Manufacturing of novel zeolite-clay composite membrane based on clay and modified diatomite- applications for the treatment of heavy metals

The main objective of this work is to present the preparation of the clay support and LTA zeolite composite membrane from natural materials such as diatomite and clay. The raw clay and diatomite were obtained from two respective sites in the region of Midelt in the High Atlas and Nador in northe Morocco. Flat supports of 40mm diameter were obtained by sintering at T= 1000°C, raw pellets obtained from clay powder of granulometry 160 μm ≤ Φ ≤ 250 μm mixed with a percentage of activated carbon as porosity agent. The supports thus developed are characterized by flow tests from a filtration pilot in order to choose those that will be used for our membrane deposit. The natural diatomite was used as a precursor rich in silica, before its use a calcination at 350°C is necessary to eliminate the organic matter that it contains (Si/Al molar ratio = 2.2). In order to obtain the LTA zeolite the addition of aluminate precursor is necessary, the mixture thus obtained will be placed in a polyethylene autoclave containing the sintered support and the synthesis will be at T= 80°C. The resulting LTA zeolite was deposited on the clay substrate as a thin layer to increase the filtration efficiency of the metal ions. The materials were characterized by different techniques such as XRD, FTIR, BET, SEM-EDAX, pHpcn. The results of the characterization by X-ray diffraction and X-ray fluorescence showed that it is indeed the zeolite LTA. The study by Fourier transform infrared spectroscopy has confirmed that the results of the X-ray. The study of N_2 adsorption-desorption isotherms (BET) of the LTA zeolite composite membrane presents a specific surface of about 5.34 m^2/g. The retention percentage of Pb(II), Co(II) and Cr(VI) ions by clay support was in the range of 98%, 90% and 20%, respectively. Retention by the LTA zeolite composite membrane was then of the order of 99%, 98% and 38%, respectively, with a filtration time of 2h90min.

Keywords: Clay support; LTA zeolite membrane; Heavy metals; Retention.