The Use of Reactive Materials in Septic Systems for Pathogens and Nitrate Removal

Details

Meeting	2009 Joint Assembly
Section	International Association of Hydrogeologists - Canadian National Chapter
Session	Pathogens and Groundwater Source Zones
Identifier	IA23B-10
Authors	Suhogusoff, A V*, Universidade de São Paulo, Rua do Lago, 562 Butantã, São Paulo, SP 05508-080, Brazil Suhogusoff, A V*, University of Waterloo, 200 University Avenue West, Waterloo, ON N2L 3G1, Canada Hirata, R A, Universidade de São Paulo, Rua do Lago, 562 Butantã, São Paulo, SP 05508-080, Brazil Aravena, R, University of Waterloo, 200 University Avenue West, Waterloo, ON N2L 3G1, Canada Stimson, J, University of Waterloo, 200 University Avenue West, Waterloo, ON N2L 3G1, Canada Robertson, W, University of Waterloo, 200 University Avenue West, Waterloo, ON N2L 3G1, Canada
Index Terms	Groundwater hydrology [1829] Groundwater quality [1831] Groundwater transport [1832] Human impacts [1834]

Abstract

The developing countries have an urgent need for cheap and efficient techniques for the improvement of sanitary conditions in areas without public water supply and sewerage system, especially in suburban regions or irregular occupation areas, where there is a great lack of social assistance. In this type of situations, the inhabitants use dug wells for water use and cesspits for disposal of sewage, which usually contaminates the groundwater with nitrate and microorganisms. As part of a study aiming to develop new sewage treatment systems in an irregular occupation area located at the District of Barragem, south region of the municipality of São Paulo (Brazil), a conventional cesspit (named as "Control") and an alternative septic system were constructed and monitored for a year. The

design of the alternative septic system included a 1m thickness reactive barrier constituted by BOF (Budget Oxygen Furnace - a byproduct of the steel-making industry) for pathogens removal, then 1m sand package where the wastewater is oxidized and at the bottom the wastewater is in contact with a 0,5m thickness reactive barrier constituted by sawdust (carbon source), where redox conditions are very reducing and denitrification and even methanogenesis can take place. The chemical and biological data collected in the alternative septic system showed complete removal of the pathogens in the BOF barrier, then nitrification occurred between the BOF and the bottom of sand package. However denitrification in the sawdust barrier was incomplete because of the high pH caused by the BOF materials, which can reduced the number of denitrifiers bacteria present in the sawdust barrier. Isotope analyses that are been carried out in the residual nitrate will provided more information about the extent of the denitrification reaction in the alternative septic system. In case of the control cesspit, it was observed the occurrence of high concentration of ammonium, dissolved organic carbon, CO2, CH4 and low dissolved oxygen, which means the whole cesspit works like a septic tank, and probably nitrification will occur below the cesspit. It is possible that saturated conditions were achieved within the control cesspit, which reduced the input of oxygen in the wastewater. This study have shown for a better treatment of wastewater, the design should be a sand bed below septic tank for nitrification occurrence, followed by sawdust barrier for denitrification reaction, and then BOF barrier, whose high pH produced will be responsible for microorganisms removal.

Cite as: Author(s) (2009), Title, *Eos Trans. AGU, 90*(22), Jt. Assem. Suppl., Abstract IA23B-10