Desalination for the Environment, Clean Water and Energy
Cyprus, 11-15 May 2014

CFD PREDICTION OF SCALAR TRANPORT IN THIN CHANNELS FOR REVERSE ELECTRODIALYSIS

A. Tamburini[a], G. La Barbera[a], A. Cipollina[a], G. Micale[a]*, M. Ciofalo[b]

[a] *Dipartimento di Ingegneria Chimica, Gestionale, Informatica, Meccanica*

[b] *Dipartimento Energia, Ingegneria dell'Informazione e Modelli Matematici*

Università di Palermo, Viale delle Scienze Ed. 6, 90128 Palermo (ITALY);

* Corresponding author: giorgiod.maria.micale@unipa.it

Abstract. Reverse ElectroDialysis (RED) is a very promising technology allowing to directly converting the electrochemical potential difference of a salinity gradient into electric energy. The fluid dynamics optimization of the thin channels to be devoted for the RED process is still an open problem. The present preliminary work focuses on the Computational Fluid Dynamics (CFD) simulation of the flow and concentration fields in these channels. In particular three different configurations were investigated: a channel unprovided with a spacer and two different spacer (made of either overlapped filaments or woven filaments) filled channels. Two passive scalars were transported along with the water in order to evaluate the polarization phenomena. Grid topology and computational domain effects were also addressed.

Results show that: (i) the grid topology affects the concentration boundary layer; (ii) the adoption of a small computational domain along with periodic boundary conditions provide the same flow field obtained with a wider domain; (iii) the woven spacer filled channel is the best compromise between pressure drops and concentration polarization.

Future works will address the inclusion of electrical effects along with the migrative transport of the ions in the channel.