Black carbon is not chemically inert as previously thought

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A paper by two University of Delaware researchers was recently highlighted on the web site of *Environmental Science & Technology (ES&T)*, which publishes papers in advance of their appearance in the print version of the journal.

Released on Aug. 14, the paper, "Graphite and Soot-Mediated Reduction of 2,4-Dinitrotoluene and Hexahydro-1,2,5-trinitro-1,3,5-triazine," was coauthored by Pei Chiu, professor in UD's Department of Civil and Environmental Engineering, and Seok-Young Oh, former Ph.D. student and postdoctoral researcher in the department and now an assistant professor at the University of Ulsan in South Korean.

The paper was sixth on the list of ten highlighted papers for the week by *ES&T*, which is published by the American Chemical Society.

The article documents Chiu and Oh's findings that black carbon, previously thought to be chemically inert, can be conductive and can actually serve as a catalyst.

Chiu explains that black carbon, which is ubiquitous in soils and sediments, is derived from both human activities and natural processes -- for example, it can result from incomplete combustion of fossil fuels and biomass, as well as from weathering of rock. Estimates indicate that from 10 to the 12th power to 10 to the 13th power grams of black carbon are released into the environment every year.

As a geosorbent, black carbon has a significant effect on the fate and transport of hydrophobic pollutants in aquatic and terrestrial systems.

“It's commonly assumed that when an organic molecule is bound to a geosorbent such as black carbon,” Chiu says, “it becomes sequestered and inaccessible. But what we've found, in studying explosives such as DNT and RDX, is that black carbon such as soot and graphite has dual roles, serving as both a sorbent and an electron shuttle.”

Chiu cautions that the study is the first confirmation of the hypothesis, and only a limited range of materials has been tested. However, he says, “This process needs to be taken into account when the fate of nitro compounds in groundwater and sediment is modeled and when we try to understand their impact on human health and ecology. On the other hand, we can exploit the process in the remediation of sites contaminated with explosives and related chemicals.”

“Additional studies are needed to identify other classes of compounds that can undergo black carbon-mediated transformation,” he adds, “as well as the reductants and medium conditions that are conducive to this process in complex environmental systems.”

Provided by University of Delaware (news : web)