# KINETIC STUDY OF NITRIFICATION IN PRESENCE OF PHENOLIC COMPOUNDS IN A SENQUENCING BATCH REACTOR

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**Introduction.** Ammonium and phenolic compounds such as cresols are present at high concentrations in wastewaters produced by industries petrochemical, chemical, steel manufacturing and resin producing industries (Suárez-Ojeda et al. 2007). These compounds provoke undesirable severe effects on the environment and human health, such as eutrophication, bioaccumulation and toxicity. Moreover, it is of interest to carry out investigations on the simultaneous removal of nutrients and recalcitrant organic compounds in dynamic systems such as sequential batch reactor (SBR). The aim of this study was to evaluate the kinetic behavior and tolerance ability of a nitrifying sludge exposed to binary mixture of *m*-cresol and phenol (10 mg/L of each one) in a SBR.

**Methods.** A laboratory-scale SBR with a working volume of 1.5 L was operated during 2 months with initial microbial total protein nitrifying concentration of 220 ± 5 mg/L according to the operating conditions described in Table 1. Air was provided into the system at a constant flow of 2 VVM. Temperature and stirring were kept constant at 30 ºC and 300 rpm respectively, and initial pH value was 8.5. Samples were withdrawn daily at the end of the SBR cycle and at different times during each cycle in order to perform the nitrification kinetic studies. All samples were analyzed for $NH_4^+$-N, $NO_2^-$-N, $NO_3^-$-N, *m*-cresol and phenol.

**Results.** Control SBR cultures without aromatic compounds were conducted to ensure that the nitrification process proceeded successfully under experimental conditions. A high $NH_4^+$-N, phenol and *m*-cresol consumption efficiency (100%) coupled with a high rate of conversion of ammonium to nitrate (98 ± 2%) was attained. Specific rates of $NH_4^+$-N removal and $NO_3^-$-N production were 1.783 g/g microbial protein-N h and 0.787 g/g microbial protein-N h, respectively. These values were used as the control specific rate values reported in Table 1. At the end of each SBR cycle, no intermediary nitrite was present in the effluent. The kinetic profiles were established for $NH_4^+$-N, $NO_2^-$-N and $NO_3^-$-N at different cycles with mixture of phenol and *m*-cresol initial concentrations of 20 mg/L. The specific rates of $NH_4^+$-N removal and $NO_3^-$-N production are shown in Table 1.

**Table 1.** Operation conditions and specific rates nitrifying in presence or absence of phenol and *m*-cresol mixture

| Cycle | Phenol and *m*-cresol mixture (mg/L) | Duration (h) | Specific rate | |
|---|---|---|---|---|
| | | | $NH_4^+$-N consumption | $NO_3^-$-N production |
| 1-38 | 0 | 12 | 1.783 | 0.787 |
| 39 | 20 | 24 | 0.079 (96%) | 0.378 (52%) |
| 45 | 20 | 24 | 0.394 (78%) | 0.234 (70%) |
| 51 | 20 | 24 | 0.405 (77%) | 0.390 (50%) |
| 57 | 20 | 24 | 0.838 (53%) | 0.670 (15%) |
| 63 | 20 | 12 | 0.827 (53%) | 0.580 (26%) |

The results indicated that a mixture of 20 mg C/L of aromatic compounds provoked the inhibition of the nitrifying process, wich was decreased with the number of SBR cycles. The ammonia-oxidizers activity was more affected than the nitrite-oxidizers by the presence of aromatic compounds. These results may suggest that use of a SBR system promoted the metabolic adaptation of the microorganisms nitrifying (Texier 2007, Data et al. 2009).

**Conclusions.** The results showed that the ammonia oxidizing bacteria were the most affected by the presence of aromatic compounds. The SBR system allowed a substantial metabolic adaptation of the microorganisms nitrifying.

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