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Digital holographic interferometry visualization of PEG-10000 accumulation on an acetate cellulose membrane: assessment of polarization layer and adsorption phenomenon

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ABSTRACT

PEG-10000 accumulation on a cellulose acetate membrane was studied with digital holographic interferometry to determine if it was a reversible adsorption phenomenon. This optical technique allows concentration differences to be seen as interference fringes. Firstly, an inert and impervious surface was assessed in place of the membrane. When pressure was applied, no fringes appeared thus indicating there was no concentration gradient near the membrane surface. Therefore, no adsorption had occurred, pointing out that pressure did not necessarily generate a deposition of PEG-10000. In a second test, it was checked if adsorption could occur if only the solution was in contact with the acetate cellulose membrane, without pressure. As no fringes appeared, there was no adsorption on that surface. In the last test, a silicon sheet was placed under the membrane to prevent permeate flux when pressure was applied to the solution. A continuous appearance of fringes was observed, indicating a concentration distribution near the membrane surface. Since there was no permeate flux, the built-up of the concentration polarization layer was avoided. Therefore, the change in the concentration was due to a continuous deposition of solute on the membrane. In conclusion, the interaction of PEG-10000 and a cellulose acetate membrane when pressure is applied causes a reversible accumulation or adsorption of solute in the membrane, a phenomenon that simultaneously occurs with the accumulation of solute in the polarization layer.

Keywords: Reversible adsorption; Polarization; Visualization; Polyethylene glycol; Acetate cellulose membrane; Digital holographic interferometry

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