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Constant pressure expression of power law non-Newtonian fluid/solid mixture

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Abstract

Expression of non-Newtonian fluid/solid mixture is often encountered in the fields of polymer and food industries. However, a reliable method for the design of the expression process has not been established. In this study, we conducted expression experiments of power law non-Newtonian fluid/solid mixture under constant pressure condition. The basic consolidation equation was derived by combining the fundamental equation for power law non-Newtonian flow through the cake with the equation of continuity and solved numerically using the Runge-Kutta method. The progress of the expression is represented by an average consolidation ratio $U-c$. The agreement between calculated and experimental $U-c$ was satisfactory when the creep deformation of the material was taken into consideration. It was also elucidated that the consolidation time required for attaining a certain degree of primary consolidation depends on the $(N+1)/N$ -th power of the total volume of the solid material $\omega(0)$, where N is the flow behavior index of the squeezed liquid. On the other hand, the creep constants B , the ratio of creep deformation to the total deformation, and η , a measure of the rate of creep deformation, both were found to be $\omega(0)$ -independent parameters, supporting the validity of the assumption made in the theoretical derivation. 2018 Taiwan Institute of Chemical Engineers. Published by Elsevier B.V. All rights reserved.


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