



Effect of a geotextile filter on leachate quality in a recirculated landfill bioreactor

Cevat Yaman*, Yusuf Küçükağa

Environmental Engineering Department, Faculty of Engineering, Gebze Technical University, Kocaeli TR41400, Turkey, emails: cevatyaman@yahoo.com (C. Yaman), yusufkucukaga@gmail.com (Y. Küçükağa)

Received 14 November 2016; Accepted 11 May 2017

ABSTRACT

Landfills cause various problems for local authorities, such as contamination of soil and water with toxins, the formation of leachate and the release of landfill gases. More economical and applicable innovative solutions to overcome these problems will be an advantage for local authorities. One of the problems that local authorities face during the operation of landfills is the cost of leachate treatment due to high energy consumption. The objective of this study is, with the use of two laboratory-scale anaerobic bioreactors, to improve leachate quality by using a polymeric geotextile (GT) material placed horizontally in the drainage layer of a lab-scale landfill bioreactor (LBR). The simulated LBR equipped with the geotextile filter (LBR-GT) achieved faster leachate quality improvement than the control reactor (LBR-C). Scanning electron microscope images showed that the GT filters allowed the biofilm to grow not only on the surface but also in the interior pores, which increased the interactions between the biomass and the organics. In this way, the leachate quality improved in a short time as a result of the high biomass growth in the GT filter. The chemical oxygen demand (COD), the 5-d biochemical oxygen demand (BOD₅), the pH, the oxidation reduction potential (ORP) and other operating parameters in the leachate were regularly monitored. The LBR-GT reached a –300 mV ORP value on the 54th day, while the LBR-C reached the same ORP value on the 145th day. After 208 d of anaerobic incubation, the removal rates for the COD and BOD₅ in LBR-C were 93% and 96%, respectively, whereas in the LBR-GT, the removal rates were 96% and 99%, respectively. The main result of this study was that the LBR-GT took only 90 d to reach 90% COD removal rate, whereas the LBR-C took 166 d to reach the same removal rate.

Keywords: Solid waste; Leachate quality; Geotextile; Landfill bioreactor

* Corresponding author.