

ABSTRACT

Sharvelle, Sybil E. Ph.D., Purdue University, December, 2006. Application of a Biotrickling Filter for the Simultaneous Treatment of Graywater and a Waste Gas Contaminated with NH_3 and H_2S . Major Professor: M. Katherine Banks.

A set of bench scale biotrickling filters were designed and operated for simultaneous treatment of graywater and waste containing elevated levels of ammonia (NH_3) and hydrogen sulfide (H_2S). Preliminary experiments were conducted to optimize graywater processing in the reactors. While surfactants have been considered to be readily biodegradable removal of carbon from graywater was not as high as expected during preliminary experiments where no waste gas was supplied to the system. Removal efficiency was not improved after several modifications to reactor design and it was hypothesized that complete removal of surfactants and their relevant biodegradation metabolites was a challenge. Therefore, surfactant biodegradation was studied in detail. Experimental work showed that while all three surfactants studied exhibited rapid primary biodegradation, secondary biodegradation of metabolites was very slow. For the case of the amphoteric surfactant studied, disodium cocoamphodiacetate, metabolites seemed to be recalcitrant. A mathematical model was developed to describe the biotrickling filter processes and this model was used to conduct a sensitivity analysis so that governing processes within the biotrickling filter could be determined. Important design parameters were elucidated as well as parameters inherent to the system, or intrinsic parameters. Results showed that optimization of wetted area in the biotrickling filter could significantly improve process performance. Therefore, a set of tracer test experiments was conducted to examine the effects of packing material and hydraulic loading rate on hydrodynamics in the bench scale biotrickling filters. Of the packing materials tested, the use of Jaeger Rings in the biotrickling filters resulted in optimized hydrodynamics. "Proof of Concept" was established for simultaneous treatment of

graywater and waste gas in the studied biotrickling filters. Complete removal of gas phase contaminants was achieved while removal of carbonaceous compounds from graywater remained stable.

