Nutrient Recovery in a Circular Economy using Membrane Technology

Hokyong Shon*

[a] ARC Research Hub in Nutrients in a Circular Economy (ARC NiCE Hub), Centre for Technology in Water and Wastewater, School of Civil and Environmental Engineering, University of Technology Sydney, NSW 2007, Australia

*Corresponding author:

E-mail address: Hokyong.Shon-1@uts.edu.au (H.K. Shon)

Abstract:

Increasing population growth and rapid urbanisation is placing increasing pressure on existing water infrastrucuture and agricultural food productivity to meet future supply and demand. The World Bank predicts that by 2050, the global population will be nine billion, placing a 50% increase in agricultural food productivity and 15% increase in water withdrawals. With these fertilise shortages, there is a strong market driver for bioavailable nutrients through a renewable approach. Decentralising the treatment of our wastes is especially interesting as it has the potential of making an industry, notoriously thirsts in energy, water and raw materials, a net producer. It was also demonstrated that the integration of source-separation of urine, faeces and greywater would help to achieve this goal, while also opening new opportunities for building a more flexible and resilient urban wastewater network. Urine valorisation is attractive due to its low volume, high nitrogen (N) and phosphorus (P) concentrations (80% of N and 50% of P inputs into sewers), and relative ease of collection and storage. As such, it has often proven to be a suitable raw material from the production of fertiliser, energy and water (this last one mainly on board of the International Space Station). However, conventional technologies often struggle in dealing with urine alkalinity, high NH_3 and dissolved organic carbon concentration (i.e. 5 to 10 g.L-1) and high salinity (i.e. 4 to 9%). That is why, the strong chemical resistance, small footprint, tuneable selectivity and versatility in the operation of processes makes them an ideal technology to extract value from human urine. As such, this presentation will cover how to recovery nutrients using membrane technology for economic, commercial, environmental and societal benefits.

Keywords: Resource recovery; urine, wastewater; membrane technology; Circular Economy