

NOTE

Removal of Ammonium Ions from Wastewater Using Natural Zeolites

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A few varieties of zeolite crystals, viz., heulandite, clinoptilolite, stilbite, natrolite and scolecite, were collected from different localities of Marathwada region of India. Each zeolite variety was treated with a domestic wastewater sample. In each case ppm level of NH_4^+ ions of pre-treated and post-treated liquid was determined. It has been found that clinoptilolite and heulandite exhibit a high potential for the removal of ammonium ions from wastewater.

Key Words: Natural zeolites, NH_4^+ ion, Wastewates.

The widespread use of chemical fertilizers and contamination of water sources with industrial wastes, increases the concentration of nitrogenous compounds in water bodies. These compounds, especially ammonium ions in high concentration, adversely affect the purity of water, lowering its quality, increasing algae and contaminating lakes, ponds and rivers. According to existing norms in drinking water ammonium concentration should not exceed 0.5 ppm.

The removal of nitrogenous compounds from wastes can be performed using physico-chemical methods. This includes adsorption by activated charcoal, chemical coagulation, ion exchange, etc. These methods have both advantages and defects¹. Use of ion exchange resins for removal of ammonium ions on large scale is practically difficult due to high input costs and subsequent regeneration of resins.

Zeolites belonging to platy family possess selective ion exchange property for ammonium ions. Clinoptilolite, a member of this family, possesses high selective exchange property towards ammonium ions. It has been used to remove $\text{NH}_3/\text{NH}_4^+$ from wastewater, in wastewater treatment facilities mostly as pilot plants in Hungary, Japan, South Africa and the United States²⁻⁴.

Owing to the availability of natural zeolites, especially heulandite and stilbite,

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in abundance in Marathwada region of India, their utility in removal of ammonium ions from wastewater has been attempted⁵.

Treatment: All the zeolites were crushed and sieved to get 200 μm sized crystals. Municipal wastewater has been used for the study. Presence of ammonium ions was determined by Nesslerization method⁶.

Each zeolite sample was assessed separately for its capacity to remove ammonium ions from the water sample. Pre- and post-ppm level of ammonium ions in the water sample was determined (Table-1). The regeneration of zeolites was done by using 0.5 M NaCl solution.

TABLE-1
EFFECT OF DIFFERENT ZEOLITES AS
REMOVAL OF IONS FROM WATER

Zeolite	Concentration of NH_4^+ in ppm		Removal
	Initial	Final	
Clinoptilolite	25	3.40	21.60
Heulandite	25	6.00	19.00
Stilbite	25	11.30	13.70
Natrolite	25	20.00	5.00
Scolecite	25	20.00	5.00

Treatment of different zeolites with wastewater exhibits ion exchange property. It reveals that these zeolites were capable of removing ammonium ions from wastewater. The most effective zeolite was found to be clinoptilolite thereby removing 21.6 ppm of NH_4^+ ions followed by heulandite removing 19.00 ppm of NH_4^+ ions and stilbite removing 13.7 ppm of NH_4^+ ions. The natrolite and scolecite were relatively less effective.

Clinoptilolite and philipsite have been already implicated for removal of NH_4^+ ions in the pilot plants in various European countries^{7,8}. For the first time heulandite, stilbite, natrolite and scolecite were used for the removal of NH_4^+ ions and utility of these zeolites is being tested in the pilot scale plant.

These zeolites were easily regenerated and reusable. However, no change in their ability to remove NH_4^+ ions was recorded after regeneration.

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