Mechanical Engineering Thesis Defense

CFD Modelling of Desorption Process of Zeolite-13X and Water Pair

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Abstract

The desorption process is widely used in numerous fields such as drying, thermal energy storage, dehumidification, etc. but due to the long duration and low efficiency of the process, ultrasound has been widely used to enhance the desorption. There are a lot of studies carried out in this area but due to the experimentation time and cost computational fluid dynamics (CFD) simulations provide an effective and cheaper way to studying the desorption process. This research aims to develop a CFD model using ANSYS Fluent for the desorption of water from zeolite-13X in the presence and absence of ultrasound as experimentally done by Daghooghi-Mobarakeh et al. The simulation results show very good agreement (error less than 1%) with the experimental results for the desorption process without ultrasound. It was found later that it is not possible to simulate the ultrasound-assisted desorption due to the computational burden imposed by the very small time step required. Hence, to study the effect of pressure induced by ultrasound the pressure term in the simulation is added/subtracted by the pressure induced by the ultrasound to determine its effects. There is no change in the desorption curve because the induced pressure is 975 Pa which is less than 1% of the fluid pressure which is equal to 101325 Pa. Also, the effects of surface diffusion and its activation energy are explored. The increase in surface diffusion enhances desorption while an increase in activation energy decreases desorption rate.

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Zoom Link: https://asu.zoom.us/j/83373252334