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Removal of Cu^{2+} ions from aqueous solution using a naturally occurring Kenyan micaceous mineral

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Water pollution by chemicals is of great public concern. Improvements in the quality and availability of water are however possible at relatively low costs. The objective of this work was to test the efficacy and applicability of a micaceous mineral of Kenyan origin (herein referred to as Mica-K) in the removal of Cu^{2+} ions from water and wastewater systems. The adsorption of Cu^{2+} onto mica-K was found to be dependent on experimental conditions, particularly: Contact time, adsorbate concentration, pH, particle size, sorbent dose and temperature. The sorption pattern of Cu^{2+} ions onto mica-K followed Langmuir, Freundlich, and Dubinin-Kaganer-Radushkevich (DKR) isotherms with correlation factors and other parameters for the isotherms confirming good agreement between theoretical models and the experimental results. Positive but small enthalpy, (ΔH^o) value suggests that sorption of Cu^{2+} is endothermic and involves moderately weak bonding between the metal ions and mica-K. The entropy (ΔS^o) value is positive indicating that there are some structural changes at the solid-liquid interface and that metal ion adsorption is likely to occur spontaneously at normal and high temperatures. Negative values for the Gibbs free energy, ΔG^o, shows that the adsorption process is spontaneous in nature without any induction period and that the degree of spontaneity of the reaction increases with increase in temperature. Kinetic modeling analysis of the Elovich, pseudo-first order, pseudo-second order, intra-particle diffusion, mass transfer and intra-particle diffusivity equations using the linear coefficient of determination, R2 values showed that the pseudo-second order equation was the most appropriate model for the description of Cu^{2+} transport with chemical sorption as its rate limiting step. X-ray photoelectron spectroscopic (XPS) analysis for Cu^{2+} ion-equilibrated mica-K, demonstrated that Cu^{2+} containing nodules existed on the surface of the mineral. Mica-K adsorbent was compared well with a commercially available elgalite ion exchange resin from Elga Company UK, when used to treat real water samples from different sources within Kenya and industrial effluents.

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Application and comparison of analytical hierarchy process (AHP) and network methods in routing of pipeline water transmission system from Taleghan Dam to Hashtgerd New City, Tehran, Iran

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For determining the optimal route of the water pipeline, technical and engineering considerations, economic, environmental and techniques that need to be applied, to all parameters simultaneously, are considered. In this study, first of influential factors in determining the route; the conditions of topography (slope, altitude), vegetation, land use, population density, length of pipeline, river and road, areas and important areas, residential, environmentally sensitive areas and centers (religious-culture) were determined using the base map and extracting the locus of points of interest from Google Earth to take action field operations navigation and to harvest land navigation. Then the data layer related target parameters in were loaded in GIS and then, applying the specific weighting the cost of map production operations based on Analytical Hierarchy Process (AHP) rate, mix and ultimately the optimal route using the lowest cost algorithm is determined. Comparison determination of the optimal route using ArcGIS software and IDRISI shows that the two routes coincide and comparing the designed route in this study (from Taleghan Dam to Hashtgerd New City) with ABFA route indicates that the route is 5/6976 km shorter than the ABFA route; despite optimal route cost only apply to influence some of the layers of the ABFA route is more. Two routes were compared on the basis of total cost and comparing them indicates that the optimal route towards the ABFA route costs will be reduced by 14%. ABFA major additional cost route resulted more from intersection with the river and the road, passing through unauthorized areas, passing through different users with higher costs and ultimately increasing the pipeline.

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