

**MORPHOLOGICAL ANALYSIS OF MODIFIED AZKAMAR
AND KRANTAU BENTONITES BY SCANNING ELECTRON
MICROSCOPY**

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Azkamar (AB) and Krantau (KB) bentonites were modified and characterized using scanning electron microscopy (SEM). SEM analysis revealed that AB exhibits thinner, more uniform, and well-ordered platelet-like particles, whereas KB has thicker, more irregular, and aggregated layers. The morphological superiority of AB contributes to its higher surface area and better adsorption potential, making it a more promising nanoadsorbent compared to KB.



Bentonite clays are widely used as adsorbents due to their high surface area and swelling capacity. The adsorption performance strongly depends on the morphological and structural properties of the clay, which can be visualized using scanning electron microscopy (SEM). This study compares the surface morphology of modified Azkamar and Krantau bentonites to explain differences in their adsorption behavior.

The morphological characteristics of the modified Azkamar (M-AB) and Krantau (M-KB) bentonites were examined using scanning electron microscopy. The SEM images revealed distinct differences in the texture and layer organization of the two samples, as shown in Figures 1 and 2.

The M-AB sample exhibited a structure composed of thin, smooth, and well-defined platelet-like particles. These layers were relatively well-separated and organized, suggesting a higher degree of exfoliation and a more accessible surface area for adsorption processes.

In contrast, the M-KB sample displayed a morphology characterized by thicker, more compact, and irregularly aggregated layers. The particles appeared coarser and less orderly, which is likely to result in a lower specific surface area compared to the M-AB sample.

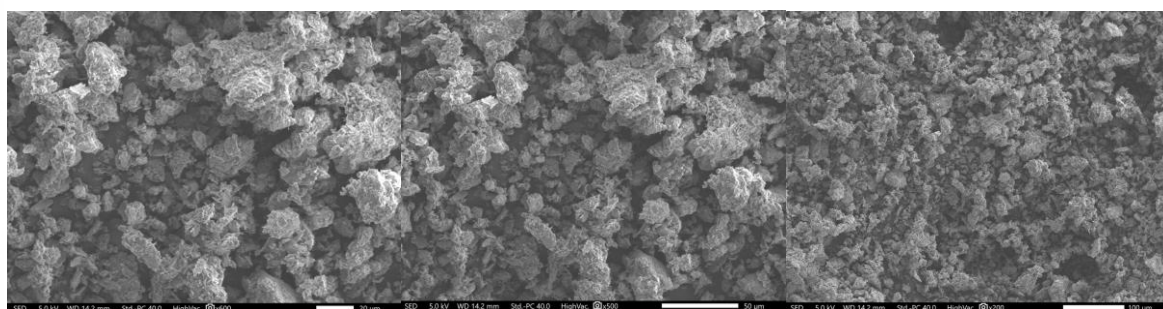


Figure 1. SEM images of Azkamar bentonite (AB) at (a) 20 μm , (b) 50 μm , and (c) 100 μm scales.

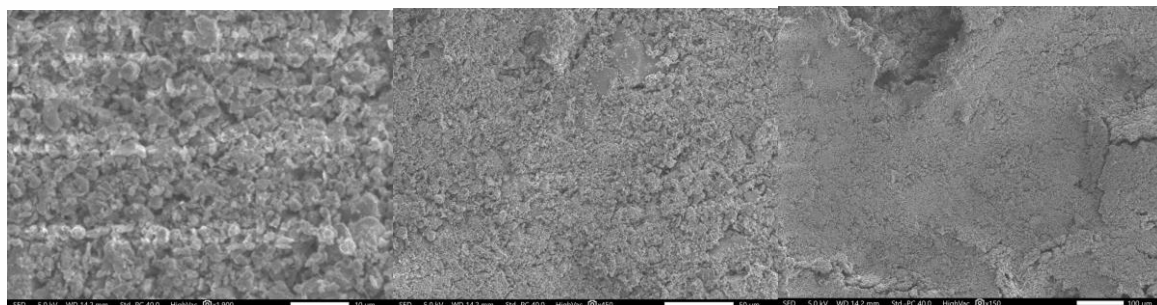


Figure 2. SEM images of Azkamar bentonite (AB) at (a) 20 μm , (b) 50 μm , and (c) 100 μm scales.

These morphological observations are consistent with the elemental composition data obtained from EDS analysis, summarized in Table 1. The M-AB sample showed a higher carbon content (28.45 wt%) compared to M-KB (18.67 wt%), confirming a more successful integration of the THAB modifier within its structure. Furthermore, the higher Si/Al ratio in M-AB (6.20) compared to M-KB (4.75) indicates a greater degree of isomorphic substitution in its tetrahedral layers, which correlates with a higher cation exchange capacity and enhanced potential for adsorption applications.

Table 1. Elemental composition (EDS results) of modified Krantau (KB) and Azkamar (AB) bentonites.

Element	Krantau (wt%)	Azkamar (wt%)
C	18.67	28.45
O	45.23	47.72
Na	1.12	0.25
Mg	2.45	0.19

Al	7.12	3.04
Si	33.89	18.87
K	0.56	0.91
S	1.23	0.19
Ti	4.25	0.18

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