

Photochemical Fate of Manufactured Carbon Nanomaterials in the Aquatic Environment

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Because carbon-based nanomaterials, known collectively as fullerenes, have some very unique properties, these materials may find wide application in important industrial and commercial sectors, including energy production. Yet, any unintended adverse impacts on human health and the environment by these materials remains a critical question. To understand if they will affect the environment, it is important to know if they will degrade in the environment. Professor Chad Jafvert and graduate student Wen-Che Hou at Purdue University were the first to show that Buckminster fullerene, or C₆₀, photochemically decays in the aqueous environment when present as nano-precipitates known as “clusters.” Some of their work is documented in the recent paper referenced below.

In sunlight and under lamps that emit light only within the solar spectrum, the brownish color of the cluster solutions fade to become nearly colorless, the size of the C₆₀-clusters decrease significantly, and molecular C₆₀ is gradually lost over a period of weeks. *Figure x.7* shows one of the C₆₀-cluster solutions under sunlight, next to a control bottle that contains no C₆₀. Hou and Jafvert have shown that the photochemical reaction does not occur in the absence of molecular oxygen (O₂), and the reaction produces water-soluble materials. While it is strongly suspected that these materials include hydroxylated-C₆₀; ongoing work will better characterize these products.



Figure. ? (Hou and Jafvert 2009)

Reference/Publication

Wen-Che Hou and Chad T. Jafvert, Photochemical Transformation of Aqueous C₆₀ Clusters in Sunlight. *Environ. Sci. Technol.*, 43:362-767, 2009.