Biological Treatment of Water Disinfection Byproducts using Biotricking Filter under Anaerobic Conditions

Abstract

The chlorination of potable water leads to the formation of harmful disinfection byproducts (DBPs) such as trihalomethanes (THMs) and haloacetic acids (HAAs). Many of these compounds are volatile organic compounds (VOCs). DBPs may be controlled by reducing the precursors used in conventional enhanced coagulation or enhanced water softening processes. The removal of DBPs from water is challenging. Water aeration and adsorption on activated carbon are traditionally used. However, the need for innovative control technologies is becoming more and more enviable. A novel, integrated technology that uses gas strip of DBPs and treating the gas phase with a biotrickling filter (BTF) system was proposed. Computer simulation was used to determine the optimum air-to-water ratio for gas stripping of DBP. The effects of microorganisms, co-metabolites, and reaction conditions on the biodegradation of chloroform were investigated. The degradation of chloroform achieved was primarily due to co-metabolism by the ethanol reducing enzymes; however, the results indicate that chloroform partially induced its own degradation. Chloroform removal efficiencies achieved with the BTF were greater than 59% with an empty bed retention time of five minutes, and an optimum loading rate of 0.6 g/m^3hr. Batch studies demonstrated that more than 94% of the chloroform can be removed using a combination of methangenic bacteria and reduction with zero valent iron.

Key Words: disinfection by-products, chloroform, bio trickling filter, anaerobic biodegradation