低剪断性混合装置の開発と剪断特性評価法の確立

メタデータ	言語: Japanese 出版者: 公開日: 2022-05-20 キーワード (Ja): キーワード (En): 作成者: 森, 茂, Mori, Shigeru メールアドレス: 所属:
URL	https://doi.org/10.24517/00057193

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2000 Fiscal Year Final Research Report Summary

Development of Mixer for Weak Shear Mixing and Evaluation of Shearing Strength in the Mixing Vessel

Research Project

Project/Area Number

11650775

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Single-year Grants

Section

一般

Research Field

化学工学一般

Research Institution

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Project Period (FY)

1999 – 2000

Keywords

Mixer / Shearing Strength / Screw impeller / Calcium Alginate Gel / Mixing Time / Agitation Power / Rotational Speed / Impeller Reynolds Number

Research Abstract

In this research, we proposed a new mixer with a screw impeller, which has been practically used as a pump vane, for weak shear mixing and discussed its mixing behaviors. Experimental results show that mixing performance of the screw impeller is affected by shapes of the impeller and a suction cone, impeller position, vessel size and liquid depth, and there is an optimum condition for good mixing by this impeller. The mixing time and the agitation power in the vessel with the screw impeller are influenced by the viscosity of the mixed liquid and rotational speed of the impeller, and the agitation power hardly depends on the liquid viscosity in the lower rotational speed range. The screw impeller has a good mixing performance because of short dimensionless mixing time, compared with a pitched paddle impeller. The product of the power number and the impeller Reynolds number was found to be a constant value.
Furthermore, a new method using spherical gels of calcium alginate for measuring the shearing strength in the mixing vessel was proposed, and its validity was also discussed in this study. The calcium alginate gels were gradually damaged by the shear stress in the vessel, Therefore, an action of shear mixing in the vessel could be quantitatively determined by examining the time course of the number of the damaged gel particles. For water mixing the complete breaking time of the gel particles in the vessel with the screw impeller was longer than that with a disk turbine impeller, and for mixing of an aqueous solution of glutinous starch syrup having the viscosity of 9.8 Pa.s the initial breaking rate of the gels for the screw impeller was lower than that for the pitched paddle impeller. Consequently, the proposed mixer with the screw impeller can achieve a weak shear mixing.

URL: https://kaken.nii.ac.jp/report/KAKENHI-PROJECT-11650775/116507752000kenkyu_seika_hokoku_

Published: 2002-03-25