Influence of the C/N/P ratio on nitrate removal in a denitrifying biofilm fluidized bed reactor

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Reactors of attached biomass are highly effective, and hence are considered as a preferred technology in removing nitrogen from wastewater. With the aim of further improving the quality of waters, the research herein discussed presents a study of the process of biological removal of nitrates of a synthetic effluent with a low degree of nitrates (40-95 mgN-NO_3^-/L) using a fluidized bed reactor. *Alcaligenes denitrificans*, a heterotrophic microorganism, was an initial inoculum to seed the basalt used as the support of adherence. With the purpose of the study and the denitrification process optimisation, several C/N/P ratios were applied and the effects of variations in the removal of nitrates, organic carbon and residual nitrate accumulation were analysed. The findings from this experimentation showed that the phosphorus and the organic carbon were limiting factors to the removal efficiency of nitrates (Figure 1b). In the absence of the required concentrations of the phosphorus (Figure 1a) the denitrification efficiency was very low for any value of the applied ratio C/N, but the quantity of organic carbon removal recorded notable values. Figure 1b, *Zone A_3*, indicates that the amount of organic carbon supplied was insufficient for completing the denitrification process, but in *Zone B_3* when the organic carbon and the amount of phosphorus were sufficient the nitrate removal efficiency increased from 45 to 95%. The growth of the biofilm, expressed as biofilm thickness (see Table 1), was neither strongly affected by the different quantities of phosphorus employed nor by the applied ratios C/N. The ratio C/N experimentally achieved for no limiting organic carbon and phosphorus concentrations was of 3.4 mgC/mgN-NO_3^-, being approximately twice the value of the stoichiometric requisites (1.43 mgC/mgN-NO_3^-). The values recorded for the specific denitrification rate were comprised within the ranged between 0.001 and 0.002 mgN-NO_3^-/mgSV h.

Table 1- The effect of C/N/P conditions in the denitrifying activity

C/N ratio applied (mgC/mgN-NO_X^-)	[P] (mgP/L)	Mean Thickness (µm)	Experimental C/N ratio (mgC/mgN-NO_X^-)	Denitrifying Activity (%)
1.78	**[7×P]** = 1.14	0.395	0.08	45
3.60	**[7×P]** = 1.14	0.402	3.40	**93**
3.60	**[3×P]** = 0.49	0.344	3.40	49
1.81	**[P]** = 0.16	0.384	0.25	15
1.43	**[P]** = 0.16	0.385	0.25	25

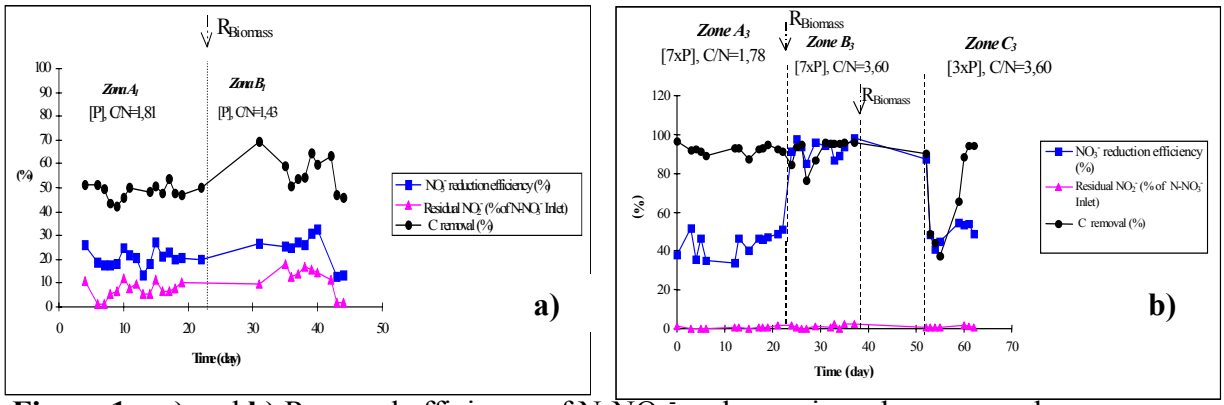

Figure 1 – a) and **b)** Removal efficiency of N-NO_x^- and organic carbon removal.