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# Non-Confidential Description - PSU No. 3523
# "Water Desalination Using Bioelectrochemical Systems"

**Keywords:**

bacterial solutions, water purification, bioelectrochemical systems, microbial electrolysis cells

**Links:**

Inventor Website
Related Article

**Inventor:**

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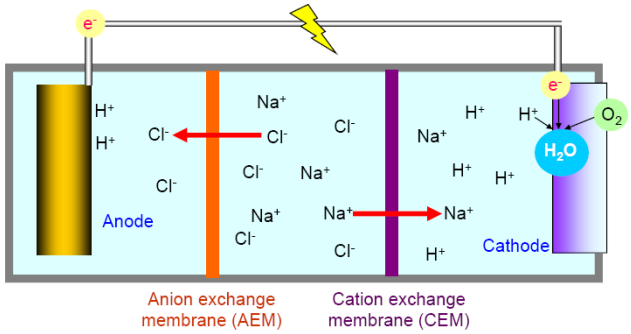


**Fig. 1 Three-chamber MDC used for desalination tests**

## Background

Electrodialysis is a well-known process for desalinating water. During the procedure, water is introduced between two membranes: an anion exchange membrane and a cation exchange membrane (or a series of membranes—as in Fig. 1). When electrical potential is applied to the electrodes, the anions migrate to the anode through the anion exchange membrane, but the cations do not pass through. Instead, the cations diffuse toward the cathode, maintaining charge balance, and as a result the water between the electrodes is desalinated. This process is generally regarded as being competitive with reverse osmosis and multistage flash evaporation for salt concentrations below 5000 ppm.

## Invention Description

The disclosed invention is a novel method for desalinating water using bioelectrochemical systems (BES). During this process, salt is removed from the water by using principles involved in creating hydrogen gas from microbial electrolysis cells (MECs) and generating electricity from microbial fuel cells (MFCs). In BES, electrical currents are stimulated by bacterial proliferation on an anode using a source of organic or inorganic matter for growth. The disclosed device contains two (or more) membranes used to desalinate the water. In one configuration of this BES, potential is added to that produced by the bacteria between the two electrodes. Anions pass to the anode through the anion exchange membrane (AEM) and cations pass through the cation exchange membrane (CEM), resulting in efficient water purification.

## Advantages / Applications

- Differs from electrodialysis in that energy can be supplied by substrate in the water, resulting in a reduced energy requirement
- When wastewater is used as a "draw" for the solution (i.e. in either the anode or cathode chamber) there is an additional reduction in salinity due to the osmotic pressure difference between the cells
- Rate of desalination can be controlled by setting potentials and current

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