Influence of Buoyant Media in Particle Layer Dynamics in Microfiltration Membrane

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Microfiltration (MF) is one of the most popular methods of colloidal suspension separation. One of the major hurdles in the membrane purification is the cake layer formation that slowly inhibits the filtration process and the need for membrane cleaning for further filtration (Judd, 2006). The mechanism of cake formation and its further growth to an equilibrium cake thickness are very important aspects of understanding the fouling dynamics and control of MF. It is proposed that the hydrodynamic forces and viscosity acting on the suspended colloids determine the rate of cake build up process (Jiao and Sharma 1997; Altman and Ripperger 1997).

In this paper experimental results of MF of kaolin clay suspensions of size (0.1-5 μm) are presented. A flat sheet membrane (PVDF) was immersed in the reactor and permeate was used in recycle mode to maintain the reservoir volume. Filtration process was carried out in presence and absence of bouyant media (granular activated carbon) and the particle deposition behaviour on membrane surface was studied. Particle size analysis measurement was performed by analyzing those particles which have not been deposited on the membrane surface. Particle Size Analyser (Malvern 2600) was used for the study.

The transmembrane pressure (TMP) development in membrane surface in presence and absence of bouyant media study showed that presence of bouyant media could reduce TMP more than two folds (Figure 1). Besides, the TMP fluctuation was two folds lower in presence of bouyant media. The less TMP fluctuation indicated smooth transition on membrane cake layer deposition development.

The average particle size distribution of kaolin clay suspension (10 g/L) in water showed 4.1 μm with D[v, 0.5] 4.45 μm. The results showed that at the fine particles were deposited on the membrane surface at the beginning followed by coarser particles. The particle deposition on the membrane in presence of bouyant media indicated that particles of different sizes are deposited randomly on the membrane surface. A sample result (Figure 1) shows the mean particle diameter deposited on membrane surface in presence and absence of bouyant media. Random deposition of the particles with different size seemed to make the cake layer less compact that allows the flux to pass though the membrane and thus reducing the transmembrane pressure. The presence of bouyant media reduced the membrane fouling by several folds. One possible reason for a reduction in fouling is the presence of a smaller amount of deposition of finer particles on the membrane surface. This result is confirmed with different air bubbling rates and filtration flux.