



Nitrophenol removal by simultaneous nitrification denitrification (SND) using *T. pantotropha* in sequencing batch reactors (SBR)

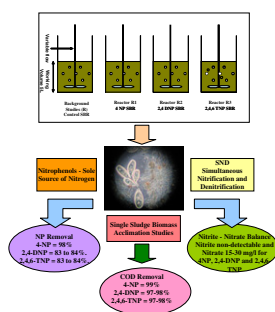
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HIGHLIGHTS

- ▶ Complete detoxification and degradation of nitrophenols was achieved via SND in SBR.
- ▶ SND was accomplished with a single sludge biomass containing *Thiosphaera pantotropha*.
- ▶ *T. pantotropha* can provide an attractive choice for SBR due to high potential of SND.
- ▶ Total nitrogen removal was achieved along with nitrophenol removal.
- ▶ SND based SBR offers operational simplicity and flexibility along with high economy.

GRAPHICAL ABSTRACT



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ABSTRACT

Nitrophenol removal was assessed using four identical lab scale sequencing batch reactors R (background control), R1 (4-nitrophenol i.e. 4-NP), R2 (2,4-dinitrophenol i.e. 2,4-DNP), and R3 (2,4,6-trinitrophenol i.e. 2,4,6-TNP). In the present study, the SND based SBR system was used to carry out total nitrogen removal at reduced aeration (DO = 2 mg/L) using a specifically designed single sludge biomass containing *Thiosphaera pantotropha*. The concentration of each of the nitrophenols was gradually increased from 2.5 to 200 mg/L during acclimation. The nitrophenols were used as the sole source of nitrogen during study. A synthetic feed was designed to direct SND in the bioreactors. It was observed that overall removal for 4-NP was 98% and for 2,4-DNP and 2,4,6 TNP, removals varied between 83% and 84%. The COD removal for 4-NP was 99% and for 2,4-DNP and 2,4,6-TNP was 97–98% during acclimation. Total nitrogen and nitrophenol removals were achieved via SND.

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1. Introduction

Nitroaromatics are important synthons due to the versatile chemistry of the nitro group. Nitro substituted aromatic

compounds such as nitrophenols are important building blocks and intermediates for large-scale production of pesticides, pharmaceuticals, plastics, azo dyes, pigments, wood preservatives, rubber chemicals and explosives (Bhatti et al., 2002; Karim and Gupta, 2006; Kulkarni, 2012). As these compounds are frequently used in industrial, agriculture and defense purposes, they are found into the effluents of these sources, soil and subsurface environment (Feng et al., 2011; Leven et al., 2012). During the production of nitrobenzene from benzene, TNP (2,4,6-trinitrophenol) and DNP (2,4-dinitrophenol) are generated as off-stream chemicals, which accumulate in industrial wastewaters. Hao et al. (1993) reported

Abbreviations: SND, simultaneous nitrification and denitrification; SBR, sequencing batch reactors; 4-NP, 4-nitrophenol; 2,4-DNP, 2,4-dinitrophenol; 2,4,6-TNP, 2,4,6-trinitrophenol; HRT, hydraulic retention time; COD, chemical oxygen demand; NO₂-N, nitrite nitrogen; NO₃-N, nitrate nitrogen; HPLC, high performance liquid chromatogram; DO, dissolved oxygen.

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