Toxic effects of butyl elastomers on aerobic methane oxidation

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Large quantities of the potent greenhouse gas methane are liberated into the water column of marine and lacustrine environments where it may be consumed by aerobic methane oxidising bacteria before reaching the atmosphere. The reliable quantification of aerobic methane oxidation (MOx) rates is consequently of paramount importance for estimating methane budgets. A widely used set of methods for measuring MOx rates is based on the incubation of water samples during which the consumption of methane is monitored. Typically, incubation vessels are sealed with butyl rubber stoppers because these elastomers are essentially impermeable for gases at the relevant time scales. We tested the effect of different stopper materials (unmodified- and halogenated butyl rubber) on MOx activity. MOx rates in samples sealed with unmodified butyl rubber were > 75% lower compared to parallel incubations with halogenated butyl rubber seals, suggesting inhibiting/toxic effects associated with the use of unmodified butyl elastomers. In aqueous extracts of unmodified butyl stoppers, we detected various organic compounds including potential bactericides such as benzyltoluenes, phenylalkanes and benzuothiazoles. The inhibition of MOx is most probably caused by organic contaminants that bleed off from the unmodified butyl elastomer into the incubation water.

Multidisciplinary geophysical-geochemical analysis for qualitative renovation by artificial recharge of aquifers (WARBO LIFE)

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Large areas of the Po Valley proximal to the delta show serious problems related to salinization of the superficial aquifers which are vital for the sustainability of the agricultural activities in the area. Since 2012 the EU life WARBO project activities regards the application of integrated direct and indirect technologies aiming at the monitoring of the possibility to enhance ground water quality in two test sits. One test site is located few km's to the south of the Po River and about 40 km on-shore the western margin of the Adriatic Sea, Northern Italy. In this area, the artificial recharge shall be initiated by flooding an existing lake formed after the termination of pre-existing quarry.

Subsurface geological and hydrogeological model of this test site have been constructed based on through analysis of existing information about surface and subsurface lithology. These were integrated by the acquisition of new geophysical data employing surface and borehole geoelectromagnetic and seismic techniques. The geophysical results helped in the definition of the geohydrogelogical conceptual model. This model, together with the geochemical data, aided in the definition of the possible interactions between surface and ground water bodies. Moreover, the outcomes of the integrated analyses helped in the optimization of the monitoring network.

One of the expected resuts of this project is to succeed in diluting the high salinity of fossil ground water whose presence, surely, contrasts the natural recharge from the Po River. This may be possible by accumulating fresh water in the existing lake. Monitoring activities shall aide in defining the rate of salinisation attenuation in acquifers characerised by modest to low avearage permeabiliy. Understanding the advantages and drawbacks of artificial recharge activites shall help in defining its usefluness or its applicability in other sites having similar characteristics.

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