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ON THE DEVELOPMENT OF A FORWARD OSMOSIS/BIO-ELECTROCHEMICAL SYSTEM FOR ENERGY RECOVERY AND WATER RCLAMATION.

Abstract

Due to the high cost of delivering supplies to space, the recovery of potable water from spacecraft wastewater is critical for life support of crewmembers in long-term missions. It is estimated that in future long term space missions, human wastes such as urine will contribute more than 50% of the total waste. Thus, in this research, we explore the concept of recycling wastewater while reusing unused components, such as urea contained in urine. A bio-electrochemical system composed of a urea bioreactor (GAC-urease) and an electrochemical cell (UBE) was designed for the purpose of this project. Also, a water reclamation system containing a forward osmosis (FO) subsystems is employed to interface both systems together (FO-UBE). A major disadvantage of the FO system is that urea tends to be poorly rejected by FO membranes. Therefore, in order to eliminate such drawback UBE is interfaced along with the FO subsystem to harvest urea while generating power in the same process. The results of this research showed the feasibility of interfacing water reclamation and bio-electrochemical strategies to achieve water recycling while obtaining useful resources. The FO-UBE system here presented has an overall efficiency ¿80.0% for the removal of organic carbons. Also, the urea recovery with the urea bioreactor system was shown to be around 86%. Therefore, the concept herein proposed has the potential to be used in water recycling applications with emphasis in contaminant recovery from wastewater for useful resources and energy.