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TRANSPORT PHENOMENA & FLUID MECHANICS

声空强化渗透脱水过程质扩散研究

孙宝芝[a], 冰秀兰[b], 姜任秋[a], 刘登瀛[a]

[a] College of Power and Nuclear Energy, Harbin Engineering University, Harbin 150001, China
[b] Institute of Engineering Thermophysics, Chinese Academy of Sciences, Beijing 100080, China

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摘要 An experimental study on intensifying osmotic dehydration was carried out in a state of nature and with acoustic cavitation of different cavitating intensity (0.5A, 0.7A and 0.9A) respectively, in which the material is apple slice of 5 mm thickness. The result showed that acoustic cavitation remarkably enhanced the osmotic dehydration, and the water loss was accelerated with the increase of cavitating intensity. The water diffusivity coefficients ranged from 1.8 × 10^-10 m^2.s^-1 at 0.5A to 2.6 × 10^-10 m^2.s^-1 at 0.9A, and solute diffusivity coefficients ranged from 3.5×10^-11 m^2.s^-1 at 0.5A to 4.6×10^-11 m^2.s^-1 at 0.9A. On the basis of experiments, a mathematical model was established about mass transfer during osmotic dehydration, and the numerical simulation was carried out. The calculated results agree well with experimental data, and represent the rule of mass transfer during osmotic dehydration intensified by acoustic cavitation.

关键词 渗透脱水技术; 气穴现象; 最大传输率; 数学模型; 食品加工技术; 干燥方法;

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Mass Transfer During Osmotic Dehydration Using Acoustic Cavitation

SUN Baozhi[a], HAI Xiulan[b], JIANG Renqiu[a], LIU Dengying[a]

[a] College of Power and Nuclear Energy, Harbin Engineering University, Harbin 150001, China
[b] Institute of Engineering Thermophysics, Chinese Academy of Sciences, Beijing 100080, China

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Abstract An experimental study on intensifying osmotic dehydration was carried out in a state of nature and with acoustic cavitation of different cavitating intensity (0.5A, 0.7A and 0.9A) respectively, in which the material is apple slice of 5 mm thickness. The result showed that acoustic cavitation remarkably enhanced the osmotic dehydration, and the water loss was accelerated with the increase of cavitating intensity. The water diffusivity coefficients ranged from 1.8 × 10^-10 m^2.s^-1 at 0.5A to 2.6 × 10^-10 m^2.s^-1 at 0.9A, and solute diffusivity coefficients ranged from 3.5×10^-11 m^2.s^-1 at 0.5A to 4.6×10^-11 m^2.s^-1 at 0.9A. On the basis of experiments, a mathematical model was established about mass transfer during osmotic dehydration, and the numerical simulation was carried out. The calculated results agree well with experimental data, and represent the rule of mass transfer during osmotic dehydration intensified by acoustic cavitation.

Key words osmotic dehydration; acoustic cavitation; mass transfer rate; mathematical model

通讯作者:
孙宝芝 hrbf@mail.etp.ac.cn
作者个人主页: 孙宝芝[a], 冰秀兰[b], 姜任秋[a], 刘登瀛[a]

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