EFFECT OF C/N RATIO IN SIMULTANEUS DENITRIFICATION AND METHANOGENESIS IN AN EGSB REACTOR

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Introduction. Industrial effluents such as seafood processing contain high levels of nitrate but an insufficient amount of electron donor (organic matter) to sustain biological denitrification. An alternative for the wastewater treatment is to combine the anaerobic digestion and the nitrate reduction process in a single unit and allow partial conversion of organic matter into energy (1, 2).
Recent investigations have shown that it is possible to maintain both processes in a single reactor, as in the expanded granular sludge bed reactor (EGSB), in which can be removed nitrate and organic matter simultaneously, but it has not been investigated precisely the effect of the composition of the influent in this kind of reactors (3).
To aim this work it was studied the effect of C/N ratio in simultaneous denitrification and methanogenesis in an EGSB reactor.

Methods. During studies, a 3 L reactor was used with a flow feed of 3 L/d, upflow velocities from 3 to 7 m/h and temperature of 30 °C. Reactor was inoculated with 900 mL of anaerobic granular sludge from a plant treating brewery wastewater, never exposed to nitrate before. Different C/N ratios were studied in this reactor by keeping a constant carbon source.
Nitrate was determined by cadmium reduction and nitrite by the sulphanilamide acid reaction (4). Biomass was determined by volatile solid suspended concentration and COD was measured by closed reflux dichromate oxidation, based both on standard methods.

Results. In the continuous studies the organic matter removal remained above 90% throughout all days of experimentation. This removal was carried out by the participation of both consortia, where it was observed that at high C/N ratios methanogenic activity predominated, whereas at low ratios degradation was carried out mainly by denitrifying bacteria and intermediate relations (C/N of 3) 50% participated in both consortia (Table 1).
Nitrogen removals were over 90%, when C/N ratios were greater than the stoichiometric (C/N>1), whereas in the ratio C/N=1 nitrogen removal was 60%, causing the accumulation of nitrite (Table 1).
The results demonstrated that the use of C/N ratios close to the stoichiometric (1.4, which includes the formation of biomass) allows high denitrification efficiencies without intermediates accumulations, whereas the use of high ratios cause a significant allowing methanogenic activity thus have two processes in one reactor (5).

Table 1. Operating conditions in the EGSB reactor.

C/N ratio	Time (days)	COD (g/L)	COD removal (%)	Nitrate (g/L)	Nitrate removal (%)
10	12	2	94	0.33	98
7	14	2	97	0.47	92
4	30	2	91	0.83	90
3	20	2	96	1.10	94
2	20	2	92	1.65	93
1	17	2	90	3.30	60

On the other hand, the increase of nitrate concentration changed the biomass distribution, which caused a decrease in the anaerobic granules size (Fig. 1).

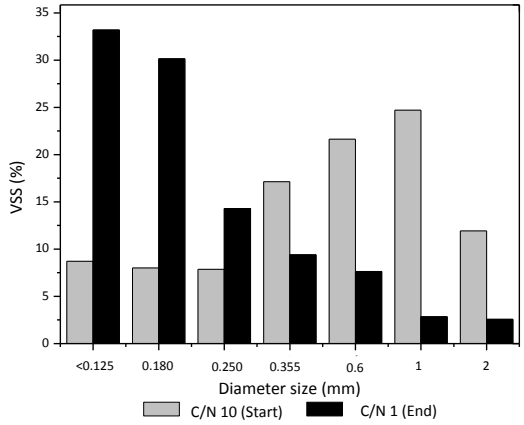

Fig.1 Granulometry made at the beginning and end of the process of simultaneous nitrification and methanogenesis.

Conclusions. The high nitrate and organic matter removals obtained in this study demonstrate the feasibility of using high rate reactors (EGSB) for fisheries wastewater treatment.

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