S2.5.1 EFFECT OF IONIC STRENGTH AND PH ON PERMEATE FLUX FOR CROSSFLOW MICROFILTRATION OF OIL-IN-WATER EMULSION USING CERAMIC MEMBRANE

Yousef Alanezi, PAAET

The relationship between the zeta potential and pH for n-dodecane emulsions (with the concentration of 600 mg/l) at different ionic strength is shown in Figure 1. Most of the filtration experiments have been conducted at pH 5-6, while few filtration tests have been carried out at high basic (pH 12) and at high acidic (pH 1.5) conditions. Moritz et al (2001) estimated the isoelectric point of zirconia to be in the pH range 5.8-6.0. The results of the experiments show that the ζ-potential of the oil droplets decreases as the ionic strength increases. The influence is particularly prominent during the microfiltration of emulsions near to their isoelectric point, where the emulsion has a tendency to instability and the oil droplets are likely to flocculate. The effects are expected to result in higher porosity filter cakes (deposits), and hence a lower value of filter cake resistance; the permeate flux was found to increase to double the value of a non-treated emulsion.

The contradictory observations about the effect of addition of mono and poly-valent salts at the same ionic strength have raised many questions such as the interaction between oil droplets themselves and with the membrane. When the NaCl salt (monovalent) is added, the emulsion pH was 5.77, and measured zeta potentials of the oil droplets were approximately -16 mV (0.1 M) and -36 mV (0.05M). In addition, bearing in mind that the isoelectric point of zirconia membrane was reported to be in a pH range 5.8-6.0, a situation is created that favours the particle-membrane attraction or interaction leading the adsorption of emulsified oil droplets i.e. more deposition which would cause flux decline. Alternatively, when the $FeCl_3$ salt (trivalent) was added, the emulsion pH was about 1.6, and measured zeta potentials of the oil droplets were close to the isoelectric point. Consequently, this condition favoured the particle-particle interaction, where large oil droplets form aggregates which sweep away easily by the induced shear, while for large aggregates, that stick on the membrane surface, form cake layer with high porosity structure due to the cross linking by Ca^{+2} and Fe^{+3} ions.

It was found that the permeate flux is dependent on the surface charge of the emulsified oil droplets (Figure 6.15) and also might be dependent on the surface charge of the membrane. High permeate fluxes are obtained at high pH and low salt concentration. Under these conditions the repulsion between the oil droplets is strong. In contrast, low filtration fluxes are measured at high salt concentration, low pH, and with a NaCl electrolyte, i.e. when the surface charges are weak and in the presence of specifications.