Liquid phase urine and faecal odour control using membranes

[1] Edwina Mercer and [1]Ewan McAdam
Corresponding author: Edwina Mercer, e-mail: e.mercer@cranfield.ac.uk

[1] Cranfield Water Science Institute, Cranfield University, Cranfield, UK

Abstract

In order to overcome the global sanitation crisis affecting 2.4 billion people, development has been initiated into safe, decentralised sanitation facilities. Membranes are an emerging technology for decentralised treatment technologies due to their reliability as a separation process providing a barrier to pathogens and other urine contaminants alongside a low footprint requirement. There is therefore potential for water reuse applications from drinking water to washing and watering crops. Although the output water will be sanitised, malodour is a key reason for preventing user willingness to adopt a new technology.

Membrane processes have also been previously used to remove volatile organic compounds (VOCs) from contaminated water, aromatics compounds in the food industry, and to separate alcohols. However, there is limited knowledge on the removal of faecal and urine VOCs. This study compares 5 commercially available membrane materials emcompassing the pervaporation, membrane distillation, and ultrafiltration processes. Performance will be determined on the selectivity of 9 VOC chemical groups typically found in urine and faeces including key malodourous compounds such as ammonia, indole, skatole, butyric acid, isovaleric acid, p-cresol, dimethyl disulfide and dimethyl trisulfide.

Analysis was carried out by initially spiking a synthetic odour solution, then faecally contaminated urine and analysing the liquid phase feed, permeate and retentate using Solid Phase Extraction (SPE) and GCMS. The results demonstrate a tradeoff between membrane selectivity and water permeation rates.The pH of urine will increase over time, causing the acid dissociation to favour more volatile species, thereby increasing odour.