Supporting Information for:

Removal of Carbon Nanomaterials by Co-Precipitation with Chitosan: A Facile Method for Water Pre-Treatment

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1. Linear dependence of C₆₀-OH UV absorbance on C₆₀-OH concentration

Dilution by milli-Q water and 1% NaOH shows similar UV spectra. Therefore, concentration fo C₆₀-OH samples in the manuscript can be calculated through Lambert-Beer equation from the absorbance at λ = 320 nm of these spectra.



Figure S1. A. UV-vis spectra of C₆₀-OH at different C₆₀-OH concentrations. The samples were prepared by dissolving certain amount of C₆₀-OH into 1% w/w NaOH and then the samples were diluted with milli-Q water. **B.** UV-vis spectra of C₆₀-OH at different C₆₀-OH concentrations prepared by dilution of C₆₀-OH stock solution with 1% w/w NaOH. **C.** Dependence of C₆₀-OH UV absorbance at λ = 320 nm on C₆₀-OH concentration.

2. Linear dependence of CNT-OH UV absorbance on CNT-OH concentration.

The concentration of the CNT-OH was measured by gravimetric analysis to show the linear dependence of CNT-OH absorbance on CNT amount in solution.



Figure S2. A. UV-vis spectra of CNT-OH at different CNT-OH concentrations. CNT-OH samples were prepared by consequent diluting of CNT-OH stock solution with milli-Q water 100, 200, 1000 and 2000 times. **B.** Dependence of CNT-OH UV absorbance at λ = 320 nm on CNT-OH concentration. Concentration of CNT-OH obtained by gravimetric analysis was 6.87×10^{-2} % w/w.

3. Removal of C₆₀-OH by co-precipitation with chitosan.

The complementary data to Figure 1 illustrating removal of C_{60} -OH by chitosan coprecipitation method.



Figure S3. A. Photographic images of 2.79×10^{-4} % w/w solution of C₆₀-OH before (1) and immediately after (2) treatment by chitosan 500 and after settling for 24 hours (3). **B.** UV-vis spectra of C₆₀-OH solutions containing 1.61 mM of chitosan 500 at pH between 3.1 and 10.5 after separation of insoluble precipitate by settling for 24 hours and centrifugation at 1,500 rpm for 30 minutes. pH was adjusted to a desired value between 4.2 and 10.5 by adding 0.5 M NaOH and to pH 3.1 by adding 0.5 M HCl.

Figure S4 complements Figure 2 in the manuscript and shows that addition of either common monovalent salts or organic solvent (ethanol) does not affect the stability of ENM at the extent necessary to induce considerable sedimentation, while the stability of both ENM are significantly affected by the presence of divalent cations.



Figure S4. A. Percentages of C₆₀-OH removed by addition of 0.01 M of common salts. **B.** CNT-OH removed by addition of 0.01 M of commonly-occurring salts. **C.** Comparison of effect of 0.01 M of chloride ion and acetate ion to the ENM stability. **D.** ENM removed by addition of 0.1% and 1% of ethanol. All data were measured after settling of ENM for 24 hours and centrifugation at 1,500 rpm for 30 minutes. The concentrations of C₆₀-OH and CNT-OH in each experiment were 2.26×10^{-4} % w/w and 2.58×10^{-4} % w/w, respectively.

5. Stability of ENM is solutions of different pH.

Both ENM are stable in basic conditions and less stable in acidic conditions. At pH 3, about half of CNT sediments but it was not sufficient to remove large fraction of ENM from aqueous phase. Stability of C_{60} -OH against pH decrease is higher and even at pH 3 around 80% of C_{60} -OH do not precipitate.



Figure S5. Dependence of the absorbance of remained of ENM in solutions at pH 3 to 10 after settling for 24 hours. Concentrations of C₆₀-OH and CNT-OH were 2.79×10^{-4} % w/w and 2.22×10^{-4} % w/w, respectively. The asterisk (*) indicates the pH of asprepared solutions of C₆₀-OH and CNT-OH, which absorbance is set as 100%. pH was adjusted to the desired value by adding 0.5 M NaOH or 0.5 M HCl.

6. Effect of settling time on sedimentation of ENM.

Figure S6 is related to the Figure 6 in the main manuscript. It shows that more than 90% of CNT-OH and C₆₀-OH were removed after *ca*. 5 hours and *ca*. 15 hours of sedimentation, respectively. In contrast, removal of ENM by co-precipitation with chitosan 10 was not efficient.



Figure S6. Time dependence of ENM removal percentage by high molecular weight chitosan 500 and low molecular weight chitosan 10. Concentrations of C₆₀-OH and CNT-OH were 2.79×10^{-4} % w/w and 2.22×10^{-4} % w/w, respectively, and concentration of either chitosan was 1.61 mM.