MIcrobial DESalination for Low Energy Drinking Water

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BACKGROUND

Water desalination has become a technologically and economically viable solution to tackle increasing water shortages in many regions of the world. As shown in **Fig. 1**, the desalination market is mostly dominated by reverse osmosis (RO). However, high energy costs of RO continue to be a major concern, with energy consumption accounting for 75% of the desalination operating costs. This energy cost for desalination is about 10 times higher than for conventional water sources, that can easily exceed 0.5 €/m^3.

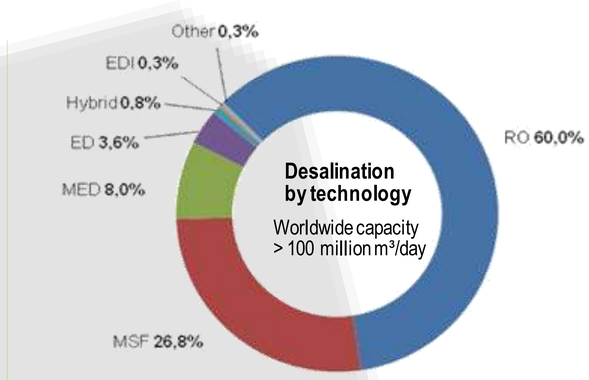


Fig 1. *Total worldwide installed desalination capacity by technology*

MICROBIAL DESALINATION CELLS (MDC)

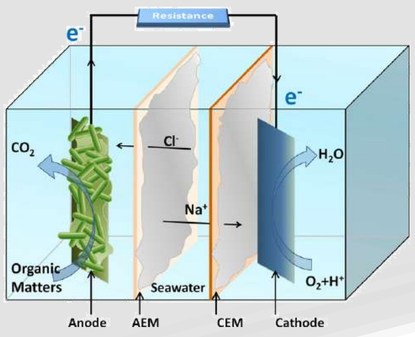


Fig 2. *MDC cell scheme*

Recently, a new technology called a microbial desalination cell (MDC) was shown to desalinate water without the use of any external electrical power. Electrical energy produced directly by the degradation of organic matter in water by bacteria was used to power desalination. Derived from microbial fuel cells (MFCs), MDC uses electric current generated from the microbial metabolism of organic compounds to drive desalination (see **Fig. 2**).
The advantages of an MDC include less external energy for the desalination process and simultaneous waste water treatment. Moreover, MDC operates under neutral pH, atmospheric pressure and ambient temperature.

MIDES TECHNOLOGY

The **MIDES** project will focus on overcoming current limitations such as low desalination rate, high manufacturing cost, biofouling and scaling, optimization of the microbial-electrochemical process, integration with RO, pre-treatment, system scale up and economic feasibility of the technology (see **Fig. 3**).

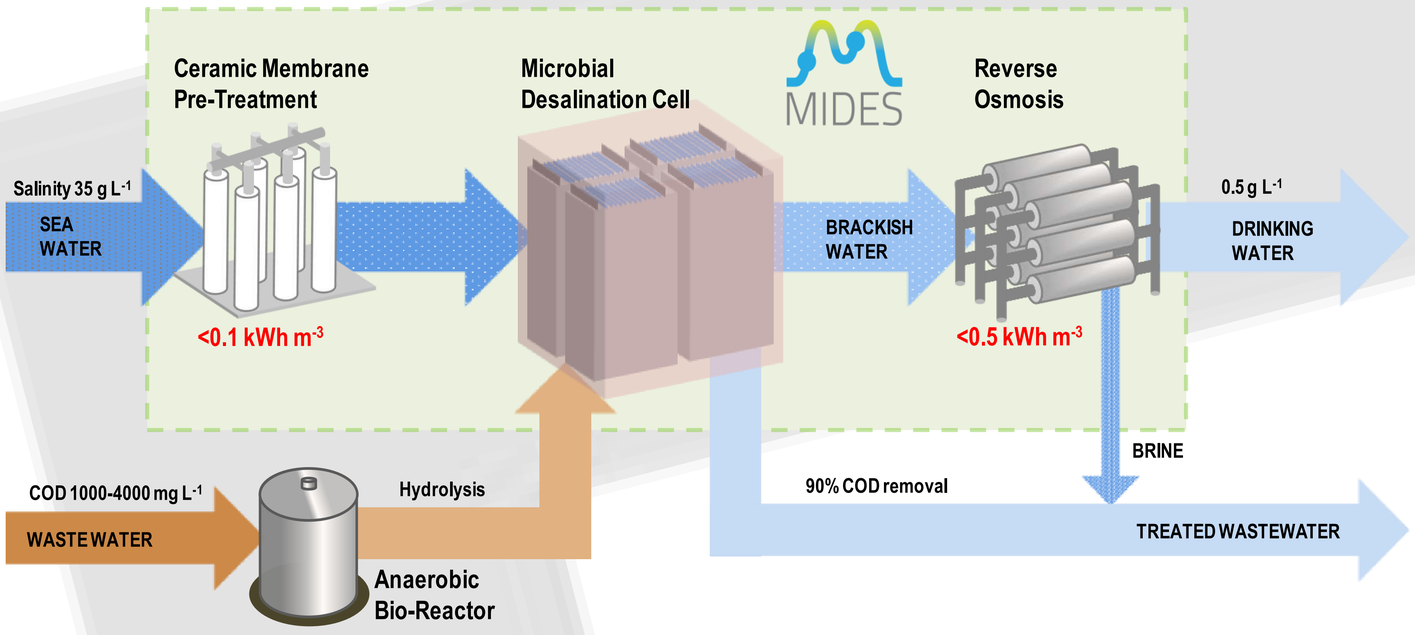


Fig 3. *MIDES technological concept*

It is predicted that in MDC salt content of seawater will decrease from 35 to 5 g/L, while the further salinity reduction to achieve drinking water quality will be performed by RO. Bioelectricity produced by MDC (3kWh/m^3) will be directly employed to diminish to 0.5 kWh/m^3 (**Fig. 4**)

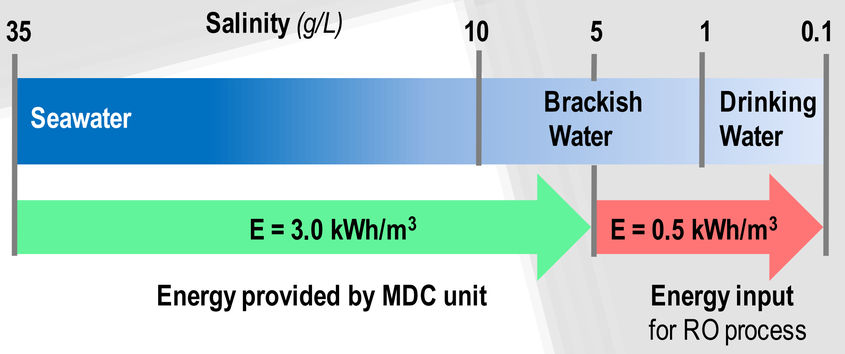
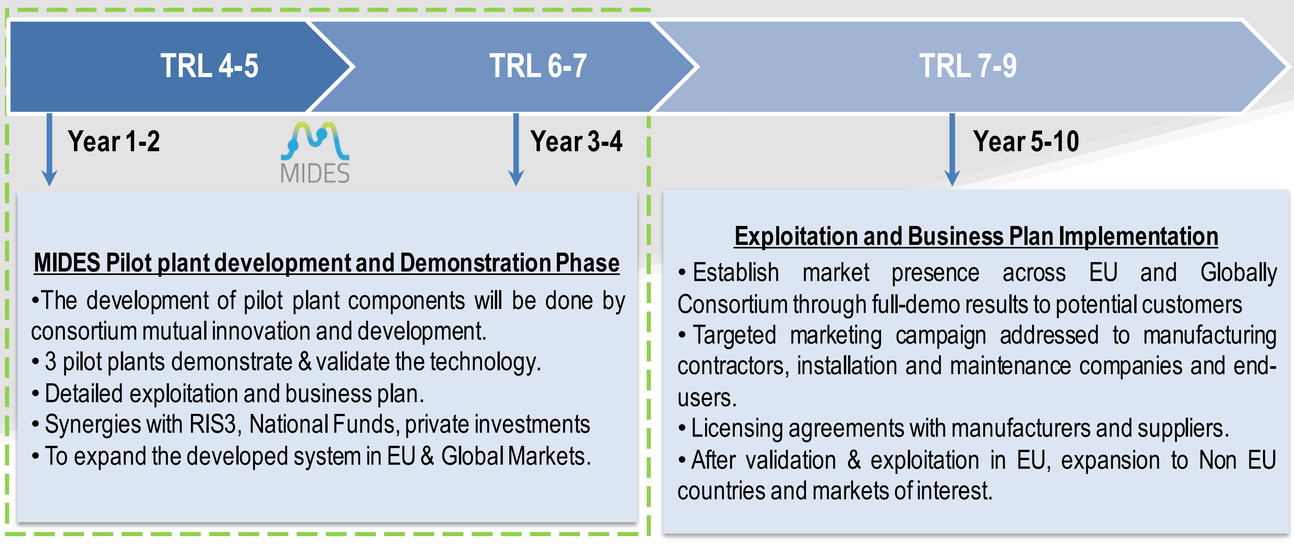


Fig 4. *Energy concept for MDC-RO integration*

The World's largest demonstrations of an innovative and low-energy technology for drinking water production using MDC technology will be achieved via: innovation in **nano-structured electrodes**; **antifouling membranes**; **electrochemical reactor design and optimization**; **microbial electrochemistry** and **physiology** expertise; and **process engineering and control** (e.g. optimized pre- and post-treatment).

EXPLOITATION AND DISSEMINATION PLAN



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