RESPIRATORY BEHAVIOR OF DENITRIFYNG SLUDGE IN PRESENCE AND ABSENCE OF 2-CHLOROPHENOL

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Introduction. Chlorophenols are recalcitrant compounds, common in nature with harmful effects even at low concentrations. It has been possible to eliminate them by various anaerobic biological processes, however, information on the effect of 2-chlorophenol (2-CP) on denitrification is scarce.

The objective of this study was to evaluate the denitrifying process in presence and absence of 2-CP using different electron donors.

Methods. The inoculum used was obtained from a denitrifying UASB reactor in steady state. Denitrifying batch assays were realized in serologic bottles with work volume of 400 mL, amended with mineral medium and inoculated with 0.5 ± 0.03 gVSS/L of denitrifying sludge. Different initial concentrations of acetate, glucose or phenol (77, 127 or 177 mg C/L) and the corresponding nitrate concentration (25, 37.5 or 50 mg N/L) were used as control denitrifying assays. Similar assays containing 22.4 mg/L of 2-CP-C were also conducted. Substrate consumption efficiencies (E) and specific consumption and production rates (q) were the response variables.

Results. When using phenol as electron source in presence of 2-CP, E, q_{NO3-} and q_{phenol} decreased between 6 and 32 times, respectively, in comparison with the assays without 2-CP (Table 1). In presence of 2-CP and glucose, the q_{NO3-} decreased in 1.8 times. These results could be due to the toxic and/or inhibitory effect of chlorophenols [1, 2].
In contrast, the denitrifying process with acetate was not inhibited by 2-CP addition, on the contrary, it was enhanced as the q_{NO3-} and $q_{acetate}$ increased up to 1.3 and 2 times, respectively. This might be due to alterations in the cell membrane caused by the presence of 2-CP [3, 4], altering the fluidity of the membrane and improving acetate transport. therefore could increase the specific consumption rate.

Table 1. Kinetic parameters of denitrifying process using different electron donors in absence or presence of 2-CP

Electron donors (mg C /L)	qc^a	q_{NO3-}^a
In absence of 2-CP		
Phenol (77.6)	40.1 ± 11.7	12.3 ± 1.2
Phenol (127.6)	12.4± 0.4	16.6 ± 1.0
Phenol (177.6)	25.9 ± 4.1	24.6 ± 1.0
Acetate (77.6)	75.0 ± 1.6	58.7 ± 0.4
Acetate (127.6)	99.4 ± 6.6	84.1 ± 2.1
Acetate (177.6)	180.4 ± 0.9	88.1 ± 3.1
Glucose (77.6)	379.6 ± 2.8	43.1 ± 0.9
Glucose (127.6)	492 ± 39.8	66.9 ± 5.2
Glucose (177.6)	780.8 ± 28.0	51.8 ± 0.25
In presence of 2-CP		
Phenol (77.6)	1.2± 0.1	5.1 ± 0.3
Phenol (127.6)	1.7 ± 0.9	4.6 ± 1.8
Phenol (177.6)	4.6 ± 0.2	4.1 ± 0.3
Acetate (77.6)	150.6 ± 15.5	59.3 ± 15.4
Acetate (127.6)	215.1 ± 10.8	91.3 ± 0.5
Acetate (177.6)	369.1 ± 31.7	120.4 ± 2.1
Glucose (77.6)	226.2 ± 3.1	34.6 ± 1.9
Glucose (127.6)	527.5± 15.6	40.3 ± 0.1
Glucose (177.6)	780.8 ± 28.0	51.8 ± 0.2

[a] mg C or N/g VSS d

Conclusions. The denitrifying activity decreased in presence of 2-CP when phenol or glucose were the electron donors whereas the denitrifying process was not inhibited by the presence of 2-CP when acetate was the electron donor.

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References.

1. Pepelko, W.E., Gaylor, D.W., Mukerjee, D. (2005). Comparative toxic potency ranking of chlorophenols. *Toxicol. Ind. Health* **21**: 93-111.
2. Liu, X.-W., He, R., Shen, D-S. (2008). Studies on toxic effects of pentachlorophenol on the biological activity of anaerobic granular sludge. *J. Environ. Management*. **88**: 939-946.
3. Keweloh, H., Heipieper, H. (1996). Trans unsaturated fatty acids in bacteria. *Lipids* **31**: 129-137.
4. Kolomytseva, M.P., Solyanikova, I.P., Golovlev, E.L., Golovleva, L.A. (2005). Heterogeneity of *Rhodococcus opacus* 1CP as a response to stress induced by chlorophenols**.** *Appl. Biochem. Microbiol*. **41**:474-479.