Purification of UF-treated anaerobically digested manure wastewater by two-pass reverse osmosis

Xuejun Guo\textsuperscript{a,b,*}, Xin Jin\textsuperscript{a}

\textsuperscript{a}State Key Laboratory of Water Environment Simulation, School of Environment, Beijing Normal University, Beijing 100875, China
Tel. +86 10 5880 7808; Fax: +86 10 5880 0397; email: guoxj@bnu.edu.cn
\textsuperscript{b}Environmental Technologies, Alberta Research Council Inc., Vegreville, Alberta T9C 1T4, Canada

Received 18 July 2012; Accepted 9 April 2013

ABSTRACT

Membrane technology provides a potential promise towards manure treatment as well as nutrients concentration and recovery in the livestock industry. A two-pass reverse osmosis (RO) system was described in this study for the purification of UF-treated anaerobically digested manure wastewater (ADMW) with respect to permeate flux, ionic rejection, permeate quality, and membrane cleaning. The permeate flux fluctuated at 26.6–33.4 and 73.7–91.2 L m\textsuperscript{-2} h\textsuperscript{-1} for the first- and second-pass RO processing, respectively, at operating pressure of 1,500 kPa in the temperature range of 24–34\textdegree C. The overall rejections of both Na\textsuperscript{+} and K\textsuperscript{+} by the two-pass RO were greater than 99\%, whereas in case of ammonia, it was approximately 88\%. The significant presence of molecular NH\textsubscript{3} at relatively high pH in ADMW solution probably induced a lower rejection of total ammonium, which also largely led to the low rejection of alkalinity and further pH increase in the RO permeate. The two-pass RO treatment afforded a complete rejection of Cl\textsuperscript{−}. The overall rejections of dissolved solids (DS) were estimated to be 94\% with the first-pass RO and 98.8\% after the two-pass RO resulting in product water containing only 45 mg/L of DS. Chemical cleaning of used membrane was successfully performed by successive flush of specific acid and base cleaning agents.

Keywords: Anaerobically-digested manure wastewater; Reverse osmosis; Ammonia; Purification

*Corresponding author.

1944-3994/1944-3986 © 2013 Balaban Desalination Publications. All rights reserved.