Palygorksite and sepiolite clay minerals for NO_3^- -N adsorption

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ABSTRACT

Adsorption is a physicochemical method for water treatment, where the contaminants solid, liquid or gas atoms/molecules adhesion takes place on the adsorbents' surface. Clay minerals are widely used as adsorbents because of their low-cost, non- toxicity, ion exchange capacity and permanent negative charge that provide high adsorption capacity, mostly for cationic pollutants (Mu and Wang, 2016). However, clay minerals may also adsorb anionic pollutants depending on their physicochemical characteristics. Palygorskite and sepiolite are clay minerals characterized by fibrous morphology and ribbons structure with empty channels and basal spacing, where zeolitic water molecules and exchangable anions can exist (Galan, 1996).

Batch kinetic experiments were conducted I order to determine the nitrate adsorption capacity of Greek fibrous clay minerals, concerning the effect of nitrate initial concentration, adsorbent's dosage contact time and pH values have been carried out. In case of palygorskite, the nitrate removal efficiency is positively correlated with initial concentration decrease, as for 15 mg/L maximum removal reached up to 20%, but with the increase to 30 and 50 mg/L the removal is degrading to 17.6% and 12% respectively. For sepiolite the highest dosage is the preferable mass to eliminate all studied nitrate concentrations as well, however, sepiolite found to be a better adsorbent for the higher concentration levels of the pollutant, reaching 22.6 % and 24.2% of 30 mg/L and 50 mg/L nitrate removal respectively, compared to the 15% removal for 15 mg/L nitrate. The adsorption process for the particular pollutant found to be not highly pH dependent, nevertheless, in acidic values the removal efficiency is slightly higher as in basic values the OH^- groups may compete NO_3^- at the active sites. To conclude, Greek clay occurrences present nitrate adsorption capacity, promising for pre- or post- water treatment, which can be sufficient in combination with more effective but costly technologies, such as biological denitrification or electrochemical methods.

REFERENCES

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