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随机填充中空纤维膜组件中非稳态渗透传质数学模型

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摘要 Based on the membrane-based absorption experiment of CO2 into water, shell-side flow
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关键词 膜分离技术 数学模型 光纤模块 CO_2 二氧化碳 质量传递

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Mathematic Model of Unsteady Penetration Mass Transfer in Randomly Packed Hollow Fiber Membrane Module

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Abstract Based on the membrane-based absorption experiment of CO2 into water, shell-side flow distribution and mass transfer in a randomly packed hollow fiber module have been analyzed using subchannel model and unsteady penetration mass transfer theory. The cross section of module is subdivided into many small cells which contains only one hollow-fiber. The cross sectional area distribution of these cells is presented by the normal probability density distribution function. It has been obtained that there was a most serious non-ideal flow in shell side at moderate mean packing density, and the large amount of fluid flowed and transferred mass through a small number of large voids. Thus mass transfer process is dominated by the fluid through the larger void area. The mass transfer process in each cell is described by the unsteady penetration theory. The overall mass transfer coefficient equals to the probability addition of the mean mass transfer coefficient in each cell. The comparisons of the values calculated by the model established with the empirical correlations and the experimental data of this work have been done.The predicted overall mass transfer coefficients are in good agreement with experimental data.

Key words hollow fiber membrane module; mass transfer; membrane separation; mathematic model

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