ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Synthesis and Characterization of Carbon nanoflakes from seeds of *Lens culinaris* (masoor dal).

Ashim Chanda, Aishee Das, Tahera Khanam Barbhuiya.

Manuscript Info

Manuscript History:

Received: 15 December 2015
Final Accepted: 22 January 2016
Published Online: February 2016

Key words:
Carbon nanoflakes, masoor dal, ***Lens culinaris*** ,TEM, SAED.

Corresponding Author

Ashim Chanda.

Abstract

Carbon nanoflakes have been prepared from seeds of ***Lens culinaris*** (masoor dal) in a muffle furnace at 300^0C. The materials were characterized by Tap density, optical microscopy, Transmission Electron Microscopy (TEM) and selected area electron diffraction (SAED). The TEM images revealed the presence of carbon nanoflakes of thickness ~1 nm. From high resolution TEM, the interlayer spacing is calculated to be 0.33nm which is characteristic of (002) plane of graphitic carbon. The SAED pattern showed concentric rings that confirms the polycrystalline nature of the material. The tap density is found to be 0.66 g/cm^3.

Introduction:-

Research on production of carbon nanomaterials has been growing explosively in the past decade owing to their exciting chemical, physical, electrical, and mechanical properties (Rodriguez et al.,1995; Thess et al.,1996; Xia et al.,2005; Awasthi et al.,2011). Hydrogen storage, chemical sensors, catalytic supports and field emitters in displays are some of the prominent applications (Tran et al.,1998; Stamatina et al.,2007; Baughman et al.,2002). The major processing route towards such material is catalytic decomposition of molecules containing carbon atoms, such as CO and hydrocarbons or any carbon rich sources including plant matter by pyrolysis (Kumar et al.,2008; Afolabi et al.,2009; Nath et.al.,2015) In the present paper, we report the synthesis and characterization of carbon nanofalkes from of ***lens culinaris*** commonly known as masoor dal.

Experimental:-

Materials and measurements:-

Seeds of *masoor dal* (**Fig.1**) were collected from Hailakandi (Assam), India used as carbon precursors for the synthesis of the carbon nanoflakes.

Fig.1 masoor dal (*Lens culinaris*)

Measurements:-

Optical microscopy was carried out using Olympus Optical Microscope. Transmission electron microscopy (TEM) images were obtained on a JEM-2100, JEOL equipment. The TEM grids were prepared using a few of drops of the ethanol dispersed powder. The tapped density is measured by mechanically tapping the synthesized material in a graduated vessel. The initial powder volume or mass is taken and then the vessel is mechanically tapped, and volume or mass readings are taken until no further volume or mass change is observed. The mechanical tapping is achieved by raising the cylinder or vessel and allowing it to drop, under its own mass. The volume of the graduated vessel was calibrated with distilled water.

Synthesis of carbon nanoflakes:-

Carbon nanoflakes were produced from seeds of *masoor dal* by calcination in a muffle furnace. A crucible was loaded with the washed, dried and ground seeds (10 g) was placed in the furnace. The furnace was heated to 300 ^{0}C for 3 hours to complete the process of calcination. The system was then allowed to cool to room temperature and the black powdered materials were taken out from the crucible and analyzed as obtained (yield 3.22 g).

Results and discussion:-

The as-obtained carbon nanoflake black powder is air stable for months and can be dispersed in aqueous and organic solvents (methanol, ethanol) under ultrasonication. The yield of the material was recorded to be around 32.20% of initial mass. Tap Density of the material was calculated to be 0.66gcm^{-3}. It is pertinent to mention that density of the synthesized materials from masoor dal were much lower than that graphitic carbon and amorphous carbon. The optical microscopic images (**Fig2(a)**) indicated the presence of non uniform agglomerated particles. The TEM micrographs of the as obtained materials (**Fig.2(b)**) revealed the presence of carbon nanoflakes of thickness ~1 nm. From high-resolution TEM (HRTEM) image, the lattice fringes (**Fig.2(c)**) were observed at an interplanar distance of 0.33 nm which correspond to (002) plane of graphitic carbon. The concentric ring pattern in SAED attested the graphitic carbon and polycrystalline nature of the material (**Fig2(d)**).

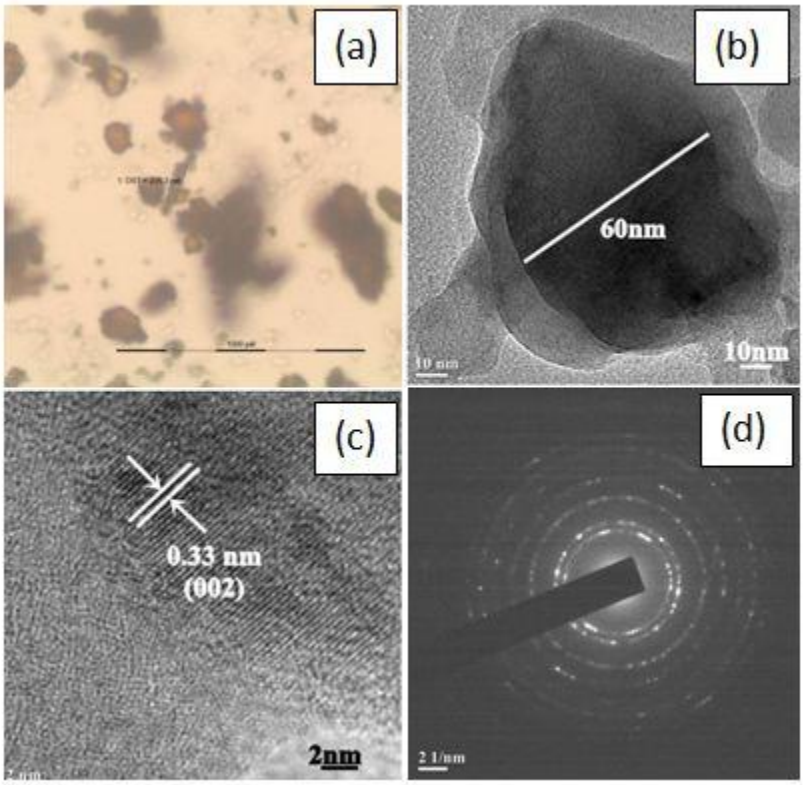

Fig.2 (a) optical microscopic image **(b)** TEM micrograph **(c)** HRTEM **(d)** SAED pattern of the as synthesized nano flakes

Conclusion:-

Carbon nanoflakes were obtained by calcination of seeds of *masoor dal* an unconventional natural and renewable precursor, as a carbon source without using any template or external catalyst. The thickness of the carbon nanoflakes was about 1nm. The tap density is 0.66g/cm^3. The method afforded gram quantity of the material which can be further scaled up.

Acknowledgment:-

Authors thank Sophisticated Analytical Instrument Facility, North Eastern Hill University, Shillong and Institutional Biotech Hub, S.S.College Hailakandi for instrumental facilities.

References:-

Afolabi S, Abdulkareem A S, Iyuke S E et al. Continuous production of carbon nanotubes and diamond films by swirled floating catalyst chemical vapour deposition method. S. Afr. J. Sci., 2009, 105:278-281.

Awasthi A, Kumar R, Raghubanshi H, et al. Synthesis of Nano-Carbon (Nanotubes, Nanofibres, Graphene) Materials. Bull. Mater. Sci., 2011, 34(4): 607-614.

Baughman R H, Zakhidov A A, de Heer. W A. Carbon Nanotubes-the Route Toward Applications. Science, 2002, 297:787-792.

Kumar M, Ando Y. Gigas Growth of Carbon Nanotubes. Def. Sci. J., 2008, 58(4):496-503.

Nath A, Purkayastha D D, Sharon M, et al. Catalyst free low temperature synthesis and antioxidant activity of multiwalled carbon nanotubes accessed from ghee, clarified butter of cow's milk. Mater. Lett. 2015, 152: 36-39.

Rodriguez N M, Chambers A R, Baker T K. Catalytic Engineering of Carbon Nanostructures. Langmuir, 1995, 11: 3862-3866.

Stamatina I, Morozana A, Dumitrua A, et al. The synthesis of multi-walled carbon nanotubes (MWNTs) by catalytic pyrolysis of the phenol-formaldehyde resins. Physica E, 2007, 37: 44-48.

Thess A, Lee R, Nikolaev P, et al. Crystalline Ropes of Metallic Carbon Nanotubes. Science, 1996, 273 (5274): 483-487.

Tran S J, Verschueren A R M, Dekker C. Room-temperature transistor based on a single carbon nanotube. Nature, 1998, 393: 49-52.

Xia W, Su D S, Birkwer A. et al. Chemical Vapor Deposition and Synthesis on Carbon Nanofibers: Sintering of Ferrocene-Derived Supported Iron Nanoparticles and the Catalytic Growth of Secondary Carbon Nanofibers. Chem. Mater., 2005, 17: 5737-5742.