3. Result and Discussion

3.1. Characteristic of Natural Diatomite

The elemental composition of the natural diatomite obtained by the SEM-EDX (Figure 1A) method shows that silicon, oxygen, aluminum and iron are the main elements, while sodium, magnesium and chlorine are the minor elements. The structure and morphology of natural diatomite were studied by SEM (Figure 1B). The microstructure of the sample mainly consists of numerous frustules of diatomaceous algae with pores in the range of 0.8–1 μm. Fragments of non-uniformly distributed particles of laminated plates are also found. This phenomenon is related to the content of the clay minerals in the mineral composition of diatomite rock. The results of the XRD analysis (Figure 1C) reveal that the diatomite used is composed of such minerals as kaolinite, illite, halite, quartz and amorphous silica, reflected by the following peaks at 2θ: 12.43°, 25.03° for kaolinite, 17.69°, 21.02°, 35.10° for illite, 31.69°, 45.45° for halite and 21.02°, 26.79°, 50.25° for quartz. The presence of amorphous silica of diatom frustules is indicated by a broad peak in the range of 2θ between 20° and 35°. Functional groups, determined by the FTIR-ATR method, in natural diatom are represented in Figure 1D. The main spectral peaks of functional groups are detected at 3697, 3621, 1631, 1026, 913, 796, 694, 525 and 451 cm^{-1}. The signals generated at 3694 and 3621 cm^{-1} correspond to tension vibrations of Al-OH and Si-OH groups [39,40]. The strip appearing at 1631 cm^{-1} is related to the vibration of H-O-H due to the stretching and bending of adsorbed water on the surface of silica [41]. The intensity of the adsorption strip centered at 1025 cm^{-1} is due to O-Si-O stretching, in which silicon atoms are located in tetrahedral coordination [42]. The bands recorded at 796 cm^{-1} and 694 cm^{-1} are assigned to vibrations in the silicon structure of the symmetric external Si-O bond [43,44]. The intense peak at 451 cm^{-1} corresponds to variations of the Si-O-H bond [45], while the peak of weak intensity at 525 cm^{-1} characterizes the presence of the Si-O-Si bond in diatomite [46]. A weak signal identified at 913 cm^{-1} corresponds to the vibration of Si-O-Al bonds and suggests the presence of clay in the diatomite [47].