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Synthesis of carbon dots from leaf of *Cynodon dactylon (grass*)

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Abstract

The research compares the properties of carbon dots made from *Cynodon dactylon grass* found in the local garden of Vadodara, Gujrat, India. Carbon dots (CDs) have gotten a lot of interest in the recent decade because of their wide range of uses. The aim of this study was too-green synthesis of carbon dots utilizing a aq. extract of *Cynodon dactylon grass* in a green and environmentally friendly way. A eco-friendly hydrothermal method was used to prepare carbon dots using *grass*. Furthermore, carbon dots characterized by various techniques like UV-visible, IR spectra. Carbon dots present in the *grass* is done by the UV and IR spectrum analysis.

Keywords: Carbon dots; Cynodon dactylon; Green synthesis; Research

1. Introduction

Intense fluorescent Carbon dots are the name for carbon nanoparticles that are smaller than 10 nm in size and are a member of the carbonaceous family. These were initially discovered in 2004 and drew the interest of numerous academics because to their high luminescent quality. During the unintentional electrophoresis of single-walled nanotubes, they were found [1]. Carbon Dots are typically less than 10 nm in size and are quasi-spherical nanoparticles comprised primarily of carbon and oxygen. Because of its many intriguing properties, carbon dots have just become a brand-new type of fluorescent nanomaterials. They have been successfully used in many different fields, including sensing [3], bio imaging [2], drug delivery [4], catalysis [5], and optoelectronic devices. Their exceptional qualities, such as high water solubility, low toxicity, excellent biocompatibility, functionalizability, and photo stability, are thought to make them preferable to other types of fluorescent materials, such as organic dyes and semiconductor quantum dots [6]. They have also shown themselves to be viable options for creating fluorescent biosensors and chemo sensors for a variety of analytes. To date, numerous methods have been devised to create carbon dots, including laser ablation, are discharge, thermal treatment, electrochemical oxidation, combustion, ultrasonification, hydrothermal treatment, and microwave therapy [7-10].

The hydrothermal synthesis technique, on the other side, was thought to be one of the simple techniques for creating CDs, requiring little-to-no equipment, little energy, straightforward manipulation, and one-step preparation [11]. In particular, CDs can become active without post-treatment due to hydrothermal synthesis [12]. Many carbon sources or precursors are available for the creation of CDs. When compared to the chemicals used to produce CDs as precursors, natural materials are one of the most popular and easily accessible materials in nature and are advantageous for industrial applications and large-scale production.[13] Green CDs, or natural renewable sources, offered exceptional qualities like low cost, high availability, high yield, high biocompatibility, and high regenerative capability. Apple [14], jackfruit [15], cabbage [16], orange[17], banana[18], oolong tea[19], pear[20], jujubes[21], betel leaf[22], guava leaf[23], bamboo leaf[24], etc. are some examples of the natural sources of CDs.

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Objective

The objective of proposed of the work is study extraction, synthesis of carbon dots in *Cynodon dactylon grass* .The analysis is done by UV visible, IR spectra on the *grass* extract of the detection of the chemical constituents, carbon dots present in it. 3.

1.1. Application of carbon dots

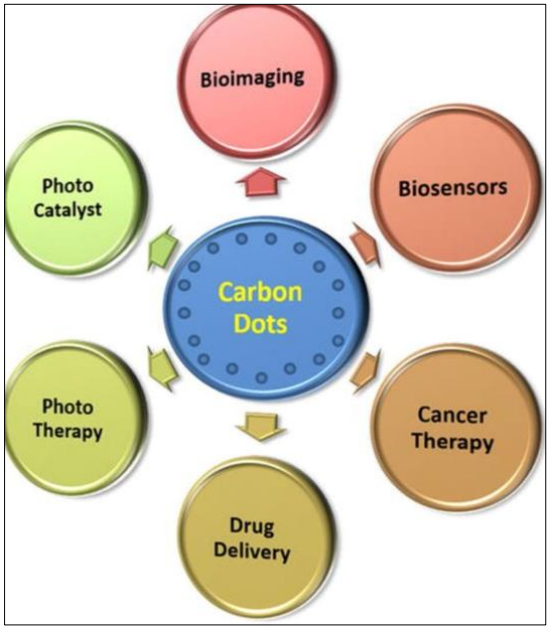


Figure 1 Application of Carbon Dots

2. Material and methods

2.1. Methods experimental section

Cynodon dactylon grass was collected in Vadodara, Gujarat, India, nearby to a garden. Deionized water was used to wash the freshly cut *grass*.

A home mixer grinder used to ground the *grass Cynodon dactylon* into a paste. The *grass* paste that was produced was extremely soft and fine. It was manufactured specifically into a fine paste so that, when combined with water, the substance completely disperses and we can extract the most carbon from the *Cynodon dactylon Grass*.

The number of carbon dots extracted will be less if the paste's consistency changes or if the *grass* paste has a flaky texture, which would reduce the possibility of extracting the *grass*'s carbon content. Consequently, we decided to make a very thick and fine paste.

The following stage involved combining 800 ml of Deionized water with 165 grams of *grass* paste This combination was then heated for 3 hours at 150 °C. and 1700 rpm on the hot plate and magnetic stirrer, respectively. A normal household tea filter and filter paper were used to filter the solution, producing a yellow-colored solution. After that, the solution was centrifuged for 30 minutes at 4000 rpm to get clear of any remaining heavier particles. The solution was then decanted into a 500 ml container. The former was a clear solution with a light yellow color. The solution was then refluxed for three hours at 150 the ℃ before naturally cooling. It was then centrifuged for 30 minutes at 4000 rpm. Then, 1 N 25 ml of NaOH was added to suspend the solution.

Using a traditional heating technique, the *grass* solution was synthesized. The solution's PH was adjusted to 11 using KOH aqueous solution after 500 ml of *Cynodon dactylon* extract was transferred to an Erlenmeyer flask (1 N). A cotton plug was used to seal the flask, which was then heated to 180 °C. for 5 hours. After the flask had cooled, the Cynodon

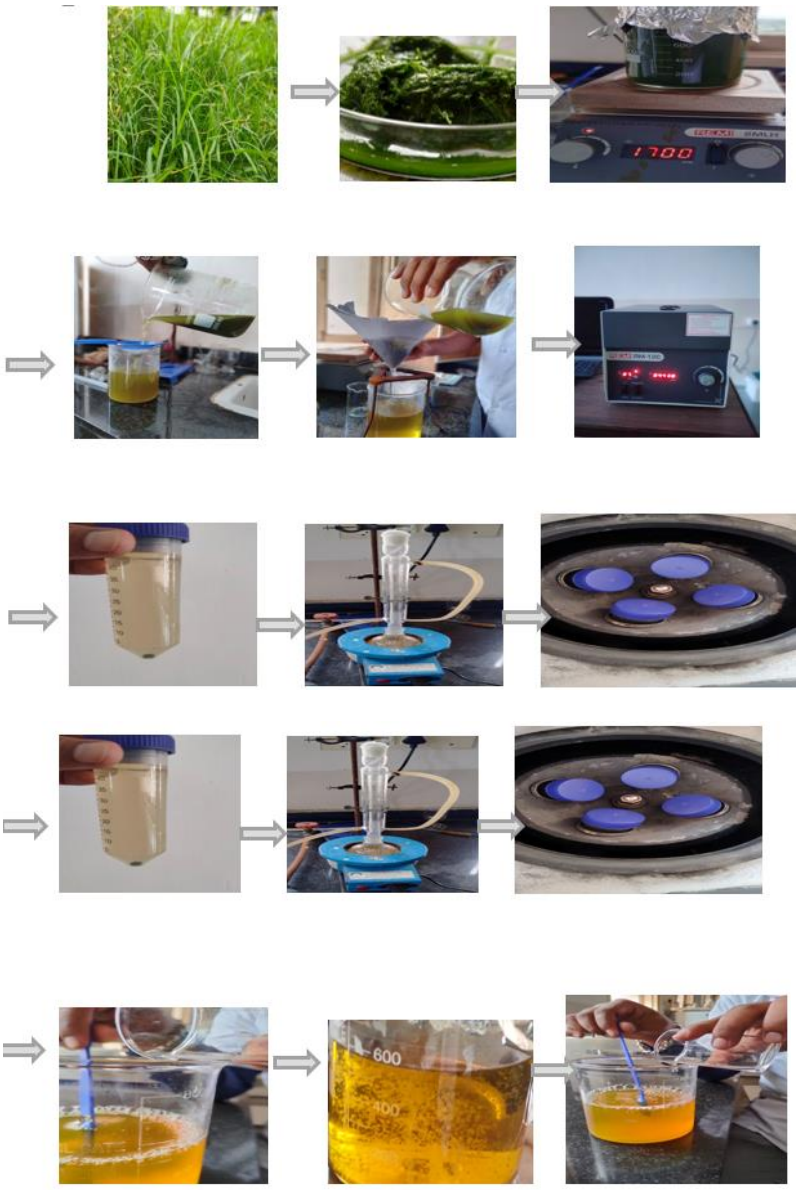
Dactylon dark brown dispersion was separated via filtration. After neutralized, the sample was centrifuged at a high speed of 4000 rpm for 15 minutes.

After that, 2 ml of ethylene diamine and 25 ml of sample were mixed.

Take 50 ml of *Cynodon dactylon* extract and combine it with 1.5 ml of phosphoric acid in the second process.

Then, using standard heating techniques, 100 ml of samples were obtained and combined with 1.5 ml of ethylene diamine and 1 ml of phosphoric acid. These three samples were also filtered, neutralized and centrifuged following the same method. Which samples were checked under UV Light and IR Spectra.

2.2. Graphical experimental section



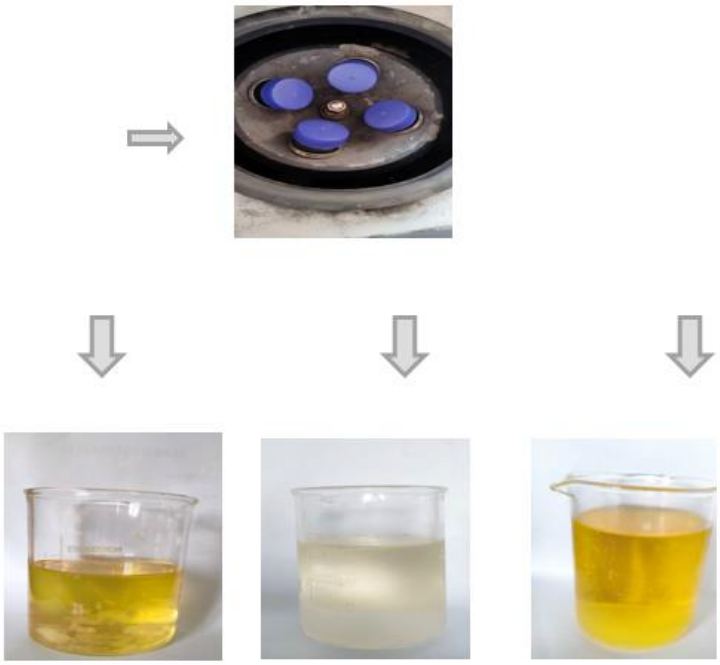


Figure 2 Schematic Photographs of Carbon Dots preparation

3. Results and discussion

3.1. Characterization of carbon dots

3.1.1. Uv-visible spectroscopy

Ethylene Diamine

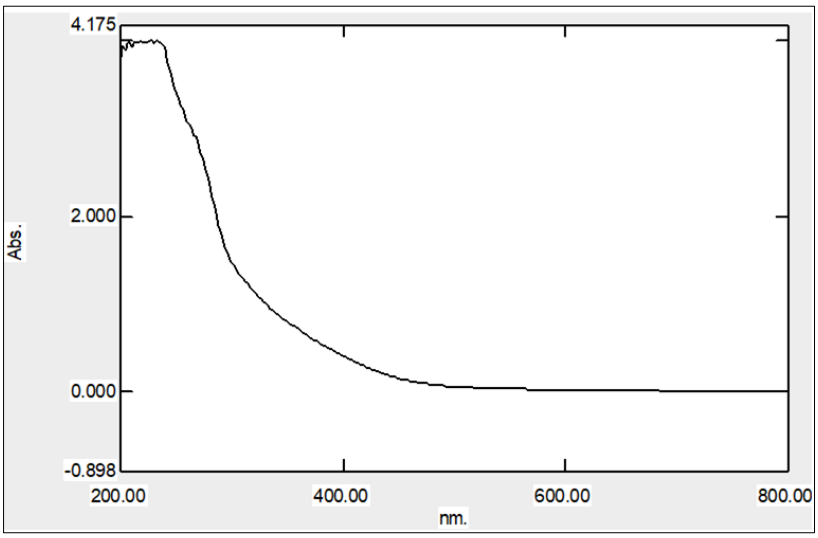


Figure 3 UV visible spectra of *Cynodon dactylon grass* carbon dots

Phosphoric Acid

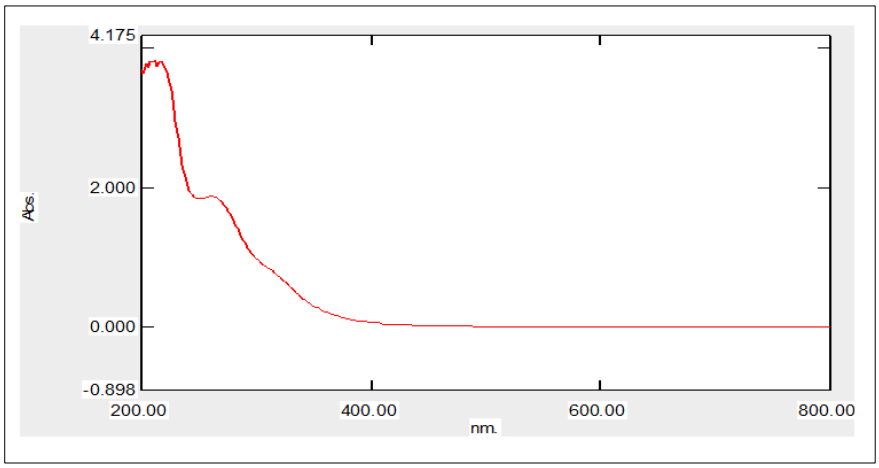


Figure 4 UV visible spectra of *Cynodon dactylon grass* carbon dots

EDA+PA (MIX)

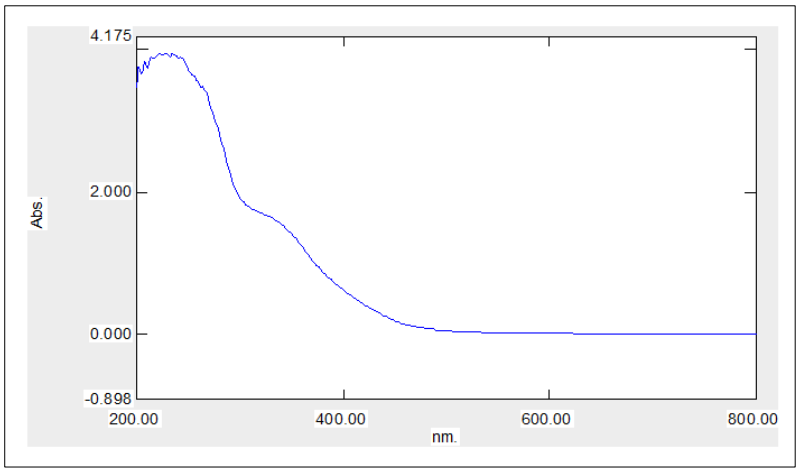


Figure 5 UV visible spectra of *Cynodon dactylon grass* carbon dots

IR data

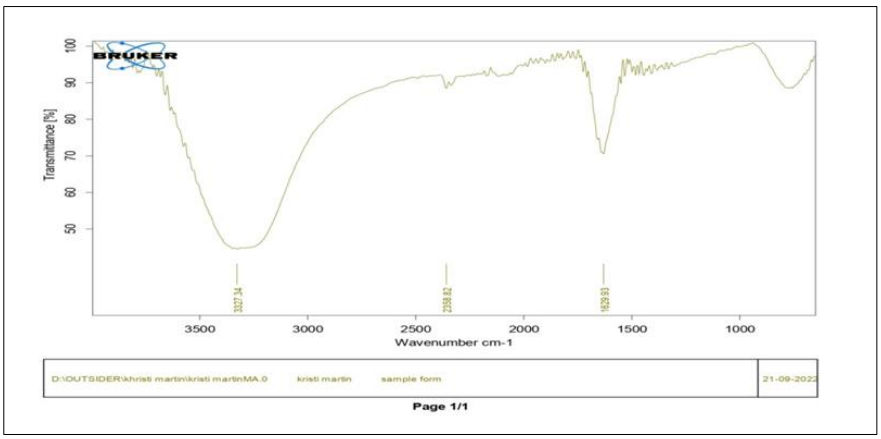


Figure 6 IR SPECTRA (Sample of EDA)

Table 1 Data of the carbon dots

Serial Number	Peak value	Inference
1	3327.34	O-H
2	2358.82	O-H
3	1629.93	C=O

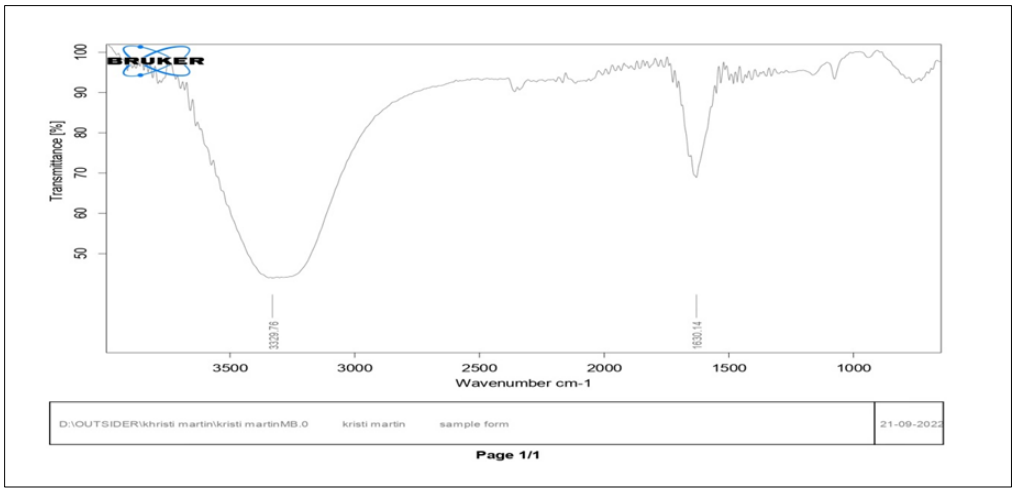


Table 2 Data of the carbon dots

Serial Number	Peak value	Inference
1	329.76	O-H
2	630.14	C=C

Table 3 Data of the carbon dots[19]

Serial number	Peak value	Inference
1	3330.51	N-H
2	1630.04	C=O

4. Conclusion

The green synthesis method of Carbon dots are reported in this article[25]. The particle was created by *Cynodon dactylon grass* extract. The synthesis of carbon dots from *grass* using NaOH, KOH, Ethylene diamine, Phosphoric acid and DI water etc. This carbon dots are characterized by various technique like UV-Visible, IR spectra[26]. The conformation of IR spectra of carbon dots are 3327.34, 1630.14 nm etc. The key functional group present in the carbon dots samples were determined using IR tests as a qualitative analysis. Wide bands in the 3300-3500 cm-1 range were observed in carbon dots samples, indicating hydroxyl group O-H stretching ,N-H stretching at 3327.34nm and 3329.76nm respectively. At 1629.93 nm C=O stretching occurs in primary amide. At 1630.14 nm C=C stretching occurs in alkene. these dots are used in medical and pharmaceutical work and also lots of application with these dots.

Compliance with ethical standards

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