



Nutrient recovery of source-separated urine via forward osmosis and a pilot-scale resource-oriented sanitation system

Yangyu Xu, Lu Zhou*, Qibo Jia

School of Environment, Tsinghua University, Haidian District, Beijing 100084, China, Tel. +86 10 62773079; emails: zhoululu@tsinghua.edu.cn (L. Zhou), xu-yy14@mails.tsinghua.edu.cn (Y. Xu), jiaqibo@mail.tsinghua.edu.cn (Q. Jia)

Received 24 December 2016; Accepted 6 May 2017

ABSTRACT

Urine contains large amounts of nutrients and can be used as fertilizer. However, these nutrients are difficult to eliminate when they infiltrate sewage, and thus become pollutants. A new toilet system using forward osmosis (FO) as the key element was designed to recover resources from human excreta. In this system, FO was used to harvest the nutrients in urine and also could be regarded as a pretreatment for reverse osmosis. In this study, the influence of membrane material, draw solution concentration, flow rate, etc. was investigated for application of FO in urine enrichment. The differences between synthetic urine and natural urine before and after enrichment were compared and analyzed. With pH adjustment, the rejection of N, P, K, and other nutrients in urine was >80%. The results of the pilot-scale toilet system showed high potential for the adoption of FO to recover the nutrients in urine. By integrating this system with other treatment techniques, toilet wastewater will no longer be a burden but rather a resource.

Keywords: Forward osmosis; Source separation; Resource recovery; Sanitation system; Urine

* Corresponding author.

Presented at the 13th IWA Specialized Conference on Small Water and Wastewater Systems & 5th IWA Specialized Conference on Resources-Oriented Sanitation, 14–16 September, 2016, Athens, Greece.