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Synthesis of Multi-Walled Carbon Nanotube by using Ethanol as a Carbon Source

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Editorial

The challenges associated with synthesis carbon nanotubes are still the main causes [1,2] which limit the use in many application [3,4] in spite of the amazing physiochemical properties and variety of types of single walled carbon nanotubes (SWNTs), few walled carbon nanotubes (FWCNTs), and multi walled carbon nanotubes (MWNTs) [5]. The prediction for the near future is the possibility of removing all the obstacles that prevent or hinder the manufacturing process of this carbon-polymer distinguished in all the specifications [6]. The methods which commonly depend on the synthesis of carbon nanotubes include arc discharge [7], chemical vapor deposition [8,9], and laser ablation [10] which represent physical, chemical, or miscellaneous methods. Chemical vapor deposition techniques are the simplest, cheapest, and most flexible methods as compared with the other types for this purpose [11]. This technique generally depends on making a precipitation process at high temperatures for the clouds of precursor, vapor which mainly contains an appropriate percentage of carbon atoms [12]. The process of synthesis can be done in two ways: the first by using a catalyst, and the second without a catalyst [13], which acts as center for the growth of the tubular structures of carbon nanotubes, thus increasing the diameter of these centers and leading to the process of building carbon atoms towards more than one wall [14,15]. In this regard, chemical vapor deposition was used to synthesis MWNTs by using ethanol alcohol as a sources of carbon at temperature of 750-800°C without using a catalyst. Figure 1 shows a diagram for the process of synthesis in the schematic below.

In brief, the process involves heating the tube furnaces to the required temperature, then evaporating alcohol at 60°C by using a magnetic heater stirrer with a continuous flow of N_2 gas, which is used as a carrier gas at flow rate equal to 100 cm^3/min. The volume of ethanol which was used was 30 cm^3 and the process of evaporation took 1h. When the evaporation process had finished, the furnace tube heater stopped its continuous flow of N_2 gas until the cooling of the tubes of the precipitation reaction, followed by purification process which included two steps: the first was heating the product in an oven for 4h [16] and the second was the oxidation of the remaining product by (30%) H_2O_2 at 50°C for 4 dyes [17]. The characterization systems used to identify the types of CNTs with their percentage of purification were commonly Raman spectroscopy, XRD, TG, SEM, and TEM. In this project the studies included FESEM to identify the morphology and diameters for the synthesis product. Figure 2 shows FESEM images only dark tubes could be seen without any more color which leads to an important point: there is no catalyst in the product as a result of the methods used without a catalyst. Also, it could be seen that the diameter of product was about 35-79 nm and the length 6 – 14 µm which refers to MWNTs with the same ratios as FWNTs [18].

In conclusion, the ability of the synthesis of CNTs in all types can be converted in to a higher sensitivity for producing fixed types and regular diameters and lengths with reduced values in the distortion on the surfaces of the CNTs.

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