System and Method for Flexible Low-Energy Membrane-Based Liquid Purification

Tech ID: 29517 / UC Case 2016-871-0

CONTACT

UCLA Technology Development Group
ncd@tdg.ucla.edu
tel: 310.794.0558.

INVENTORS

- Cohen, Yoram

OTHER INFORMATION

KEYWORDS

Water desalination, product water recovery, Low energy, membrane based separations, liquid purification, reverse osmosis, stead-state operation, water sustainability, membrane technologies

CATEGORIZED AS

- **Computer**
  - Software
- **Environment**
  - Other
  - Remediation
- **Sensors & Instrumentation**
  - Other
- **Engineering**
  - Other

RELATED CASES

2016-871-0

SUMMARY

UCLA researchers in the Department of Chemical and Biomolecular Engineering have developed a platform and method for membrane-based water purification and desalination that combines operational flexibility with energy efficiency, allowing effective treatment and desalination of raw feed water over a wider range of solute concentrations and product recovery.

BACKGROUND

Membrane technologies play a significant role in water and energy sustainability. Current membrane technologies that are used in industries at scale include desalination of seawater and brackish water by reverse osmosis (RO), as well as water purification and wastewater treatment by ultrafiltration, nanofiltration and RO membranes. However, there lies a challenge in achieving optimal performance of a number of properties within in a single platform. These include a wide range of product water recovery levels, integration of energy-optimal and operational flexibilities that will allow self-adaptive regulation of system product water recovery, and on-demand switching between steady state (*i.e.*, continuous) and cyclic unsteady-state model of operation without requiring stoppage of water production. Therefore, there is an urgent unmet need for a single-platform membrane-based liquid purification system that performs with high operational flexibility and energy efficiency.

INNOVATION

The inventors have developed a single-system platform and method that combines flexible and low-energy membrane-based liquid purification. To achieve this, the system is decoupled into separate but connected process units for liquid purification (via a membrane process unit) and for flow regulation, using a concentrate recycle unit for control of overall system product water recovery. This platform has been applied to reverse osmosis to devise a Flexible Low-Energy Reverse Osmosis (FLERO) system and method. The system can be operated in either cyclic unsteady-state mode or steady-state mode.

APPLICATIONS

- Liquid purification
- Ultrafiltration
- Nanofiltration

ADVANTAGES

- Effective operation within the membrane array design limits
- High energy efficiency
- Energy-optimal operation of process components
- Includes methods for flow regulation
- Instrumentation for system monitoring and control

STATE OF DEVELOPMENT

The inventors have developed a FLERO prototype and designed and implemented algorithms and software for its use. Operations in steady-state and cyclic unsteady-state modes have been demonstrated both in laboratory and in the field (seawater and groundwater desalination and water purification).

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,569,222	02/25/2020	2016-871

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- A Novel Ex-situ Scale Observation Detector (exsod) for Mineral Scale Characterization and Online RO Process Monitoring
- Self-Adaptive Control And Optimization Of Ultrafiltration
- Fouling and Scaling Resistant Surface Nano-Structured Membranes

UCLA Technology Development Group

10889 Wilshire Blvd., Suite 920,Los Angeles,CA 90095

tdg.ucla.edu

Tel: 310.794.0558 | Fax: 310.794.0638 | ncd@tdg.ucla.edu