Effect of herbicide concentrations on centimetre-scale vertical variability of metabolic and cometabolic mineralization potentials around the groundwater table

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ABSTRACTS

Effect of herbicide concentrations on centimeter-scale vertical variability of metabolic and cometabolic mineralization potentials around the groundwater table

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Abstract

The effect of herbicide concentrations on the measured centimeter-scale vertical variability of metabolic and cometabolic (4-chloro-2-methylphenoxy)acetic acid (MCPA) mineralizations was investigated in the aquifer sediments surrounding the groundwater table. The mineralization potentials of ring labeled–benzoic acid (BA), ring labeled–MCPA and carboxyl labeled–MCPA were determined using 96-well microplate radio-respirometric analysis. The mineralization potentials were more variably distributed at high concentration (mg kg^{-1}) than at low concentration (µg kg^{-1}), which is likely due to the lack of indigenous microbial population adapted to mineralize high concentrations. At low concentration, the greater number of 20% carboxyl labeled–MCPA mineralizing samples was observed than that of ring labeled–MCPA mineralizing samples indicating that former MCPA was more favorable energy source for the indigenous microbial population. The cold soil extracts (CSE) and BA as additional substrates decreased the time needed to achieve 20% carboxyl labeled–MCPA mineralization around the groundwater table at low concentration, whereas only a few samples reached 20% mineralization at high concentration with or without additional substrates. The ring labeled–MCPA mineralization was stimulated through CSE and BA for a few sediments at low concentration and even fewer at high concentration. The impact of CSE was most seen in the lower part of the unsaturated zone (1.64–1.73 m below ground surface (b.g.s.)) and BA stimulated the uppermost part of the unsaturated zone (1.43–1.52 m b.g.s.) at low concentration. Our results indicate that both CSE, mimicking leaching of substrates from the overlaying soil layer, and BA have beneficial impacts on the mineralization potentials of ring labeled– and carboxyl labeled–MCPA particularly, at low herbicide concentration.

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Removal of pesticides in drinking water by novel use of AOPs

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Abstract

A recently started PhD study is focused on the introducing of advanced water treatment technology to the Danish water sector. The purpose of the study is to present a novel option for removing pesticides from drinking water, as an alternative to the two traditional solutions of either using activated carbon (GAC/PAC) or the costly process of establishing a new well.

The access to clean drinking water is by many considered to be a universal human right. However, due to both a quantitative and qualitative water crisis, it may be necessary to re-evaluate this belief. It is assessed that humans appropriate 54 % of the accessible renewable water resources today, and that at the same time the quality of water is deteriorating due to pollution with amongst other things micropollutants such as pesticides. (UN, Shiklomanov)

In Denmark, the pesticide treatment frequency for the agricultural sector, which indicates the pesticide load experienced by the environment, has in the period 1996 to 2010 increased from 1.92 to 2.8, in spite of political ambitions of reaching a level of 1.7. In the most recent survey of the quality of the Danish ground-water resources, pesticides were found in 36.8 % of the groundwater reservoirs, and above the 0.1 µg/L limit