Desalination and Water Treatment
www.deswater.com
32 (2011) 397–403
August
1944-3994 / 1944-3986 © 2011 Desalination Publications. All rights reserved.
doi: 10.5004/dwt.2011.2758

Performance evaluation of chemical precipitation and upflow anaerobic floating filter hybrid processes for piggery wastewater treatment

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Received 27 August 2010 ; Accepted in revised form 1 March 2011

ABSTRACT

The study was conducted to study the performance evaluation of chemical precipitation (CP) combined with upflow anaerobic floating filter (UAFF) hybrid processes for the treatment of raw piggery wastewater. Several series of experiments have been carried out in the laboratory-scale unit using ten times diluted raw piggery wastewater, involving CP and UAFF processes operating separately and combined. The best operating conditions for the combined process were determined by optimizing the sub-processes (CP and UAFF separately). In the CP sub-unit various types and dosages of coagulants were examined including: aluminium sulfate ($Al_2(SO_4)_3$), poly aluminium chloride (PAC), ferric chloride ($FeCl_3$), ferric sulfate ($Fe_2(SO_4)_3$), ferrous sulfate ($FeSO_4$) and ferrous chloride ($FeCl_2$). Aluminium and ferric coagulants have shown the higher removal efficiency and aluminium sulfate ($Al_2(SO_4)_3$) was chosen for further experiments. Organic loading rate (OLR) and chemical constitutes caused by acid coagulants in CP have shown a significant effect on biogas production rate. Combined process of CP followed by UAFF has shown 90–95% of COD, 95–98% of SS, 75–80% of Color and 91–95% of TP removal efficiencies. There was 10–25% of increase in the removals of COD, SS and Color in comparison to the results obtained after treating the wastewater with only one of the methods — CP or UAFF. Further 3–10% of increase in the removal was observed in the process of UAFF followed by CP in comparison to results achieved from the CP followed by UAFF process, while nutrients removal was insignificant. Sludge blanket (70% of total biomass) also played an important role for the increase of removal efficiency.

Keywords: Piggery wastewater; Chemical precipitation; Anaerobic reactor; Biogas generation