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Reactive and recoverable sorbents for halogenated organic compound remediation in sediments

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Activated carbon (AC) has been proposed as a sediment amendment for aquatic systems polluted with hydrophobic organic compounds. AC acts as a strong binding agent that lowers the pollutant concentration and thus, its toxicity. A draw back of this in-situ remediation method is that although the pollutant will remain non-bioavailable for many years being sorbed into AC, it actually stays in the system. A reactive sorbent, a sorbent that would, at the same time, facilitate the degradation of the pollutant, would be better accepted by the public or the regulators than AC amendment. So far, catalysts supported on AC with zero valent iron and a reactive metal have been proposed for the dechlorination of chlorinated organic compounds. These reactive metals are usually expensive or toxic and thus, their addition to the environment is not desirable. In the present study, activated carbon modified with reduced iron(AC/Fe) is tested in batch systems in the presence of sediment and DDT sorbed on polyethylene sheets. The batch systems are equilibrated for different contact times. Then, the DDT remaining in the polyethylene sheets is quantified along with DDD produced due to the dechlorination of DDT. A small percentage of DDT is degraded to DDD in the systems containing the AC/Fe material. No degradation of DDT is observed in the control systems containing the pollutant and the sediment or the pollutant, the sediment and AC. Thus, the addition of AC/Fe to the sediment with the DDT is enough to cause the dechlorination of DDT. At the end of the experiments, a magnet rod is used to recover the AC/Fe material from the batches with the sediment. An average recovery of 83% is achieved. This is a high percentage suggesting that the material can be easily recovered. Some drawbacks of the material preparation method are identified after the composite material characterization. For example, the AC/Fe surface area is decreased with the material preparation compared to the initial surface area of the AC. This fact results in decrease of the sorption ability of the AC/Fe material compared to that of the AC. At the same time, more DDT degradation might be achievable by increasing the AC/Fe dosage from the 1% weight used in this study that is lower than commonly used for sediment amendments. More research is necessary to optimize the material preparation and properties.