribution systems

Screening for optimal membrane types

Optimization of process operating parameters

Future investigations to be done at a pilot and/or industrial scale

Potential location of the CIP waste treatment process

Potential end-users of the regenerated water stream

The integration into the water flow of Kalundborg symbiosis