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38. Fabrication of Single Walled Carbon Nanotube (SWNT) Sorbent for Volatile Organic Compounds (VOCs) Sampling

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Objectives: To investigate and compare fabrication methods of single walled carbon nanotube (SWNT) buckypapers by quantifying adsorption efficiencies. These adsorbent materials will be directly used in passive air samplers for volatile organic compounds (VOCs).

Methods: Arc discharge SWNTs in surfactants was purchased and fabricated into a buckypaper with or without a cleaning process. 200 mL of SWNT solution was suspended in 400 mL of acetone for about 18 hours. The solution was then vacuum filtered through a polytetrafluoroethylene (PTFE) membrane filter and stabilized to make a felt. A buckypaper was obtained by delaminating the felt. A cleaning process was added to the above fabrication process. After SWNT solution was vacuum filtered and stabilized, the felt was rinsed twice with 250 mL of deionized water and 50 mL of acetone. Buckypapers produced were examined for (nitrogen) adsorption isotherm, surface area, and pore size using a physisorption analyzer, which determines the capacity and affinity of the adsorbents to VOCs.

Results: Acetone suspension and vacuum filtration of arc discharge SWNTs solution yielded sturdy buckypapers. Uncleaned buckypapers showed 43 m^2/g of Brunauer, Emmett and Teller (BET) surface area with 15 nm of average pore width while cleaned buckypapers exhibited 218 m^2/g BET surface area and a 9 nm average pore width.

Conclusions: Structurally stable buckypapers were fabricated through acetone suspension followed by vacuum filtration. The cleaning process increased BET surface area more than four times and decreased the average pore size about two times. This phenomenon can be explained by the removal of surfactants and metal traces from the material and by opening more pores which were initially blocked by those impurities. An adsorption experiment with VOCs will be conducted and further investigations with more efficient cleaning processes or another fabrication process will be performed to increase surface area and develop more micropores.