Removal of NH_4^+-N from sanitary landfill leachates using natural zeolite as adsorbent

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ABSTRACT

Leachate generated owing to the physicochemical and biological decomposition of solid wastes in the sanitary landfill sites and the percolation of rainwater through the solid waste layer, constitutes a crucial environmental issue worldwide. It is considered an extremely polluting wastewater, due to its substantial concentrations in ammonium nitrogen (NH_4^+-N), organic contaminants (biodegradable and non-biodegradable) quantified as chemical oxygen demand (COD), heavy metals, halogenated hydrocarbons and inorganic salts [1]. One of the most attractive methods for the landfill leachate treatment is the adsorption technology, according to which the pollutants are transferred from the leachate to the surface and/or the channels of a solid (adsorbent) and forms bonds by physical and/or chemical interactions. Zeolite is a promising adsorbent (natural and/or modified) for the removal of pollutants, especially for NH_4^+-N, since it behaves as ion-exchanger [2].

The main objective of the current study was to determine the efficiency of leachate treatment applying zeolite adsorption process. In more detail, the effect of zeolite particle size (0.930 μm, 0.710-1.0 mm, 2.0-2.8 mm, 4.0-5.0 mm), stirrer speed (150,200, 250, 300 rpm), zeolite dosage (3, 33, 67, 100, 133, 217, 333 g/L) and pH (6, 8, 10) in leachate, was assessed on NH_4^+-N, COD and color removal, in batch experiments, using raw sanitary landfill leachate.

The optimum efficiencies were realized by using the particle size of 0.930 μm, stirrer speed of 250 rpm, zeolite dosage of 133 g/L and pH of 8, resulting to NH_4^+-N removals from 36.70±3.72 % to 53.67±0.29 % at the first 5 min of the adsorption process. The percent removal efficiencies of COD and color reached up to 22.85±1.15 % and 27.53±1.72 %, respectively.

Ultimate aim of the current study is the development and application of a cost-effective and efficient solution in the sanitary landfill sites.

REFERENCES

[1] Lim CK, Seow TW, Neoh CH, Nor MHM, Ibrahim Z, Ware I, Sarip SHM. 2016. *3 Biotech*, 6(2): 195.
[2] Bashir MJ, Xian TM, Shehzad A, Sethupahi S, Choon Aun N, Abu Amr S. 2017. *Geosystem Engineering*, 20(1): 9-20.