

ABSTRACT

For many years soils have been used to remove ammonium ions from wastewater with the resulting renovated water being used for groundwater recharge. This process relies on the cation adsorption capacity of the soil.

In Perth, Western Australia it has been found that the local soil has very little adsorption capacity. This work investigates the potential of alumina refinery solid residues (red mud and process sand) to be used for removal of ammonium from wastewater.

A mix of 32% red mud with 68% process sand has been shown to give the required percolation rate and to satisfactorily remove ammonia from simulated wastewater. However the effluent from the red mud-sand mix has high pH and sodium content rendering the treated effluent suitable only for recharge where the end use is industrial or to prevent saline intrusion.

The literature regarding utilization of red mud and wastewater treatment by soil systems is reviewed. No previous reference is found to the use of red mud for wastewater renovation for groundwater recharge.

Theoretical curves approximating the data have been obtained using the optimisation method of Cameron and Klute (1977). However better rate data must be obtained from batch tests to give credence to the models.

It is concluded that -

- (i) Ammonium nitrogen can be removed from secondary sewage effluent to a desired level by flooding and drying operations using a soil of sufficiently high cation exchange capacity.
- (ii) Red Mud-process sand mixes can be used as the soil for such a recharge operation, but the results obtained are little better than those obtained by Mathew (1981) using a Pyrtan loam - Spearwood sand mix with a lower measured cation exchange capacity.
- (iii) The adsorption mechanism is complicated by the presence of compounds in the red mud which hydrolyse under near neutral conditions.
- (iv) A major portion of the adsorption takes place very quickly, but is dependent upon ammonia concentration. In addition the time dependent portion of the adsorption capacity is significant.
- (v) Batch equilibrium isotherm results provide information which correlates to the column data.
- (vi) Dispersion effects do not appear to affect the pattern of the breakthrough curve within the range of recharge velocities normally used.

- (vii) The effluent from the red mud-process sand mix when ammonium solutions are passed through it has too high a pH and too high a sodium content to be suitable for groundwater recharge for reuse for either domestic or agricultural purposes.

- (viii) Waste water renovated through a layer of the mix could conceivably be used for recharge of groundwater for industrial use or for preventing saline wedge intrusion into heavily pumped coastal aquifers.

It is recommended that further laboratory work and a field trial be undertaken.

Keywords.

Adsorption, cation exchange, wastewater renovation, red mud, groundwater recharge, ammonium.