REDOX ELECTROLYTIC FUEL CELL FOR DESALINATION COUPLED WASTEWATER TREATMENT AND METHODS THEREOF

IITM Technology Available for Licensing

Problem Statement

- In the present era, it is utmost important to save water and reuse wastewater to overcome the water scarcity.
- Owing to limited access to freshwater resources, desalination is widely practiced as an alternate source of portable water.
- There have been discussed a few non-patent and patent literatures regarding desalination techniques for wastewater treatment.
- The prior arts techniques required huge cost and need external power as input for proper desalination and tedious process to remove metal contaminated wastewater.
- The prior art literatures has failed to disclose the solution as described in the present invention which address above issues efficiently.

Technology Category/ Market

Chemical Engineering: Electrochemical cell;
Industry: Wastewater treatment plant, Clean Energy, Test Equipment, Automotive, Advanced material.
Applications: Fuel cell or batteries, Serve as a source of clean environment with power production from various water bodies in several remote location, wastewater treatment plant.
Market: The global water **electrochemical cell** market is projected to reach US$**1252.00** million by the end of **2027**, at a **CAGR** of **25.05%** during forecast period of **2021** to **2027.**

Technology

- Present Patent describes **a fuel cell, and electrochemical method using redox species for simultaneous wastewater treatment and desalination.**
- Further, said patent does not require any external energy to be supplied as input.
- Said Patent talks about a electrochemical fuel cell which comprises a plurality of chambers:

1. **1st chamber filled with nitrogenous waste wherein anode is submerged in the nitrogenous waste; (Anode is nickel foam), wherein 1st chamber responsible for organic electrooxidation and electric production;**
2. **2nd chamber filled with brine, & the 3rd chamber (cathode chamber) filled with Cr(VI). Cathode chamber for Cr(VI) reduction; & middle chamber for desalination (cathode is catalyst free carbon brush).**
3. **Cow Urine/urea is chosen as anolyte which leads to organic oxidation at anode & inorganic reduction in terms of Cr(VI) reduction at cathode, which further leads to the redox reaction simultaneously.**

- The process leads to the nitrogenous waste (urea/cow urine) oxidation and reduction of Cr(VI) along with desalination in a redox cell.

Intellectual Property

IITM IDF Ref. 1655;
IN Patent No. 354452 (Granted)

TRL (Technology Readiness Level)

TRL- 3/4, Proof of concept ready, tested and validated in laboratory.

Research Lab

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Key Features / Value Proposition

❖ ***Technical Perspective:***

1. An electrochemical fuel cell compact in size, used for reduction of Cr(VI) to Cr(III) from wastewater.
2. Said cell generates power from contaminated wastewater.

❖ ***Industrial Perspective:***

1. Power production from the electrochemical cell and this technology is a standalone process or can be suitably combined with conventional reverse osmosis to save on cost.
2. Industrial usage for chromium reduction, desalination, wastewater treatment, urea oxidation.

Images

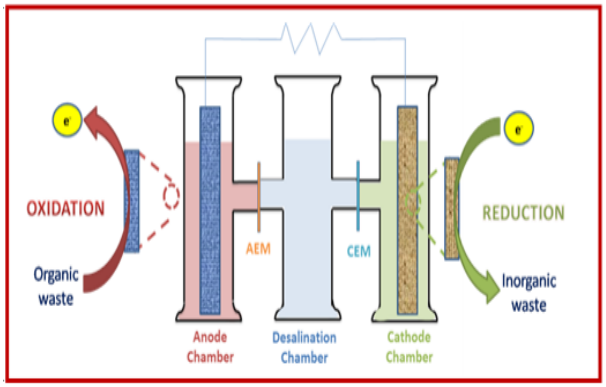
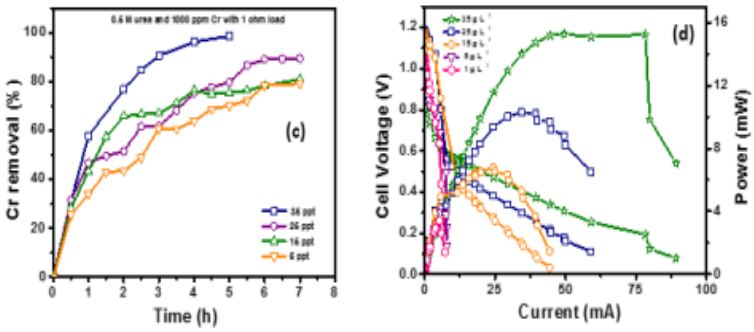
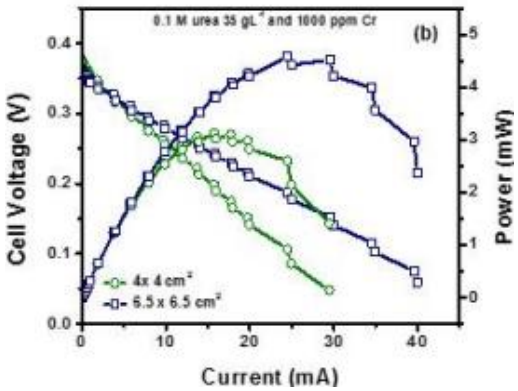
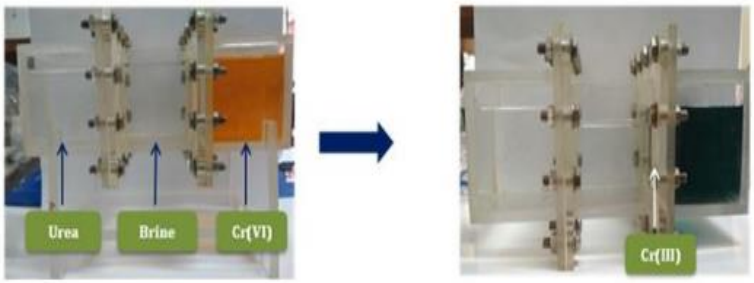


FIG.1: Illustrates the schematic of electrochemical cell.



FIGs.2A & 2B: Illustrate Cr(VI) reduction on carbon brush cathode at different brine concentration, and P_{max} of different brine concentrations (35 gL^{-1} to 1 gL^{-1}) of ECDC with 0.5 M urea and 1000 ppm Cr as optimized condition





FIGs.3A & 3B: P_{max} curve with 0.1M urea, 35 gL^{-1} brine and 1000ppm Cr(VI). Image showing the color change of Cr(VI) from dark yellowish-orange to green.

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