Use of carbon-amended composite particles to accomplish in-situ treatment of contaminated sediments

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Introduction: Abundant laboratory and mesocosm-scale research by others has conclusively documented that activated carbon (AC) is highly effective at binding various organic sediment contaminants (including PCBs and PAHs), resulting in significant measured or potential reductions in contaminant exposure and bioavailability in various ways [1, 2, 3]. Follow-up demonstrations by many of the same workers and others have confirmed similar results at field scale when AC is used in the context of in-situ sediment treatment [2, 4, 5].

In many cases, in-situ treatment has generally been accomplished by placing AC-amended material in very thin, discontinuous to continuous (cm-scale) layers across surfaces of contaminated sediment, then allowing bioturbating organisms to naturally mix the AC-amended material into the sediment over time, sometimes accelerated by mechanical mixing. Some projects have instead or also involved injecting/ mixing AC-amended material directly into impacted sediment masses.

Methods for placing, or "delivering", organic sorbents like AC onto *submerged* sediment surfaces, in particular, have included pumping flowable, AC-amended slurries down through the water using a pipe [3, 6], or by broadcasting masses of settleable, AC-bearing pellets across water surfaces above the target sediment [4, 7, 8]. Although certainly not without merit, existing methods for delivering AC to submerged sediment surfaces have perceived limitations or challenges with respect to controlled placement, special equipment needs and/ or novelty. Relatively little information appears to be available so far on the economics of these methods, which precludes an adequate comparison of costs.

The material delivery technology known as BioBlok® in Scandinavia (AquaBlok® in the U.S.) has a proven track record in the field of remedial sediment capping and as a delivery technology for active treatment materials [9, 10, 11, 12]. Using this multi-patented technology, easily settleable composite particles can be, and have been, created and amended with a host of different innovative treatment materials – including organic sorbents like AC or carbon-rich soil – to accomplish various capping-based remedies in submerged aquatic environments.

To date, however, use of the composite particle-based technology to *also* accomplish in-situ sediment treatment – including its use for delivering target quantities of AC or carbon-rich soil across submerged surfaces in a controlled, environmentally protective and cost-effective manner – has yet to be fully explored and demonstrated at field scale.

Methods: Presented in this paper is an alternative method for accomplishing in-situ sediment treatment using selected organic sorbents, i.e. AC and carbon-rich soil – a method which utilizes amended composite particles based on an already established delivery technology.

Discussion: Available information on projects planned or conducted in the U.S. and/ or Norway will be presented and discussed.

References: [1] Ghosh, U. (2006), presentation to NGI (Norwegian Geotechnical Institute) Workshop, Sept. 2006, Oslo, Norway ; [2] Luthy et al. (2009), final report, ESTCP Project ER-0510 ; [3] Cornelissen et al. (2008), presentation to SedNet sediment conference, Oslo, Norway, May 2008 ; [4] Ghosh, U. (2010), presentation to USEPA/ USACE/ SMWG Joint Sediment Conference, April 2010; [5] Schroeder (2009), presentation to NARPM conference, June 2009 ; [6] Eek et al. (2010), presentation to Miljøringen meeting, June 2010, Norway ; [7] Ghosh, U. (2009), presentation to DOE Mercury Summit, October 2009 ; [8] Menzie et al. (2007), presentation to Battelle sediment conference, January 2007 ; [9] US EPA (2007), SITE program, document no. EPA/540/R-07/008; [10] Barth et al. (2008), *Remediation*, Autumn issue; [11] Hull and Moreno (2006), *Canadian Reclaimation Magazine*; [12] www.aquablokinfo.com.''