

Al, Fe, and Zr-Based Trimetallic Pillaring of Bentonite Clay for Gas Adsorption



Nezihe Ayas^{1,*}, Nasrin Pourmoghadam², Tolga Kaan Kanatlı³

^{1,2,3} Department of Chemical Engineering, Faculty of Engineering, Eskisehir Technical University, Eskisehir, Turkey.

Structural pillaring is a widely used technique that improves the adsorbent's surface area and interplanar spacing. Aluminum is a frequently utilized pillaring metal due to its unique ability to create Al₁₃ polymer structures in montmorillonite materials. Iron and zirconium are also often used pillaring metals; however, when employed as stand-alone pillaring agents, they are known to be less effective; so, they are typically utilized in combination with Al in bimetallic form and are reported to improve the pillaring action on bentonite clay. However, there are no instances in the literature of them being used in trimetallic form on bentonite clay. In this work, monometallic Al/Bentonite, Fe/Bentonite, Zr/Bentonite and the trimetallic Al-Fe-Zr/Bentonite pillared clays were synthesized and characterized. An OH/metal ratio of 2:1 was used. The adsorbents were analyzed through X-ray diffraction (XRD) and their interplanar distances were calculated. They were further analyzed through scanning electron microscopy (SEM), and N₂ Adsorption/Desorption analysis via Bruner, Emmett, Teller method (BET). Using the Bragg equation on XRD patterns, the interplanar layers of the Al, Fe and Zr pillared bentonite materials were calculated as 19.0, 16.9 and 4.0 Å respectively. Al/Bentonite was used in the gasification of sugar beet pulp to determine if the adsorbent has catalytic activity as well. The H₂ and CO₂ concentrations of the gas product were observed as 51 and 36% respectively, which is a promising result. Adsorption tests are being continued.

Keywords: Adsorbent, Hydrogen, Pillaring, Bentonite, Trimetallic

Biography:

Nezihe Ayas is a full professor of Chemical Engineering at Eskisehir Technical University. Her research interests include gasification technology, energy conservation, hydrogen energy and fuel cells, bioenergy, biodiesel and catalyst preparation via different synthesis methods. She is the author of 100+ national and international journal papers along with a similar number of conference papers on the different aspects of her areas of expertise. She has been involved as a project manager in 25+ international and national funded projects. Her research team is actively working in the areas of biofuel production, hydrogen, gasification and fuel cell technologies, process modelling and simulation.