10-9-2019

Produced Water

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Energy-Water Desalination Hub
DOE Water Challenge Prize

- Low Cost, Efficient Treatment Technologies for Produced Water
  - DOE is focused on treatment technologies to remove those constituents that complicate the use of current or future desalination technologies
- Chevron Technology Ventures, which launched a contest seeking cost-effective solutions for managing produced water from oil and gas operations;
Fossil Energy

NETL Water Crosscut Program

- Advanced Cooling Technology
- Non-traditional Water Use
- Water Treatment and Detection
- Technology
- Decision Science and Modeling

Water Availability

Source: Tidwell et al. 2014
Next Generation Desalination Membranes

Developed biomimetic-based (kidney-like) reverse osmosis (RO) membrane with 5 times higher permeate flow per unit of pressure than traditional RO membranes (RD100).

Also developing bio-based electrodialysis membranes.

https://www.youtube.com/watch?v=11RQ3N9uH1w

Developing laminar graphene oxide (GO) membranes, whose structure is ideal for water desalination. Structure is chemically tolerant to 1-ppm, one month, free chlorine exposure, as well as hydrocarbons (ie: toluene, oils)

Developed and tested reverse osmosis membranes with integrated antimicrobial peptide mimics to reduce biofouling.
Selective Ion Removal to Enhance Desalination

Recent Projects:

- Impaired Water Reuse in Power Plant Cooling (Nenoff LDRD)
- pH control/scale prevention in Power Plant Cooling (Brady and Krumhansl, US Patent 9140145)
- Advanced coagulation for Oil Sands Water Recycling (Brady et al., WFO)
- Carbon Mineralization for Climate Change (Columbia/Sandia ARPA-E).

SiO$_2^{aq}$ concentration in some waters:
- Los Alamos tap water, 88 ppm; Cooling tower, 123 ppm; El Paso desal conc. 148 ppm;
- Canada Oil Sands, 239 ppm; Geothermal (Wairakei, Ohnuma), 520-560 ppm
Desalination Technology Large-scale Demonstration and Evaluation

Coal Bed Methane produced water treatment for rangeland rehabilitation, Bloomfield NM
In cooperation with Bureau of Land Management, Los Alamos National Laboratory, NM Oil Conservation Division, New Mexico Agriculture Department, and New Mexico State Laboratory

Laboratory and pilot-scale testing of Zero Discharge Desalination (ZDD) at BGNDRF with 97% water recovery - technology license purchased by Veolia
Decadal-scale barrier island migration and tundra bluff erosion

Source: UAF et al. 2019