

ABSTRACT

A feasibility study into the use of ion exchange technology for in-house treatment of wastewater from a nitrous oxide (N_2O) production plant was carried out at the AFROX Northern Operations GOC in Gauteng.

The N_2O plant at GOC produces large quantities of acidic wastewater effluent on a daily basis. Municipal by-laws require the company to either treat this wastewater effluent before discharging it into the municipal sewer or to use a suitable wastewater removal company to remove the effluent and discharge it at an approved wastewater disposal site.

The objectives of this study were three-fold:

- to propose the best approach technologically, for treating N_2O wastewater produced by GOC such that it reaches regulatory requirements for discharge into the municipal sewer system;
- to determine whether the proposed treatment method may produce reclaimed water that may have alternative beneficial uses (for example, in boilers or coolers); and
- to carry out a cost-benefit analysis that compares the financial feasibility of the proposed in-house treatment method over the existing practice of outsourcing wastewater removal and disposal.

The study makes suggestions as to a suitable technique for wastewater treatment and reuse in the N_2O production plant. Although the actual implementation of the findings will depend on AFROX, adoption of these findings will ensure that AFROX Northern Operations GOC goes beyond reactive compliance with environmental regulations and takes a step towards sustainable water usage – with benefits for both the company and the environment.

Results from the laboratory bench-scale tests indicated that weak base anion (WBA) resins (Lewatit MP 68) with a theoretical capacity of 1.3 eq/L were suitable for

treatment of the high strength and high nitrate concentration wastewater however their limited operating capacity impacted their effectiveness in recovering large amounts of the treated wastewater. The test further indicated that for ion exchange technology to be used successfully to treat the high strength wastewater, a high capacity special resin, LEWATIT A356 with theoretical capacity of 3.4 eq/L and operating capacity of 1.92 eq/L ought to be employed.