Kinetic and Physiological Evaluation of Ammonium and Nitrite Oxidation Processes in Presence of 2-Chlorophenol

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Abstract The effect of 2-chlorophenol (2-CP) on ammonium and nitrite-oxidizing processes was kinetically evaluated in batch cultures with nitrifying sludge at steady state. Assays with ammonium or nitrite as energy source and 2.5, 5.0, or 10.0 mg 2-CP-C/l were conducted. Control assays without 2-CP were also performed. Ammonium-oxidizing activity was completely inhibited at the different 2-CP concentrations, whereas nitrite-oxidizing activity was present as nitrite was completely consumed and converted to nitrate irrespectively of 2-CP concentration. In the presence of 2.5 and 5.0 mg 2-CP-C/l, no significant effect on specific rates of nitrite consumption and nitrate production was observed, but a significant decrease on these parameters was observed at 10.0 mg 2-CP-C/l. The nitrifying sludge previously exposed to 2-CP was unable to completely recover its ammonium and nitrite oxidation capacity. Nevertheless, complete 2-CP consumption was achieved in all assays. The effect of 2-CP on ammonium oxidation was observed at kinetic and metabolic pathway level, whereas the effect on nitrite oxidation was observed and kinetic level. The results obtained in this work evidenced that in order to achieve a successful nitrification process the presence in wastewater of even 2.5 mg 2-CP-C/l should be avoided.

Keywords Ammonium oxidation · 2-Chlorophenol · Inhibition · Nitrite oxidation · Membrane · Nitrification

Introduction

Chlorophenols are included in the rank of organic pollutants with a high priority for elimination [1]. These compounds are widely distributed in air, soil, water, and in many

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