EXECUTIVE SUMMARY

The removal of organic pollutants from water in both industrial and municipal water is a great challenge to water providers worldwide. Some of these pollutants are very toxic and pose serious health risks to humans and animals. Additionally, the presence of organic pollutants in the water often leads to the corrosion of the turbines that are used for power generation at power stations. This obviously makes the power generation process less efficient and thus has cost implications, especially for the end user. Besides the corrosion of turbines, the removal of contaminants from water contaminated with organic pollutants also has a bearing on the total cost of generating clean water. To this end, municipalities and industries sourcing water from Rand Water's treatment plants and Eskom's power stations are plagued by high water costs.

Geosmin and 2-MIB are detectable by the human nose at concentration levels as low as 10 ng/L. These compounds are common water pollutants and are renowned to cause bad taste and odour in drinking water. Although geosmin and 2-MIB do not pose any serious health risks to humans, they impact on the aesthetic and consumer acceptability of drinking water. Currently available technologies such as activated carbon are unable to remove these pollutants to low levels (i.e. ppb levels). In our laboratories, we have found cyclodextrin polymers to be effective in the removal of a range of organic pollutants from water to ppb levels. However, these investigations were confined to water samples deliberately spiked with specific pollutants and have not been proven with "real" water samples. We sought to integrate data accumulated in the laboratory by testing and applying these polymers on a larger scale and on real systems.

Cyclodextrin-based polyurethanes were employed in the removal of 2-MIB, geosmin and other organic pollutants in environmental water sampled from Lethabo Power Station (Eskom) and Zuikerbosch Water Treatment Plant (Rand Water). The water samples were extracted using Solid Phase Microextraction (SPME) and thereafter identified and quantified using gas chromatography/mass spectroscopy (GC/MS). The new cyclodextrin polymer technology was compared with treatment methods currently applied at the power station and treatment plant. To determine the environmental friendliness of this technology, biodegradation studies were also carried out. These entail performing soil burial tests prior to the characterization of the polymers using thermogravimetric analysis (TGA), Fourier transform infra-red (FTIR), scanning electron microscopy (SEM) and Braunner Emmet Tellet (BET).

The extraction and analysis of geosmin, 2-MIB and other pollutants using SPME and analysed using GC/MS, respectively, were successful. Also, the removal of geosmin and 2-MIB from the two types of samples (i.e. the Rand Water and Eskom samples) to ppb levels was achieved using the cyclodextrin polymers. These polymers showed negligible degradation upon exposure to the different types of soil over a period of 119 days.