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Fluorocarbon–hydrocarbon hybrid gold NPs synthesized by bulk exchange reactions and surface coatings of fluorocarbon coated gold NPs are increased

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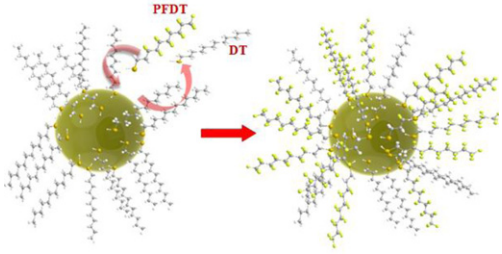
HIGHLIGHTS

- The surface coverage of fluorinated gold NPs is increased.
- Reactivity of fluorinated ligand is increased by thiolation.
- Fluorocarbon–hydrocarbon coated hybrid gold NPs are synthesized and characterized.
- Hybrid NPs show different behavior at the air/water interface regarding their feed ligand ratios.

GRAPHICAL ABSTRACT



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ABSTRACT

Surface structure of nanoparticles (NPs) has considerable effect on their usability and efficiency in a wide variety of applications such as electronics, photonics, catalysis, chemical sensing, and drug-delivery systems, etc. This turns the surface modification of nanoparticles into a quite important and intriguing issue. Therefore, being able to decorate the surface of NPs with desired ligands and with high surface coverage is becoming more significant day after day. Several agents can be used for the surface decoration. Fluorinated chains are among the most important ones in accordance with having fluidization effect over lipid membranes and being able to be used to manipulate/control the surface interactions. This letter covers enhancing surface coating of fluorocarbon (PFDT; 1H,1H,2H,2H-perfluorodecanethiol) coated gold NPs by modifying a classic synthesis procedure: Brust's two phase method. Moreover, surface decorated NPs with mixed fluorocarbon (PFDT)-hydrocarbon (DT; 1-Dodecanethiol) ligands were synthesized, and their interfacial and bulk properties were investigated by Thermogravimetric Analysis (TGA), Fourier Transform Infrared Spectroscopy (FTIR), Nuclear Magnetic Resonance Spectroscopy (NMR), Transmission Electron Microscopy (TEM), and utilization of surface pressure-area isotherm data.

1. Introduction

Perfluorinated chains are one of the most hydrophobic molecules, which are known. Fluorocarbons are not only highly hydrophobic, but also have high oxygen dissolving capacity and extreme inertness [1]. Fluorocarbons are also additionally recognized by their biological inertness, thermal and chemical stability. However, there are some concerns about the environmental and biomedical applications of fluorocarbons related with its bioaccumulation. It is known that fluorinated compounds show lower hemolytic activity than their hydrocarbon analogs and their hemolytic activity decreases with the increasing chain length to a certain extend [2,3]. Therefore, it is possible to restrain the side effects of fluorinated compounds by controlling their chain length and the amount used [4]. All these properties make fluorocarbons convenient molecules to be used in several applications requiring low energy property such as surface engineering. Also, it is possible to see fluorocarbons in imaging systems from two-photon microscopy to MRI imaging [5]. Blood replacement by fluorocarbon emulsion significantly increases the image quality due to the

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