Enhanced mobility of fullerene (C_{60}) nanoparticle in the presence of stabilizing agents

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The effects of four stabilizing agents, tetrahydrofuran (THF), Suwannee River humic acid (SRHA), Suwannee River fulvic acid (SRFA), and Tween® 80, on the transport and retention of nC_{60} nanoparticles in water-saturated 40-50 mesh quartz sand was explored through a combination of experimental and mathematical modeling studies. To accurately determine the concentration of nC_{60} in aqueous suspensions containing either SRHA or SRFA, a novel analytical method was developed that involved liquid-liquid extraction and high performance liquid chromatography. At concentrations of up to 45 mg/L, the presence of THF, a transfer solvent used in the preparation of aqueous nC_{60} suspensions, did not alter nC_{60} transport and retention behavior. In contrast, the addition of SRHA (20 mg C/L), SRFA (20 mg C/L), or Tween® 80 (1, 000 mg/L) to influent nC_{60} suspensions greatly enhanced nC_{60} transport, as illustrated by coincidental nC_{60} and non-reactive tracer effluent breakthrough curves (BTCs), and minimal nC_{60} retention. Subsequent nC_{60} transport experiments revealed that the presence of adsorbed-phase Tween® 80 enhanced nC_{60} retention, characterized by retention profiles that exhibited exponential decay. A mathematical model that accounts for coupled surfactant and nanoparticle transport processes, including a spatially- and temporally-varying attachment rate coefficient, was able to accurately predict measured surfactant and nC_{60} effluent and solid-phase concentration profiles. These findings demonstrate that both natural and anthropogenic stabilizing agents have the potential to dramatically increase the transport nC_{60} nanoparticles in water-saturated quartz sand.

Even carbon-numbered n-alkanes predominance in lacustrine sediments and its climate significance in Linxia Basin, NE Tibetan Plateau, NW China

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n-Alkanes generally constitute the major fraction of saturated hydrocarbons and their distribution patterns are characterized by carbon-number ranges and predominances, depending on the nature of the source material and its microbial or geochemical alteration. In the present study we have identified such distributions for the first time in lacustrine sediments of continuous sedimentary section in the Linxia Basin, NE Tibetan Plateau, NW China, aging from 13Ma to 4.4Ma. Total n-alkanes of the sediments were characterized by two major groups. One was n-alkanes in the range n-C_{16} to n-C_{20} with a strong even carbon number predominance and a maximum at n-C_{18}, the other, those from n-C_{27} to n-C_{31} with an odd carbon number predominance and a maximum at n-C_{29}. We think that the even carbon-numbered n-alkanes in lacustrine sediments of the Maogou section have most likely a direct contribution from microorganisms. Based on various geochemical parameters and the correspondence between the strong even carbon number predominance of alkanes and warm-arid enviroment from bottom to top in study section, the most likely origin of n-alkanes is a kind of bacteria which preferenably live in the weak oxic-anoxic and warm-arid environments. And we suggest that n-alkanes with a high even carbon number predominance record information related to arid climate change.

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