



Broom fibre PRB for heavy metals groundwater remediation

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Soil contamination by heavy metal and, though it, of groundwater represent a serious alteration of original geochemical levels owing to various human activities as: particular industrial processes and their non-correct treatment emission, urban traffic, use of phytosanitary product and mineral fertilizer.

Heavy metals are genotoxic contaminants who can be found by environmental matrix analysis or by examination of the genetic damage induced, after exposition, to sentry organism. In this last case we use a relative quantitation of the gene expression monitoring the mitochondrial oxidative metabolism hepatopancreas's gene of the organism used by bioindicator. This test is based on consideration that the hepatopancreas is the first internal organ affected by heavy metals or any other pollutant that the organism is exposed. In this work, the organism used by bioindicator to evaluate the pollutant contamination of waste water is *Danio rerio* (Zebrafish) that is a little tropical fish of 2-3 cm, native on asiatic south-east rivers. This organism has a large use in scientific field because its genome is almost completely mapped and, above all, because the congenital gene cause in human, if it was mutated in zebrafish, similar damage or almost similar mutation that happens in human being so you can develop a dose – response curve. To do this, after prepared a cadmium solution with a concentration 10 times the Italian normative limit, the organisms have been put in the aquarium to recreate the optimal condition to survival of zebrafish observed by continuous monitoring by web-cam. After one month exposition, that we took little by little sample fish to analyzing, for different exposition time, the hepatopancreas's fish.

First results shows considerable variation of the gene expression by interested gene in mitochondrial oxidative metabolism compared to control, highlighting the mutagenicity caused by heavy metals on *Danio rerio*'s hepatopancreas and, mutatis mutandis, also in human being.

One of the most interesting techniques applied in contaminated aquifer by heavy metals is the PRBs (Troisi et al., 2002; Calvin et al., 2006), in particular broom fibers PRB (Troisi et al., 2008). The first results highlight an optimum removal capacity for contaminants underlined from following removal percentage: 98.01% (Cd), 99.95% (Cu), 97.35% (Pb) and 99.53% (Zn).

A fundamental parameter for PRB design is the decay coefficient who indicates the removal capacity (degradation, transformation, adsorption/absorption, mass transport, etc.). This parameter has been determined for four heavy metals: Cadmium (Cd), Copper (Cu), Lead (Pb) and Zinc (Zn) carrying out column tests. Besides, for real use of broom fibers PRB same tests have been performed, using flow cells, to estimate a relation between hydraulic conductivity of fiber and its density.

References

Chien C. C., H. I. Inyang and L.G. Everett (2006). *Barrier Systems for Environmental Contaminant Containment and Treatment*. Taylor and Francis Group eds.

Troisi S., C. Fallico, S. Straface S. e L. Mazzuca. (2008). *Biodreni per la bonifica di siti contaminati realizzati con fibre naturali liberiane ad elevato sviluppo superficiale*. CS2008A00018. Università della Calabria.

Troisi S., E. Migliari and S. Straface (2002). *Soil and groundwater contamination by heavy metals in the industrial area of Crotone*. Third International Conference Risk Analysis III. Sintra, Ed. by C.A. Brebbia. WIT Press.