

Thermal desorption of water over Ca-LTA zeolite-Diatomite based adsorbents

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Abstract. In this study, the thermal desorption of water molecules on hydrated zeolite-diatomite based adsorbents are investigated using thermogravimetric and derivative thermogravimetry (TG-DTG) analyses. The zeolite-diatomite adsorbents are prepared by physical mixing of commercial Ca-exchanged LTA zeolite with appropriate amounts of purified diatomite powder. The pure form of diatomite is obtained from raw diatomite by applying both chemical and thermal treatments. The diatomite loading rate in the adsorbent samples ranges from 15 to 25 wt.%. The water desorption isotherms are measured by heating the adsorbent samples from 20 to 350°C at different heating rates. According to TG and DTG profiles, two main distinct temperature regions of water loss are observed. The first weight loss is located in 80-130°C temperature range, which can be attributed to the loss of weakly bound water molecules. The second weight loss observed in the range of 160-350°C is ascribed to the stronger bound water molecules to the cations that are located in zeolite cavities and diatomite pores. The apparent activation energies values for the water desorption on Ca-exchanged zeolite, calculated by using Kissinger and Ozawa methods are in close agreement. The value of both activation energies and enthalpy of the prepared samples seems to depend on the diatomite loading rate. Indeed, the increase of diatomite loading rate in adsorbents lead to the decrease of activation energy and enthalpy values particularly for sample containing 15w% of diatomite. These results highlight clearly the complexity of water desorption kinetics on the zeolite and diatomite pores.

Keywords: Zeolite, diatomite, adsorption.