

Persistence of Fermentative Process to Phenolic Toxicity in Groundwater

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Abstract

The fermentation process is an important component in the biodegradation of organic compounds in natural and contaminated systems. Comparing with terminal electron-accepting processes (TEAPs), however, research on fermentation processes has to some extent been ignored in the past decades, particularly on the persistence of fermentation process in the presence of toxic organic pollutants. Both field and laboratory studies, presented here, showed that microbial processes in a groundwater-based system exhibited a differential inhibitory response to toxicity of phenolic compounds from coal tar distillation, thus resulting in the accumulation of volatile fatty acids (VFAs) and hydrogen. This indicated that fermentation processes could be more resistant to phenol toxicity than the subsequent TEAPs such as methanogenesis and sulfate reduction, thus providing us with more options for enhancing bioremediation processes.

Table 1. Major compositions (mmol l^{-1}) of groundwater and pH.

Location	Phenol	m/p-cresol	o-cresol	NO_3^-	SO_4^{2-}	Fe^{2+}	PO_4^{3-}	Ca^{2+}	Mg^{2+}	Mn^{2+}	HCO_3^-	TOC	pH
CGW†	90	45	35	0.17	2.2	0.08	0.003	1.6	0.28	0.05	1.5	226	7.0
Inoculum‡	0.01	<0.01	<0.01	<0.01	<0.01	0.08	<0.1	0.55	0.30	<0.01	0.40	0.25	6.5
SGW§	0	0	0	0	0.21	0.01	0.30	0.55	0.33	<0.01	0.18	1.2	6.5

† Contaminated groundwater.

‡ Inoculum: Uncontaminated background groundwater.

§ SGW: Synthetic groundwater.

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