Characterisation of Natural Clay and Application to the Adsorption of Erythromycin from Water Media

Flamur Sopaj[a, b*]
Martin Jendrlin[c] Albana Veseli[a, b]
[a]*Department of Chemistry, Faculty of Natural and Mathematical Sciences, University of Prishtina "Hasan Prishtina", str. George Bush, 10000Prishtina, RepublicofKosova*
[b]*Academy of Science of Albania, Unit of Albanian Nano-science and Nanotechnology - NanoAlb 1000 Tirana, Albania*
[c]*Lennard-Jones Laboratories, Birchall Centre, Keele University, Keele, Staffordshire, ST5 5BG, United Kingdom*
flamursopaj@gmail.com

Abstract

Erythromycin (ERY) is an antibiotic that is suggested to be classified as one of the prior drinking water contaminants at latest European Union Water Framework Directive (EU – WDF). Since most antibiotic residues can hardly be removed from wastewater using conventional treatments, alternative methods such as adsorption receive great attention considering one of the most efficient and cost-effective treatment methods for antibiotics. Among the adsorbents, clay minerals have garnered increasing attention due to their unique properties including availability, high specific surface area, low cost and cation exchange capacity. In this work natural clay was characterized and applied for the removal of erythromycin from water solution. The clay was dug up in the form of soft stones, it was dried and ground in a mortar, then washed with distilled water. The separated clay was studied by X Ray Diffraction analysis which reviled its chemical composition as 55.2% $KAl_2(AlSi_3O_{10})(OH)_2$, 23.6% SiO_2, 21.2% LiC_6. Surface area was determined by N_2 adsorption/desorption isotherms and the BET equation, it appeared to be 79.33 m^2/g. Erythromycin solution 50 µM after being treated for 24 hours was centrifuged and its concentration was monitored by electrochemical methods such as cyclic voltammetry. The voltamogram was recorded in a three electrodes electrochemical cell, using a screen printed carbon electrode as working electrode (SPCE). The electrochemical signal measured after the adsorption process was almost invisible compared to a 14 µA peak observed for the initial concentration, which means Erythromycin was almost completely removed from the solution. The application of these natural materials in real samples purification, their reuse, economic analysis and life cycle assessment are other issues that should be considered.

References

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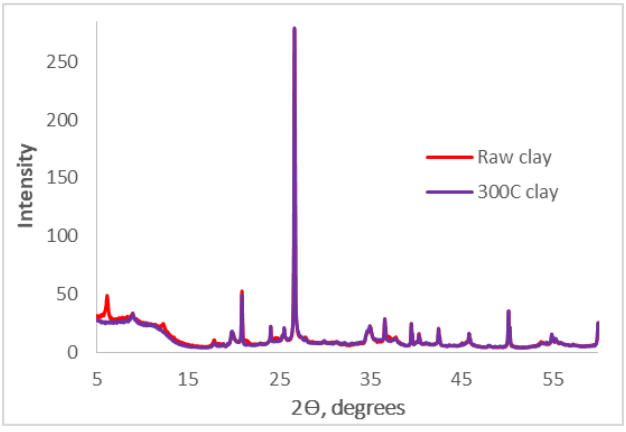

Figure 1: XRD spectrum of the studied clay. Cu Kα at 40 kV and 40 mA, 2θ=5−60°, 2684 steps, time per step 0.764 s.