EFFECT OF SULFIDE IN A NITRIFYING SEQUENTIAL BATCH REACTOR

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Introduction. Diverse industries generate wastewaters with high concentrations of ammonium and sulfide. Nitrification and denitrification biological processes are used to transform ammonium into N_2 (1). However, knowledge on the inhibitory effects of sulfide on the nitrification respiratory process is still limited (2). Previous results showed that nitrifying sequential batch reactor (SBR) might be a good alternative to eliminate simultaneously ammonium and inhibitory compounds from wastewaters throughout the operation cycles (3).
The aim of this study was to evaluate the effect of sulfide on the nitrifying respiratory process in a SBR.

Methods. A laboratory-scale 2.0 L SBR was operated with cycles of 12 h. Each cycle consisted of the four following periods: fill (0.08 h), reaction (11.25 h), settle (0.25 h) and draw (0.42 h). The biomass used for inoculating the SBR (400 ± 35 mg microbial protein/L) was obtained from a continuous reactor in steady-state nitrification. The operating conditions and the culture medium composition were similar to those described by Texier and Gomez (3). Sulfide was added to the reactor at the following initial concentrations (mg HS^--S/L): 0.0 (cycles 0-117), 2.5 (cycles 118-163), and 5.0 (cycles 164-206). Samples were withdrawn at different times over 12 h cycles for conducting kinetic studies (3).

Results. In spite of the sulfide addition, the overall nitrifying performance of the SBR culture did not change significantly (Fig. 1). The ammonium consumption efficiency (E_{NH4}) was 99.0% ± 1.0 and the nitrate production yield (Y_{NO3}) of 0.96 ± 0.02 mg NO_3^--N/mg NH_4^+-N consumed. Nitrite was never detected at the end of culture. However, an inhibitory effect of sulfide on nitrification was observed through a decrease in the specific rates of the process (Table 1). The specific rates decreased by 30 to 50% for NH_4^+ consumption and by 7 to 42% for NO_3^-

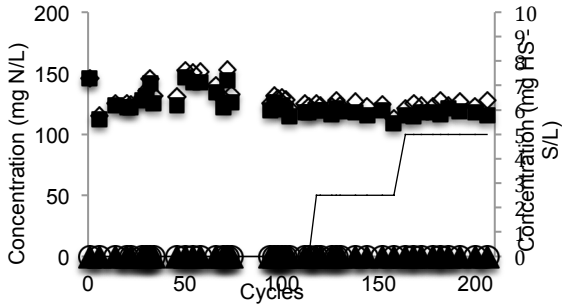

Fig. 1 Nitrification process in a SBR fed with sulfide (NH_4^+-N in ◊; NH_4^+-N out ○; NO_3^--N out ■; NO_2^--N out ▲; HS^--S —)

These preliminary results would suggest that the ammonium oxidation to nitrite (first step of nitrification) is a process more sensitive to sulfide than the nitrite oxidation to nitrate (second step of nitrification) in the reactor, as previously observed in a nitrifying SBR fed with *p*-cresol (3).

Table 1. Specific rates of ammonium consumption and nitrate formation in a nitrifying SBR culture at different initial sulfide concentrations.

HS^--S (mg/L)	q_{NH4+} (mg NH_4^+-N/mg microbial protein.h)	q_{NO3-} (mg NO_3^--N/mg microbial protein.h)
0.0	0.070 ± 0.007	0.045 ± 0.006
2.5	0.049 ± 0.007	0.042 ± 0.004
5.0	0.035 ± 0.004	0.026 ± 0.002

Conclusions. Although sulfide showed inhibitory effect on nitrification processes, the SBR culture with addition of sulfide (0-5 mg HS^--S/L) maintained a stable nitrifying activity along the cycles with high values of efficiency and nitrate yield.

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References.

1. Bernet N., Spérandio M. (2009). Application of biological treatment systems for nitrogen-rich wastewaters. In: *Advanced Biological Treatment Processes for Industrial Wastewaters*. IWA Publishing, London. 186-208.
2. Bejarano D.I., Thalasso F., Cuervo-López F.M., Texier A.-C. (2013). J. *Chem. Technol. Biotechnol.* DOI 10.1002/jctb.3982.
3. Texier A.-C., Gomez J. (2007). *Water Res* 41:315-322.