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Wei Yao, Zhan Wang*, Peng Song

Beijing Key Laboratory for Green Catalysis and Separation, Department of Chemistry and Chemical Engineering, Beijing University of Technology, Beijing 100124 P.R. China.

*Corresponding author：Tel: 86-10-67396186; fax: +861067391983, wangzhan3401@163.com

Abstract:

It is important to clarify the mechanism of the cake layer formation in the early stage of filtration (initial stage and pseudo-steady stage). In this paper, a series of short-term dead-end microfiltration of sludge suspensions domesticated at three different ratios of carbon to nitrogen (C/Ns) (63:10, 100:5, 200:5) were conducted in constant pressure mode. Flux decline behaviors were analyzed and structure of cake layer was characterized by 3D optical digital microscope (3D-ODM) to explore the mechanism of the cake layer formation. Results showed that the sludge floc was the key substance in the initial stage of the cake layer formation while colloid matters dominated later. Based on the inhomogeneous structure of the formed cake, a dynamic traversing mechanism was proposed to reveal the fact that colloid matters traveled through the hole formed by sludge flocs and accumulated on the membrane surface. Meanwhile, a piecewise function about the relationship of accumulated filtrated volume (v) and filtration time (t) was established to reveal this mechanism. Moreover, the model predictions showed good agreement with experimental data and its applications were also approved by other activated sludge suspensions, kaolin suspensions and real wastewater.