pH influence in the nanofiltration membranes properties

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Keywords: nanofiltration; zeta potential

Nanofiltration membranes (NF) are used in many industrial sectors for various purposes, such as desalination of food and desulfation of seawater injection wells for oil extraction. An important feature of NF membranes is selective ion rejection. Studies indicate that the separation occurs mainly through two mechanisms: by size exclusion favoring the preferential passage of small ions and by electrostatic interactions between the membrane and the charged species. In contact with water or electrolyte solutions membranes may acquire electric charge through different mechanisms including dissociation of the functional groups constituting the membrane structure, adsorption of ions present in the solution, adsorbing polyelectrolyte surfactant ions and charged macromolecules. These loads have an influence on the surface distribution of the ions in the solution due to the necessity of electroneutrality of the system. NF membranes repel ions having the same charge on its surface [1]. Permeation tests on the pH of the feed solutions are of fundamental importance in the transport properties of the membranes, which comprise the permeate flux of the solution and the rejection of the membrane to a given component present in the solution. This can be explained by the fact that, depending on the pH, functional groups present in the membrane structure or the feed solution may be protonated or not promoting a change in the surface charge of the membrane [1]. Experimentally, we can determine the electrical charge of the membrane surface when in contact with water, by measuring the zeta potential. The determination of this potential at different pH values allows to obtain curves zeta potential and hence determining the isoelectric point. This point is indicative of equal positive and negative charges, where rejection of the membranes is minimal. The aim of this study was to investigate the influence of pH of saline solutions in transport properties, permeate flux and selectivity of commercial NF membranes, SR90 and NF/FILMTEC/Dow. First, the membranes were compressed to 15 bar before being acquired three equal measure flow at intervals of 20 minutes (flow compression). After compaction, pulled out of the water feed tank and added to a solution of Na_2SO_4 and binary NaCl, 1000 mg /L of each anion. For for each membrane tests which were performed at pH 5, 8 and 10. After 1 hour permeation binary solution, an aliquot was collected and permeated into the chromatograph for analysis of ions. The flow was measured at the beginning and at the end of permeation. The difference of the concentration of the feed solution and the permeation was determined rejection of the membrane. For the determination of zeta potential and isoelectric point obtaining equipment was used SURPAS (Anton Paar). The Figure 1 shows the values of zeta pontencial membranes commercial SR 90 and NF. Both membranes showed a decrease in zeta potential with increasing pH indicating a negative zeta potential at neutral pH. The Table1 shows the results of flux and rejection at different pH values. The NF membranes and SR90 were similar. Both membranes showed a flow reduction and an increase of rejection with increasing pH. This can be explained by the fact that more alkaline pH in the membrane pores become smaller, and consequently there is a decrease in flow rates and an increase in the rejection not only due to the pore size, but also due to the increased number of negative charges on the surface [1].

Table 1: Results of flux and rejectionat different pH values

Memb.	pH	Flux (L/m^2 h)	Rejection (%)		Point isoele tric
			SO_4^{-2-}	Cl^-	
SR 90	5	21	63	4	3,2
	8	14	85	30	
	10	11	91	47	
NF	5	70	82	7	2,5
	8	66	85	19	
	10	68	85	28	
	8	25	56	12	
	10	29	30	5	

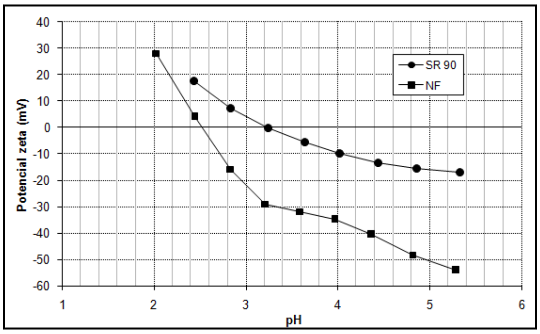

Figure 1- Zeta potential versus pH of the membrane and NF commercial SR 90.

References

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