Aromaticity Of Nano Structural Almond Oil Soot Particles In Different Environment

Rakhi Tailor, Minal Bafna, Y.K.Vijay

Abstract: Carbon soot is a fine dispersion of black carbon particles in a vapor carrier.Formation of soot by incomplete combustion on different substrate to investigate water soluble carbon nanoparticles around 40nm in size.Here we demonstrate a smart type of carbon nano soot. However the production of carbonaceous soot in natural environment as well as in humidity environment by a simple way of incomplete combustion of almond oil by flame deposition method,is an very simple,inexpansive method for synthesis of soot. synthesized soot particles were analyzed by Field emission scanning electron microscopy (FESEM),Energy dispersive X-Ray (EDX), X-Ray diffraction (XRD), Fourier Transfer infrared spectroscopy (FTIR), and UV-visible spectroscopy and Raman spectroscopy. Morphology study of synthesized carbon soot nano particles indicates the presence of large amount of amorphous carbon nano material. Infrared spectroscopy results indicate the small size clusters present in soot particles as well as UV & FTIR results shows the presence of aromaticity.The humidify environment is an important factor for morphology and formation of carbon nano particles.

Keywords: Almond, Soot, Diya or clay lamp, Humidity, Clusters

1. Introduction:

Over the past decades carbon nano materials like carbon nanotube graphite have shown wide appreciation as super capacitor ,transparent electrodes, and high speed transistors due to their novel physical chemical and mechanical properties. Carbon soot is a member of carbonaceous family group. It is an environ friendly nano material. The formation of carbon soot by flame deposition method using Diesel, Kerosene and Candle wax. The size of these soot particles in nano range makes them dangerous [1]. Many people had observed carbon nano materials and fibers in deposit inside furnaces dealing with Hydrocarbons[2].When soot material is condensed at high temperatures; observed graphene layers and synthesis of water soluble carbon nano tubes from mustard oil contain several junctions and other structural defects leading to bonding frustration of graphene carbons[3,5].Carbon nano particle are a mixture of elemental carbon and a trace amount of hydrocarbons[6]. In the atmospheric soot present a high molar ratio of hydrogen in small sized aromatic clusters[7]. The prepared carbon soot by candle wax only compound of carbon and oxygen no other material were observed[8]. Synthesized mustard oil soot have a single walled carbon nano tubes(SWCNTs) can be used for potential applications in fuel cell , carbon nano capacitors[9]. Raw material of carbon is most important things in controlling the morphology and yields of the carbon nano materials[10,11]. Superamphiphobic functionalities of carbon soot make and it useful in many applications like oil and water separation, anti-icing, corrosion resistance and energy saving buildings[12,13].According to research of NASA's earth observatory suggest that black soot emissions after the way sunlight reflects off snow. Since thousands of year ago (RAMAYAN & MAHABHARAT KAL) soot was used as cosmetic component "KAJAL". Now new "nano-kajal" that hase no side effects or irritation to our eyes. A soot material collected by vehicle like Bus exhaust is useful to making ink. Which leads to harvesting green energy for useful purpose. Making white board marker pen ink from soot particles was satisfies the standard ink specification as it tested in chemical laboratory[14,15,16].

2. Experimental

2.1 Materials:

The sweet Almond oil used in this study which was purchased from local market of jaipur and for oil lamp we used Deepak or "Diya"(was also purchased from jaipur market) with homemade cotton wick. Generally vegetable oils contain glycerides of a mixture of a several types of fatty acids. Almond oil is comprised 62% of monosaturated oleic acid, it's an omega-9 fatty acid 29% of linoleic acid; it's a poly unsaturated omega-6 essential fatty acid and 9% of saturated fatty acid.

2.2 Sample production:

In this study Almond oil carbon soot particles were produced in two different environments

A) Natural without humidity

B) Natural with humidity

At room temperature it is well known traditional and easiest method to produce carbon soot is flam deposition method. In this method take a diya filled with almond oil and dip a cotton wick in it. Put it on floor & light up the diya for collection of soot take another diya put it reverse at a some height with the help of other layers of diya's and make the arrangement as shown in fig 2.2(a) and 2.2(b)

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Fig:2.2(a) Without Humidity

Fig:2.2(b) With Humidity

In this arrangement distance between tip of wick and collector diya's surface is approx 5cm.For 2 hours the almond oil was burned and collect the soot particles using spoon. For the second condition, production of soot in humidity environment all set up arranged in a plate which was filled with water to provide this sample surrounding moisture as shown in above fig:2.2(b) theses soot's are classically known as kajal and has been in used as a medicament against common eye liners.

2.3Characterization of carbon soot's:

The characterization properties of carbon soot's are investigated by FESEM,EDX, XRD, FTIR,UV-Visible and raman spectroscopy.SEM and EDX measurements has been taken by using Nova Nano FE-SEM 450 (FEI) Scanning electron microscopy. Power X-Ray diffraction (XRD) were collected X-Ray diffractometer (Panalytical X Pert Pro), operating in the bragg configuration using CuKα radiation (λ=1.5418 A^0) and Ni filter. FTIR spectra of particle's from almond oils were recorded in transmission mode on a FT-IR spectrum 2 (PerkinElmer)working a KBr beam splitter and KBr detector the spectra was recorded in the solid state in KBr pallets in the range 400 to 4000 cm^{-1} having resolution of 4 cm^{-1} . UV-Visible spectra of powder was recorded in absorbance mode on a LAMBDA 750(PerkinElmer) double beam, double monochromator with the range of 200-800nm. Raman characterization of prepared soot's was performed using STR250 Laser Raman spectrometry. The samples were taken in powdered form on a glass plate. Charge coupled detector was used as a detector & data were processed with the subtraction of leaser induced background luminescence.

3. Result's and discussion

3.1 Morphological characterization:

The carbo soot material deposited on glass surface were investigated by scanning electron microscopy at different magnifications(25,000-2,00,000) presented in figure3.1(a,b) and 3.1(c,d) for both non humidify and humidify samples. The particles are very small occur non individually and individually.Synthesized soot particles in flame deposition method breaks up to form other small substances.FOR condition first (Non humidify) the surface morphology is seen to be non-uniform there are several grains with look like carbon nanotubes but for the second condition (humidify)is seen to be uniform and particle size small comparatively.The SEM images for both of conditions shows carbon soot particles of average sie less than 50nm .The formed soot particles shows morphology of agglomerated clusters for non humidify and uniformly distributed carbon nano particles for humidify sample.

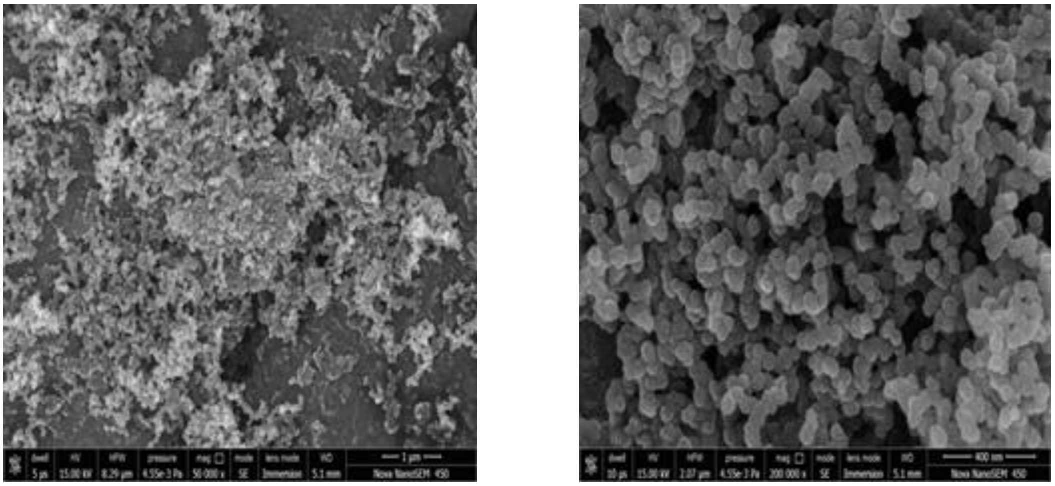

***Fig: 3.1**(a,b) SEM of almond soot without humidity at low and high magnification*

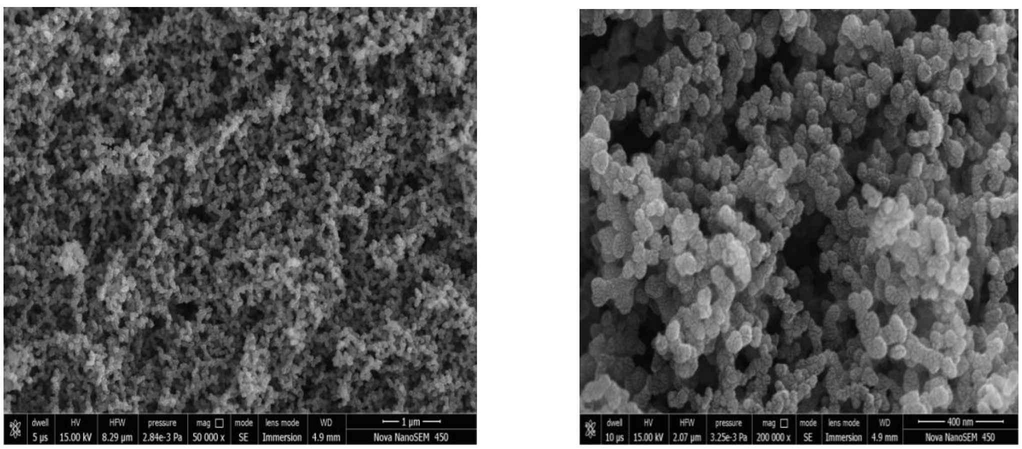

***Fig: 3.1**(c,d) SEM of almond soot with humidity at low and high magnification*

Energy dispersive spectroscopy (EDS) of soot particles are presented in figure 3.1(e) and 3.1(f) for non humidify and humidify environments The spectra shows the presence of carbon and oxygen. For first condition the EDS analysis indicates the soot to consist of 92.10% weight carbon and 7.90% weight oxygen as well as for second condition it consist of 87.86% weight carbon and 12.14% weight of oxygen.The table (1) shows the percentage composition of elements carbon and oxygen obtained from EDS Specta both of samples. The EDS spectrum reveals that almost 85% of the sample contains pure carbon and remaining 15% oxygen that confirming the absence of any other external impurities. The X-Ray diffraction (XRD) Pattern of almond oil soot's are shown in figure 3.1(g) & 3.1(h). The carbonaceous soot obtained was used directly. Both the soot's samples got too prominent peaks for natural without humidity soot powder a high intense peak at 24.74^0 and a low intense at 42.13^0 as well as for the humidify soot we obtained two bragg diffraction peaks at 24.04^0 and 43.69^0 with greater intensity compared to non humidify soot due to this property that shows crystallinity is not lost.

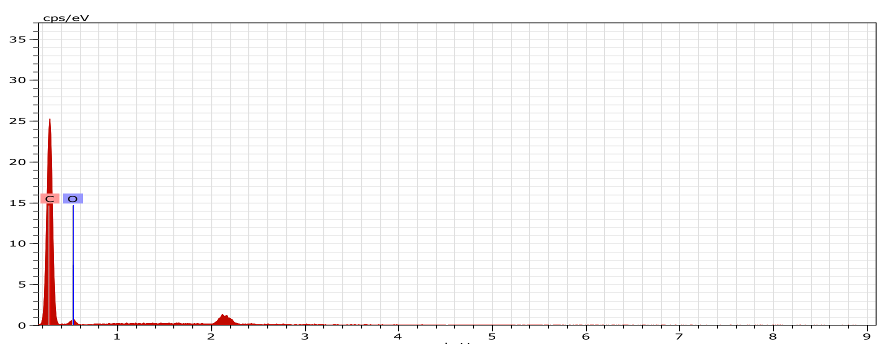

***Fig: 3.1**(e) EDX Spectra of almond oil soot in without humidity case*

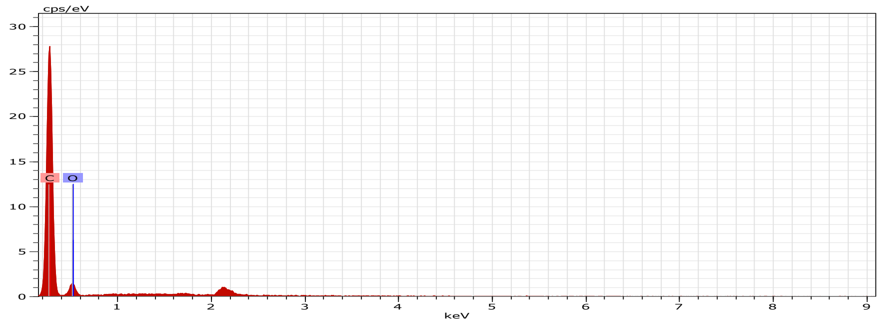

Fig: 3.1*(f)* *EDX Spectra of almond oil soot in with humidity case*

Table-1 ELEMENTAL COMPOSITIONS OF SAMPLES

Samples	Precentage of elements (%)	
	Carbon element	Oxyge element
Mustard oil soot without humidity	92.10%	7.90%
Mustard oil soot with humidity	87.86%	12.14%

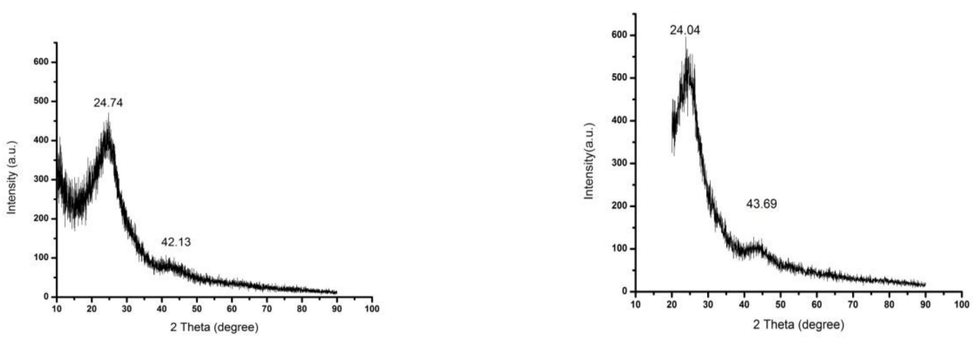

Fig: 3.2 *(g,h) XRD spectra of almond soot without humidity &with humidity*

A high intense peak at 24.74^0 for natural soot indicates the presence of large amount of amorphous carbon as well as a broad intense peak at 24.04^0 for humidify soot indicates the presence of less amount of amorphous carbon due to its high great intensity in both of two conditions peaks are at 42.13^0 and 43.69^0 and indication of the presence of low quality carbon nano material. These all peaks denoted the presence of multi walled graphite carbon nanotubes.

3.2 Spectroscopic characterization

The UV spectra of produced carbon soot particle in two different environments are shown in figure 3.2(a) & 3.2(b). For non humidify environment only obtained a one broad peak at 375.31nm in near visible region that arises from the n-$\pi^{\times}$ transition of enthracene. The optical absorption spectra for humidify condition shift to longer wavelengths at 409.34nm, 492.86nm,604.19nm & 695.66nm all are in visible region that arises from n-$\pi^{\times}$ transitions of may be NO_2,C=S & N=O due to this transition intensity of band is low. The spectra of both conditions revealing the presence of aromatic ring.

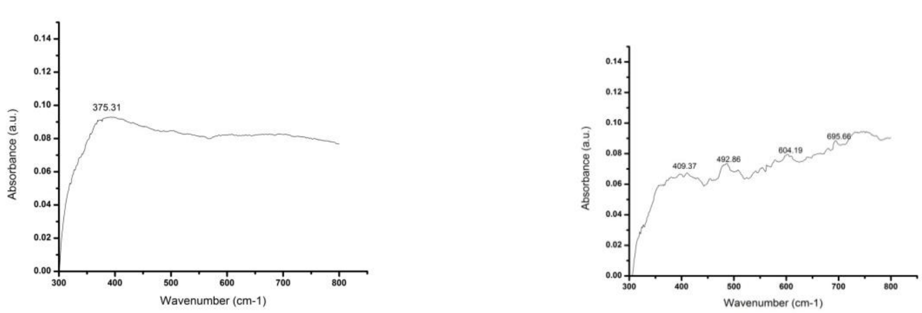

Fig:3.2*(a,b)UV-spectra of Almond soot in non Humidify and humidify environme*

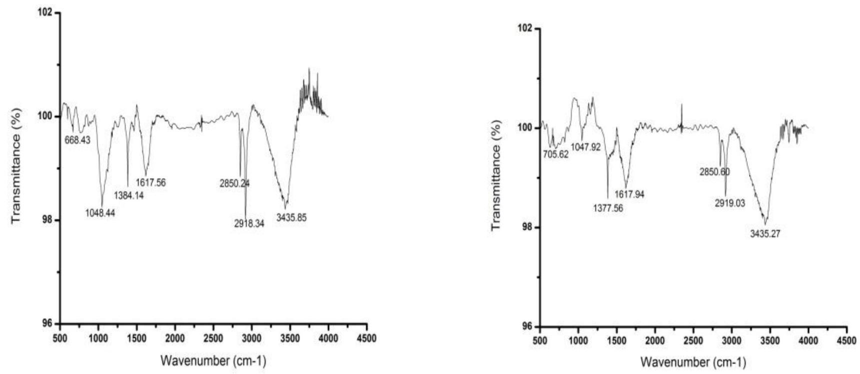

Fig:3.2*(c,d) FTIR spectra of non humidify and humidify sample*

FTIR transmission spectra for non humidify and humidify samples are shown in figure 3.2(c) & 3.2(d). the IR band attribution is given in table(2). A Peak at 3435cm^{-1} is for water O-H stretch, peaks at 2918cm^{-1} & 2919cm^{-1} are for C-H stretch or carboxylic acid O-H, peaks are at 2850cm^{-1} for C-H stretch or (-C-H) aldehyde **A weak peak for both soot spectra at 1617cm^{-1} detected for C=C aromatic stretch. Two bands at 1384 cm^{-1} and** 1377 cm^{-1} stretch for –CH_3 group. Some detected band are at 1048 cm^{-1},668 cm^{-1} & 1047 cm^{-1} ,705 cm^{-1} indicates the presence of SP^2 & SP^3 clusters.

Table 2 Assignment for the IR bands to the functional groups present in the carbon soot materials.

IR Band Position cm^{-1}		Assignment of the soots
Non Humidify soot	Humidify soot	Stretching bands
3435.85	3435.27	Water O-H stretch
2918.34	2919.03	-C-H stretch or carboxylic acid O-H
2850.24	2850.60	-C-H stretch or -C-H aldehyde
1617.56	1617.94	C=C Amide or C=O amide
1384.14	1377.56	-CH_3 Bend
1048.44	1047.92	C-OH stretch
668.43	705.62	C-Cl,C-Br

The Raman spectra of almond oil without and with humidity are presented in figure 3.2(e) & 3.2 (f). The two bands centered around 1338cm^{-1} and 1581cm^{-1} are obtained from the Raman spectra of non humidify carbon soot nano particles. These bands are D and G bands, the presence of G band is attributed to the nano crystalline graphitic structure and D band is observed for amorphous carbon as well as surface defects in carbon soot nano particles[17]. The intensity ratio of D and G band I_D/I_G=0.91 and using the relation by Knight & White crystalline size is 20nm [18].For humidity condition exhibits two prominent bands centered around 1335 & 1568 cm^{-1} the evaluated intensity ratio I_D/I_G=0.77 which indicates more amount of disorder in the system. In both of conditions D bands are at around 1338 & 1335 cm^{-1} has been attributed the presence of amorphous carbon and G bands are at around 1581 &1568 cm^{-1} correspond to an E_{2g} mode of graphite which is related to the vibration of sp^2 bounded carbon atoms and the presence of multi-walled carbon nano tubes(MWCNT$_s$).

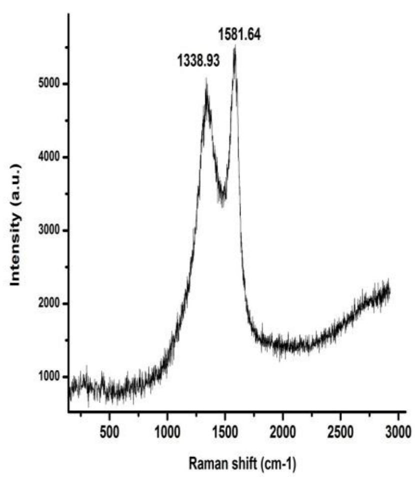

Fig:3.2*(e) Raman spectra for non humidify and humidify Almond oil soot particles*

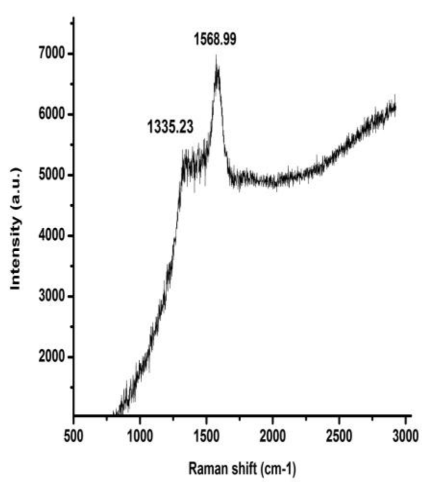

Fig:3.2*(f) Raman spectra for humidify Almond oil soot particles*

The intensity ratio of D and G band I_D/I_G=0.91 and using the relation by Knight & White crystalline size is 20nm [18].For humidity condition exhibits two prominent bands centered around 1335 & 1568 cm^{-1} the evaluated intensity ratio I_D/I_G=0.77 which indicates more amount of disorder in the system. In both of conditions D bands are at around 1338 & 1335 cm^{-1} has been attributed the presence of amorphous carbon and G bands are at around 1581 &1568 cm^{-1} correspond to an E_{2g} mode of graphite which is related to the vibration of sp^2 bounded carbon atoms and the presence of multi-walled carbon nano tubes(MWCNT$_s$).

Conclusion:

Carbon nano kajal made by burning of Almond oil shows the presence of large amount of amorphous carbon and multi-walled carbon nano tubes by soot's structural study.FESEM images of synthesized soot in the form of carbon necklace and the formed particles are in size 30-60nm.For the morphology and nano size of soot humidity is a important factor. Raman study also shows the presence of amorphous carbon as well as surface defect in carbon particles. IR study carried out to identify the presence of any functional group and bands are at low wave region indicates the presence of sp^2 & sp^3 clusters. An aromatic cluster has implication for the optical proprieties of soot which study revealing the presence of aromatic rings. The carbon soot is useful for die purpose and marker pen ink.

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