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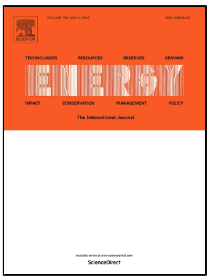

Numerical investigation of moisture removal and energy consumption of porous body affected by EHD

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Numerical investigation of moisture removal and energy consumption of porous body affected by EHD

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Abstract

In this study, the convective drying rate of a porous body driven by Electrohydrodynamics (EHD) was numerically investigated. Two different types of collecting electrode were compared: wall plate collector and segmented plate collector. Firstly, wall plate collector was examined and compared with non-EHD case. The numerical results showed that the moisture removal in the wall plate collector was 5 times higher than the non-EHD case. Secondly, the wall plate collector was replaced with a segmented plate collector. Different arrangements, as well as the various vertical distances between the emitter and the collectors, were examined to find a higher mass transfer. The numerical results showed that moisture removal in the segmented collector in the most appropriate conditions was about 3 times greater than the wall plate collector case. Finally, to gain a more general conclusion, the specific energy consumption (SEC) and pressure loss of all cases were evaluated. The results indicated that the pressure loss has increased greatly by using the EHD-induced flow. Moreover, it was depicted that for the wall plate collector the SEC reached to 8.2 watt-hr/kg when it decreased to orders of 10^{-2} watt-hr/kg for the segmented collector cases.

Keywords: Electrohydrodynamics; Drying; Numerical study; Porous body; Segmented plate collectors

1. Introduction

Drying is a moisture removal from a solid object including evaporation and mass transfer of the moisture to the solid surface and the surrounding air as well. In order to achieve the desired mass transfer with minimum energy consumption, different techniques have been used. One of the promising techniques is the application of Electrohydrodynamic (EHD)-induced flow. The