Abstract

Human consumption of water contaminated with faecal pollutants is the source of most sanitation related diseases. Excreta related diseases can be controlled by improvements in excreta disposal. The primary consideration is to remove contact between the people and the faecal matter. The conventional waterborne sewage system is not an achievable minimum standard in dense peri-urban areas in the short term, due to its high cost. A need for a cost effective system that is easily maintained and does not require electricity or highly skilled labour for developing communities in South Africa was identified. The objective of this investigation was to assess the suitability of the Anaerobic Baffled reactor (ABR) as a primary onsite treatment system for low-income communities.

The ABR is a high-rate compartmentalised anaerobic bioreactor, the design of which promotes the spatial separation of microorganisms. The trials were conducted on a 3200 L pilot-scale reactor placed at Kingsburgh wastewater treatment works, which receives only domestic wastewater. The ABR proved to be stable and consistent in its performance. Operating at a hydraulic retention time of 22.5 h, the reactor effluent was **ca.** 200 mgCOD/L. The 0.45µm filtered (soluble) COD was 100 mg/L, indicating there was approximately 100 mg/L of COD in the effluent that was in particulate form. The ABR achieved 60%VSS and 50%TSS removal with effluent TSS content of about 225 mg/L. The system was hydraulically overloaded and organically under loaded. The Biochemical Methane Potential tests showed that 60% of the COD in the effluent was biodegradable, and the effluent COD could be reduced to less than 100 mgCOD/L if the HRT is increased giving a possible removal of 80%. The analytical campaign revealed that we were sampling at peak flow, when COD was high. The average COD fed to the reactor was much lower than that showed by routine analysis and the ABR had a “true” COD removal of 42%. The reactor was able to handle the daily variation of the wastewater.

Settling tests were done to measure how much of the suspended solids in the ABR are retained at the operating upflow velocity. The method selected was shown to have an error that ranged from 5 to 42%, and the ABR was retaining between 60 and 90% of solids in the reactor at an upflow velocity of 0.5m/h.

The preliminary work with the fabric membrane showed great potential benefits that can be gained if it had to be included. It showed good ability to remove indicator organism and solids that contributed a lot to the effluent COD. The membrane had 5 log removal of indicator organism and 80% reduction of COD. The membrane was operated for a short time before clogging; its operational lifespan needs to be greatly extended before it can be used with the reactor in a community. Since there is no nutrient removal in the ABR, the effluent can be used for food production provided sufficient pathogens removal is achieved.

Provided that the first compartment can be modified and the concentration of pathogens in the effluent is sufficiently reduced, the ABR can be considered for use in a community.