EuroSciCon

8th Edition of International Conference on

Chemistry Education and Research

August 27-28, 2018
Zurich, Switzerland

J Org Inorg Chem 2018, Volume 4
DOI: 10.21767/2472-1123-C5-015

PURIFICATION OF SINGLE WALL CARBON NANOTUBE (SWNT) PRODUCED BY ARC-DISCHARGED METHOD BY SIMPLE AIR OXIDATION AND ACID REFLUX METHODS

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Arc discharge method is a suitable method for the mass production of single-walled nanotubes (SWNT). But this process also produces lots of impurity like amorphous carbon, graphite nanoparticles and metals particles (like Fe, Co, Ni or Y) along with this nanotube structure. A simple, cost effective but useful refinement technique for purification of SWNT produced by arc-discharged method is discussed in this report. This novel purification method is incorporated with air oxidation followed by nitric acid treatments to remove the unwanted particles. At the first stage of this purification, oxidation of SWNT in air at temperatures of 400°C for 4 h burns out the carbonaceous particles and in the next step nitric acid (HNO3) reflux with for 8 h etches away the catalytic metal particles. The approach of a selective oxidative etching process is based on the fact that the burning temperature of amorphous carbons is faster than that of carbon nanotube which involved at the first stage of purification here and in the second stage encrypted metal nano particles within SWNT can be melted into the acid by heat treatment. These two processes are complementary to each other to remove the carbonaceous particles and transition metals. This whole purification process provides a total yield of about 25-30 wt.% with the 77% purity which was confirmed by the thermogravimetric and NIR analysis respectively. The effects of each treatment in the purification process is also discussed by characterizing the intermediate products using thermogravimetric analysis, Raman spectroscopy, vis-NIR spectroscopy, scanning electron microscopy and transmission electron microscopy.

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