Modification of heterogeneous membrane Ralex by the fibres

D. Nedela, J. Krivcik, J. Hadrava
Membrain s.r.o., Pod Vinici 87, 471 27 Straz pod Ralskem, http://www.membrain.cz

Introduction

Heterogeneous ion-exchange membrane RALEX (Figure 1) is used in the desalinization stacks of Mega company. Main idea of the presented work is modify a surface of the membranes by functionalized nanofibres (FNF) to improve its transport properties. Nanofibres were prepared and functionalized by Elmarco company. Two types of functionalized nanofibres cation-exchange and anion-exchange were prepared. This material was fixed on membrane surface of membrane by pressing at higher temperature. The cation-exchage nanofibres ware fixed on one side of membrane CM-PES and anion-exchange nanofibres were fixed to one side of membrane AM-PES (Figure 2). The properties of modified membranes were copared with standard membranes Ralex (Tab. 1).
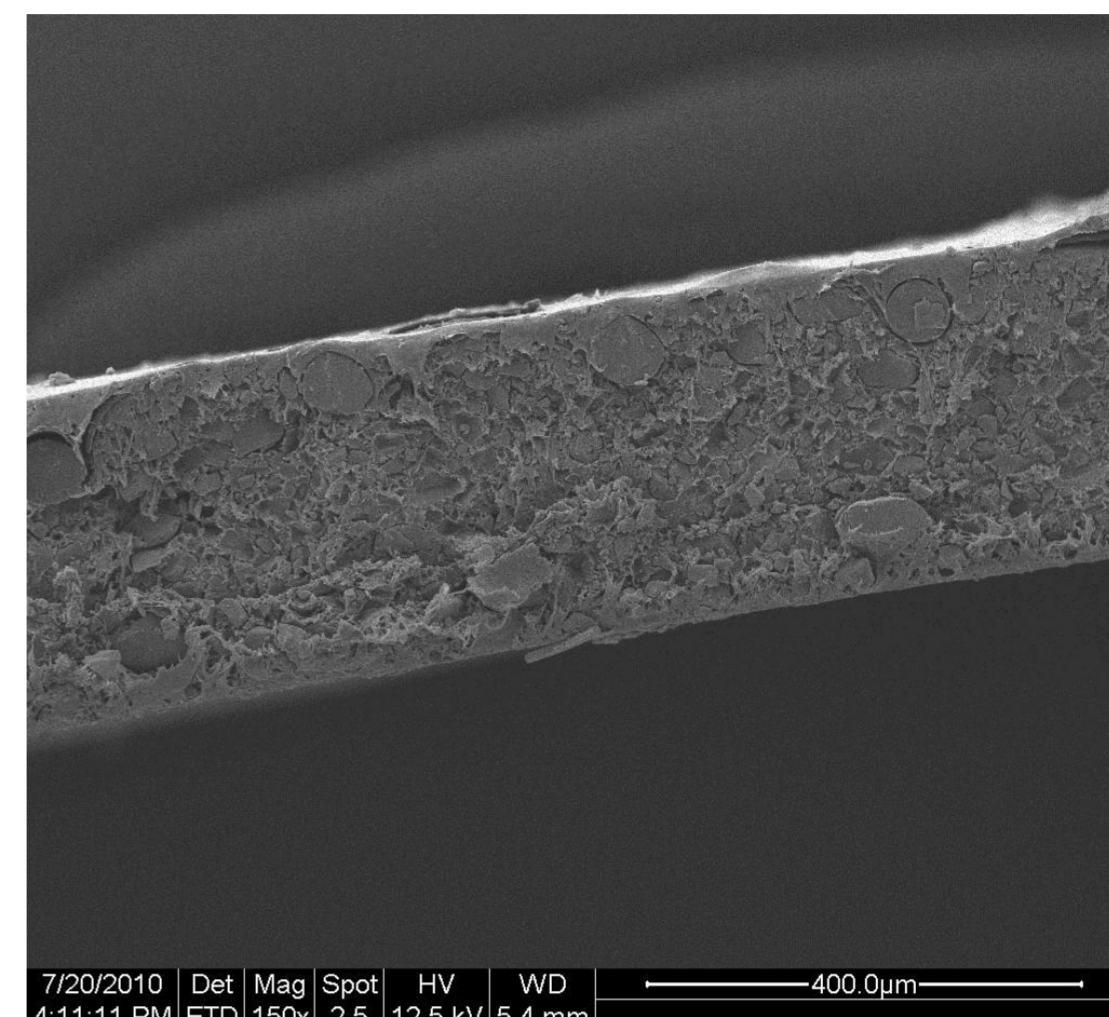

Figure 1: Membrane RALEX

Test of desalinization

The modified membranes and membranes Ralex were placed in an electrodialysis stack. The nanofibres layer was only on one side of membrane. The nanofibres layer was placed to the diluate chamber at first (FNF-D) and than it was placed to concentrate chamber (FNF-K). Every test was repeated.
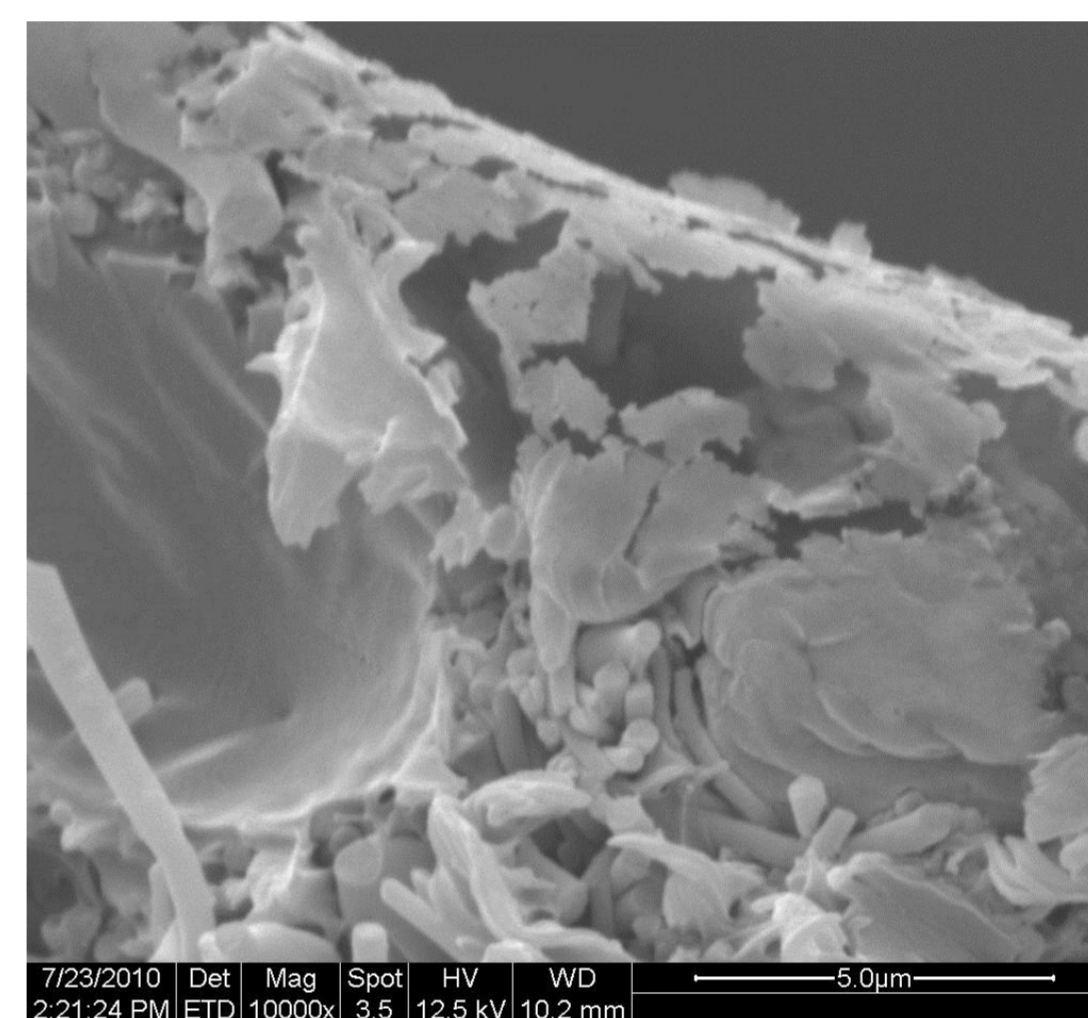
Parameters of test

- Electrodialysis stack EDR-Z/10-1.0
- Number of membrane pair 10
- Voltage 1V/pair
- Desalinated solution Na_2SO_4 (20 g/l)
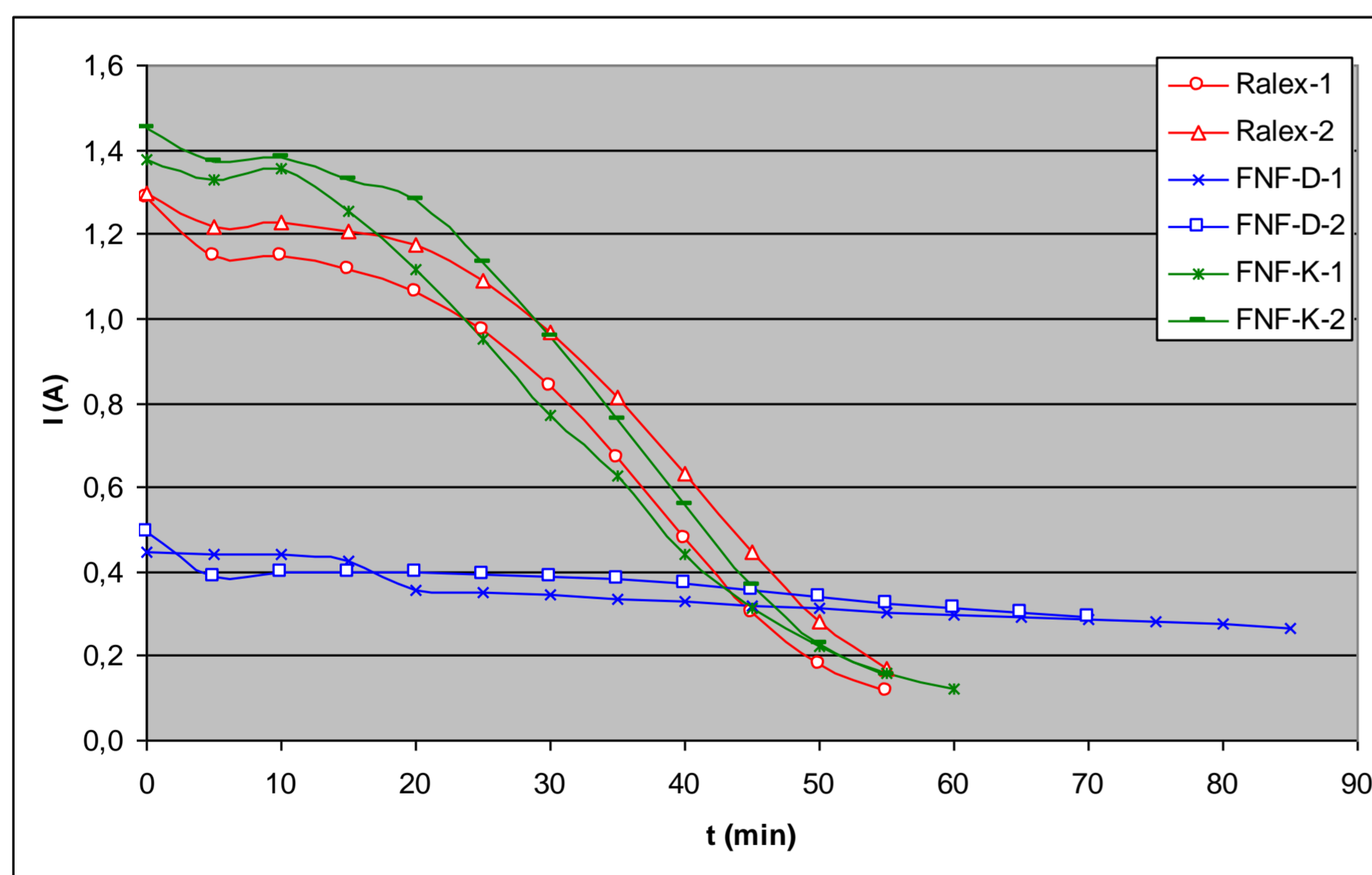- Solution flow rate C,D 70 l/h, E 50 l/h

Figure 2: Membrane with nanofibres

Figure 3: Current during desalination

Type of membrane			**4**	**6**	**10**	**12**
			CM	CM	AM	AM
			11-62-10	11-62-10	11-60-10	11-60-10
			FNF	RALEX	FNF	RALEX
PHYSICAL PROPERTIES						
thickness of dry m.		tl_s[mm]	0,455	0,422	0,438	0,436
thickness of wet m.		tl_z[mm]	0,654	0,653	0,572	0,614
Swelling changes Δ (%)	thickness	Δ tl	43,8	54,5	30,6	40,8
	length	Δ d	3,00	2,54	4,57	4,08
	width	Δ š	5,10	3,09	14,95	3,06
	weight	Δ m	61,30	60,20	25,00	53,10
ELEKTROCHEMICAL PROPERTIES						
R_A [Ωcm^2] (0,5 M NaCl)			4,41	6,85	4,97	7,36
R_S [Ωcm] (0,5 M NaCl)			72,9	104,8	83,9	118,8
t (0,5/0,1M KCl)			0,972	0,968	0,957	0,960
P [%] (0,5/0,1M KCl)			94,4	93,6	91,4	92,1

Tab. 1: Properties of membranes

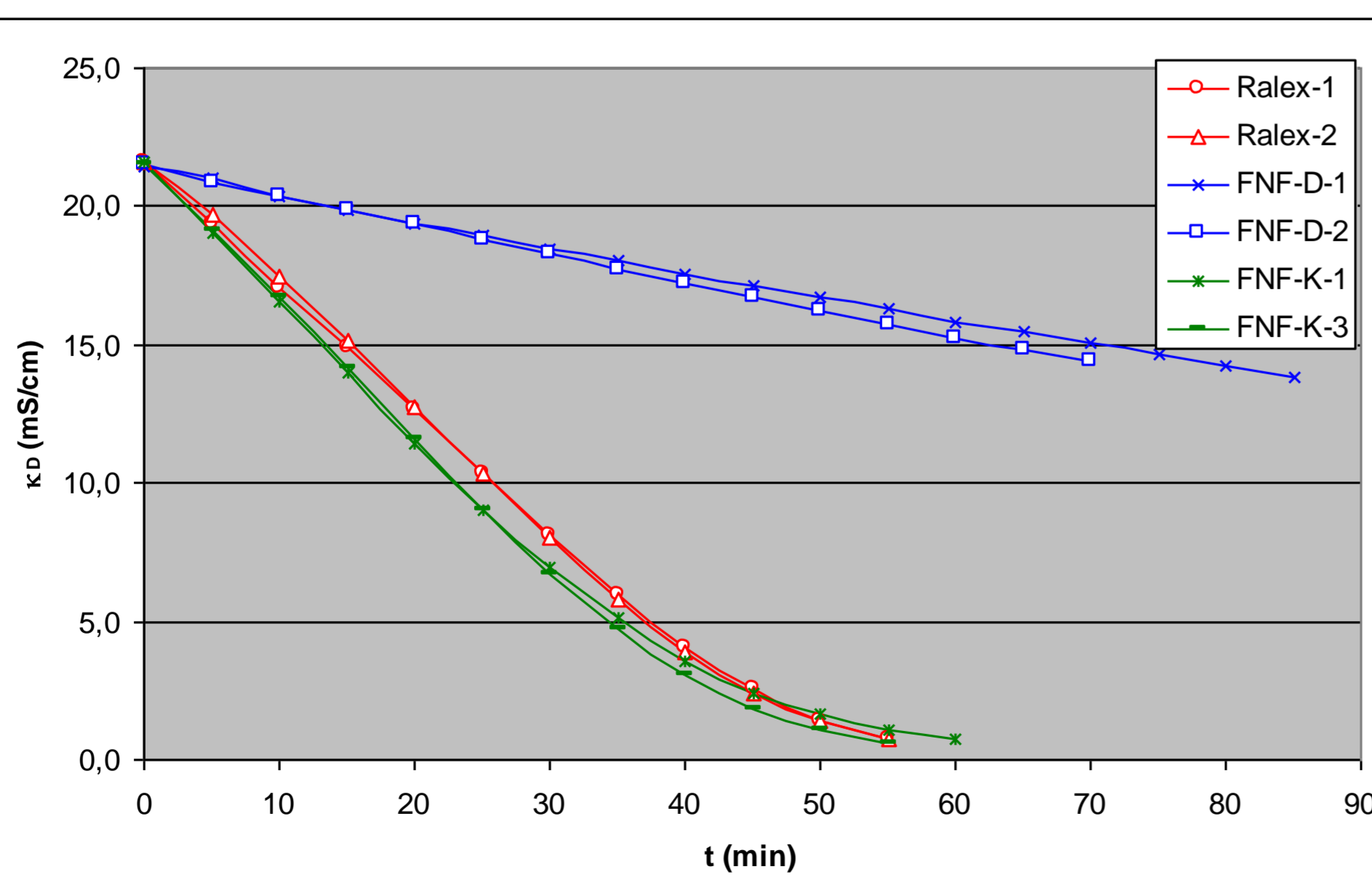## Results

- Resistance of modified membranes by functionalized nanofibres is less than resistance of standard membrane Ralex. The permselectivity of all is very similar.

- The results of desalination test depend on orientation of nanofibers layer. When was nanofibres layer placed to the diluate chamber desalination was very slowly. When was nanofibres layer placed to the concentrate chamber desalination was little faster than desalination of stack with membranes Ralex .

Figure 4: Conductivity of diluate