EXPLORING CONVECTIVE DRYING BEHAVIOR OF HYDROXIDE SLUDGES THROUGH MICRO-DRYING SYSTEMS

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Abstract

Drying appears as a major step prior to the valorization of sludge produced within Drinking Water Treatment Plants (DWTP), but this thermal operation is energy consuming. Deeper knowledge about sludge drying behavior is required to improve drying efficiency.

Factorial experimental design is used to characterize the drying behavior of hydroxide sludges. The studied ranges are a temperature from 70 to 110°C, a velocity from 1 to 3m/s and an absolute humidity from 0.005 to 0.2kgwater/kg dry matter. A monitoring of the mass and the surface/volume is performed continuously during drying.

The influence of drying conditions is shown on the maximum drying flux, the time to reach 95% of dryness, the final volume, and the critical moisture content. Furthermore, the slowing-down phase is described by a simple coefficient to be compared with each other.

Through X-ray tomography, variations of dimensional characteristics such as the volume and exchange surface of the sample bed were obtained. This technique allowed to confirm that shrinkage, which is an important phenomenon occurring during the sludge drying , must be taken into account.

The results show that the temperature and the velocity of air both increase the maximum drying flux and the final volume and reduce the drying time. Air humidity produces opposite effects. The most important result is the absence of influence of these operating conditions on the drying curve shape, proving the existence of a drying characteristic curve for a specific sludge.

Keywords: Convective drying, hydroxide sludge, kinetics, shrinking and crack