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Influence of the hydrocarbon chain length of imidazolium-based ionic liquid on the dispersion and stabilization of double-walled carbon nanotubes in water

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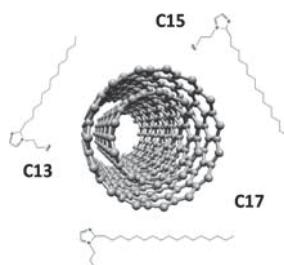
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HIGHLIGHTS

- Synthesis of imidazolium-based ionic liquids from natural compounds (fatty acids).
- Stabilization of 50 mg/L double walled carbon nanotubes in water up to 20 days.
- Dispersibility increased with increasing the length of the hydrocarbon chain.

GRAPHICAL ABSTRACT



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ABSTRACT

Imidazolium-based ionic liquids with a long hydrocarbon chain 1-methyl-1-ethanol-2-alkyl-imidazolium iodide ($[M-E-C_n-Im] I$, $n = 13, 15$ and 17) were used for the dispersion of DWCNTs in water. DWCNTs suspensions obtained were stable for more than a month, and no sedimentation was observed. The stability of the suspensions was investigated (measurement of optical density, zeta potential, particle size, viscosity, and TEM images). Monitoring of the absorbance by UV/vis spectrophotometry for 20 days showed that at low concentration (1 mM), the best suspension was obtained with the ionic liquid ($[M-E-C_{15}-Im] I$). At higher concentration (10 mM), the dispersion efficiency increased with the length of the hydrocarbon chain. This could be explained by the hydrophobic interaction between the hydrophobic moieties of the ionic liquid and the CNTs. Therefore, we were able to stabilize DWCNTs using a low concentration (1 mM) of imidazolium-based ionic liquids synthesized from natural compounds. This work highlights the potential of imidazolium-based ionic liquids for the preparation of aqueous suspensions of DWCNTs at high concentration with a limited amount of added surfactant (50 mg/L of DWCNTs with 50 mg/L of ionic liquid).

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1. Introduction

Carbon nanotubes (CNTs), described as such for the first time in 1991, are still of great interest for the scientific community due to their exceptional intrinsic properties (electrical, mechanical and thermal), opening a very wide field of applications for these

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