# Treatment of the Textile Effluent Using Canna Indica Leaves and Stalk Biochar

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**Abstract: -**
The various dyes, organic and inorganic chemicals, and heavy metals in textile effluent water make it cost-prohibitive to clean, thus it is thrown into waterways, polluting them. Water treatment technologies include ozone, adsorption, membrane separation, bio-sorption, biodegradation, electrochemical degradation, and UV radiation.

Biochar prepared from Canna indica leaves and stem biochar prepared at 500 degrees Celsius was used for removing the color and COD of the wastewater from the dye industry. Batches were tested at various temperatures and concentrations. At 30ºC and 20 hours, the dosage was examined in relation to COD and color elimination. The samples showed no further adsorption change. The pH and flocculation rpm were fixed at 6.65 and 100 respectively. Canna leaves removed 77–83 percent of COD at doses of 1–2.5 gm, whereas Canna stalks removed 14.7–73.142 percent at the same dose. Canna leaves remove color and COD more selectively.

**Keywords: Adsorption, biochar, canna stalk biochar, canna roots biochar, waste water treatment**

## 1. Introduction

With pigment and dye industries the growth economic of world is high [1]. Direct dye and azo dyes present in the waste water is around 75 to 80% [2]. Many dyes for oxidizing are stable [3]. One method called adsorption study used for much area of industries for waste water treatment, and for this we reduce the costing of many industries [4]. Many chemical industries send waste water directly to water body and some of treat by caustic [5]. Now a days a challenging for reducing COD and color for industrial waste water of dye and pigment industries [6]. Now a days some technique like nano-partical and nano material metal oxides widely introduce for different studies [7]. For many years they used bio oil and biofuel method but can't achieve good result based on that [8]. In literature only few papers is presenting on biochar used for waste water treatment with different component like walnut, peanut, agriculture material [9]. More waste water producing industries is dye, pigment and textile industries, because some processes used water for washing [10]. Remove component of all dye is mandatory from water [11]. There is many processes used for remove dye from water is adsorption, filtration, oxidation [12], and coagulation [13]. Now a day some technique used for preparation of biochar by pyrolysis and hydrodynamic cavitation process and it's a very effectively by using on industrial waste water treatment [14]. Suitable item is for waste water is bio char [15]. While preparing biochar we can control temperature, pH, timing, concentration of solution [16]. Some biomass which are used for soil treatment, are used to prepare bio char [17]. Biochar is producing carbon containing materials which are widely used in treatment of waste water; also it causes environmental pollution [18]. A pyrolysis is thermochemical conversion of biomass, and is highly preferable method for noncombustible gas [19]. For waste water treatment biochar has large application [20]. Different technology like adsorption [21], ozonation [22] used for bio char. Biochar is made from the heating of natural organic materials (rice husk, manure, wood, strew dust, crop and other waste, etc.) in a high temperature, sometime it get by absence of air based on different temperature. This process is call as Pyrolysis [23]. There are different three types of pyrolysis like Slow (300-700 ºC), Fast (400-800 ºC), and Flash (800-1000 ºC) [24]. It was generally found that the bagasse treated with additives caused mass degradation at lesser temperatures and formed considerably greater yields of biochar than untreated raw bagasse [25]. Sometimes for water/wastewater treatment, bio char can have extensive application prospects [26]. New bio char-based supports (bio char obtained by pyrolysis of Miscanthus Straw Pellets (MSP) and Soft Wood Pellets (SWP) at 550 and 700ºC) were successfully prepared using ultrasound-assisted methodology [27]. The best operating conditions were pH = 2 and 100 mesh granulo metry. Also, adsorbent dosage studies were carried out, as well as equilibrium and adsorption kinetics [28]. As an emerging sorbent with great potential, bio char has shown significant advantages such as the broad sources of feedstock, easy preparation process and favorable surface and structural properties [29]. These results imply that biochars have good potential as a green effective sorbent for remediation of Sb (III) contaminated water, and simultaneously reduce the toxicity of Sb (III) by catalytic oxidation [30].

## 2. Material and Method

### 2.1 Materials

*Canna-Indica* plant collected from cannel near kosamba, Gujarat, india. Self-made SS-321 reactor, Nitrogen cylinder for nitrogen purging. Weighing balance, Muffle furnace (Shree radhe Technology) with maximum temperature range is $800^0$C to $1000^0$ C. Simple Filtration unit with funnel and filter paper. Flocculator for stirring sample, UV-Spectrophotometer (Spectrophotometer-893).

### 2.2 Preparation of Canna-Indica Leaves & Stalk Biochar

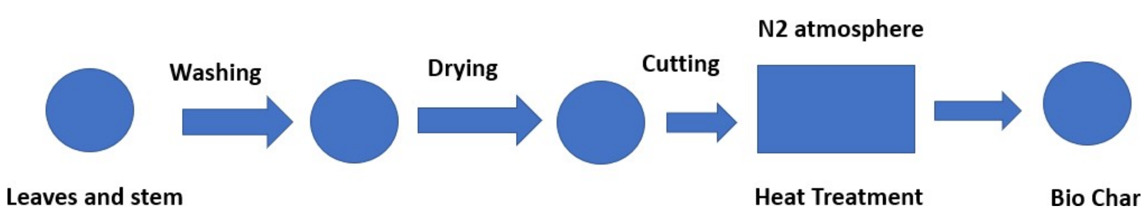



**Figure 1: Schematic diagram for preparation of biochar from canna indica**

- The schematic design for the production of canna leaves and canna stalks for biochar in a home-made reactor is shown in Figure-1.

### 2.3 Preparation of *Canna-Indica* Leaves Biochar

Canna-Indica was gathered from the canal for the purpose of preparing charcoal. These leaves should be washed in water three times in order to remove any undesirable material. The next step is to let it dry out for seven days. When the process of drying the canna leaves is complete, the leaves are sliced into pieces. When the material has been reduced to smaller pieces, it will be time to weigh the material on the weighing scale. Then, put sixty to seventy grams of cannabis leaves into the stainless steel reactor, and make sure the reactor is tightly sealed. Start the nitrogen supply as you place the reactor in the Muffle Furnace. Then turn on the muffle furnace, adjust the temperature to $500^0$ degrees Celsius, and begin the process. As the temperature continues to rise at a rate of 20 degrees Celsius per minute, the biochar will be heated for a total of one and a half hours. After then, let it sit out for the entire night in the cold air (at that time stop nitrogen purging). Once the temperature has been brought down to room level, the muffle furnace and the reactor can be opened. Take away all of the biochar, and focus on the weight.

### 2.4 Preparation of *Canna-Indica* Stalk Biochar

Washing these stalks with water three times will get rid of any unwanted material and get you ready to produce biochar out of the Canna-Indica that was salvaged from the canal. The following step is to dehydrate it for seven days at room temperature. When the canna stalks have been allowed to completely dry, they are then cut into pieces. As soon as the material has been cut up into more manageable chunks, it will be time to weigh the item on the scale. After that, a canna stalk that weighs between 60 and 70 grams should be inserted in the SS reactor, and the reactor should afterwards be turned off in the appropriate manner. As you insert the reactor into the Muffle Furnace, the supply of nitrogen should be activated. After that, start the process by turning on the muffle furnace, setting the temperature to $500^0$ degrees Celsius, and adjusting the temperature as needed. The biochar will be heated for a total of one and a half hours, provided that the temperature continues to climb at a pace of 20 degrees Celsius per minute. Following then, leave it exposed to the chilly air outside for the entirety of the night (at that time stop nitrogen purging). When the temperature has been lowered to room temperature, the doors to the muffle furnace and the reactor can be opened. Take off all of the biochar and concentrate on the total weight instead.

### 2.5 Process of Absorption

Before beginning the process of absorption, you will first need to get some biochar that has a particle size of 90 microns (a screen of this size will allow 90 percent of the material to pass through it). Now pour the wastewater from the industrial textile into the flocculator, and start mixing it up with the paddles. You will need four beakers, each with a capacity of 100 milliliters. It should be supplemented with biochar at a variety of concentrations (0.4gm, 0.7gm, 1gm, 1.5gm). The sample has to be left at room temperature for seventeen hours before being analyzed. After a period of 17 hours, the pH of the sample has been measured and found to be 6.65. The flocculation has to be stopped immediately. Using the filtration set up, which consists of a funnel and some filter paper, to get started on the process of filtering the liquid. Gather the milliliters that have been filtered into a single container, and then forward the absorbed biochar that has not been able to pass through the filter paper so that it may be further processed. Depending on the temperature at which the biochar was analyzed, a variety of tests were carried out ($300^0$C, $400^0$C, $500^0$C, $600^0$C, $700^0$C, $800^0$C). Nonetheless, it is important to point out that biochar that was burned to $500^0$ degrees Celsius had great results in terms of removing color and COD from the water.

**2.6 Different practical run table (Canna-indica Leaves)**

• The results of the various experiments are summarised in figure, from which we can deduce that making biochar from cannabis leaves at a temperature of $500^0$ degrees Celsius produces a higher percentage of the expected yield and removes more of the colour than making biochar at $300^0$ degrees Celsius, $400^0$ degrees Celsius, $600^0$ degrees Celsius, $700^0$ degrees Celsius, or $800^0$ degrees Celsius.

• The FTIR and FESEM analysis report of canna leaves and canna stalk biochar that was created at $500^0$ degrees Celsius is also included in the section under "Results."

• This particular run was executed with a varied timing, as well as a different level of focus.

• figure displays the outcomes of all of the many experiments that were carried out. Here, we carry out many iterations of our planned study project, after which each sample is analysed to determine its COD and colour. As a result, we also define the COD value both at the beginning and the end, which is the primary criterion for the firm.

• Moreover, we feel it is important to point you that the highest COD reduction is 83%, and that colour removal may reach up to 94%.

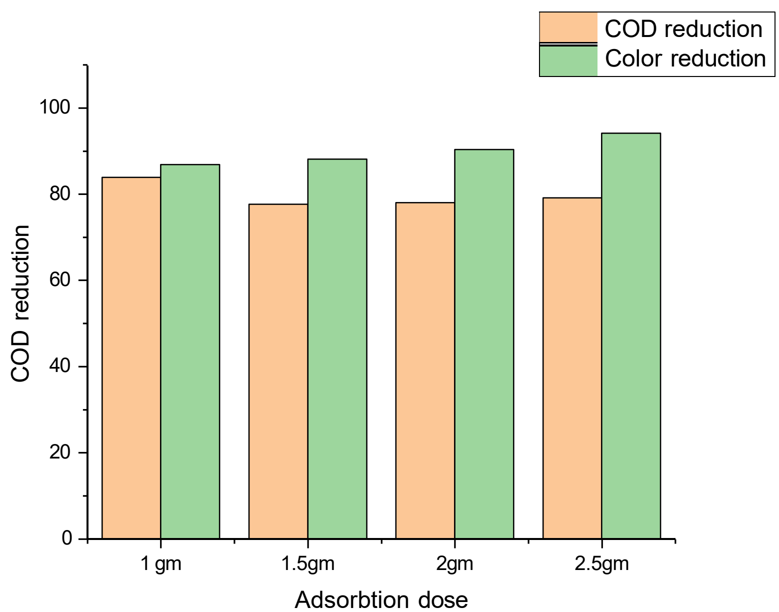



**Figure:-2 Canna indica Leaves biochar adsorption doses vs. COD and color reducing**

- The findings from all of the different trials are summarized in figure below. Because of these findings, we are able to arrive at the conclusion that the production of biochar from canna stalk at a temperature of $500^0$ Celsius results in a greater percentage of yield and removes more color than the production of biochar at temperatures of $300^0$ C, $400^0$ C, $600^0$ C, $700^0$ C, or $800^0$ C. These temperatures were tested.

- By using canna-stalk biochar, the maximum amount of chemical oxygen demand (COD) that can be removed is 71 to 73%, and the maximum amount of colour that can be removed is 93% after using it for 17 hours at a temperature of 30 degrees.

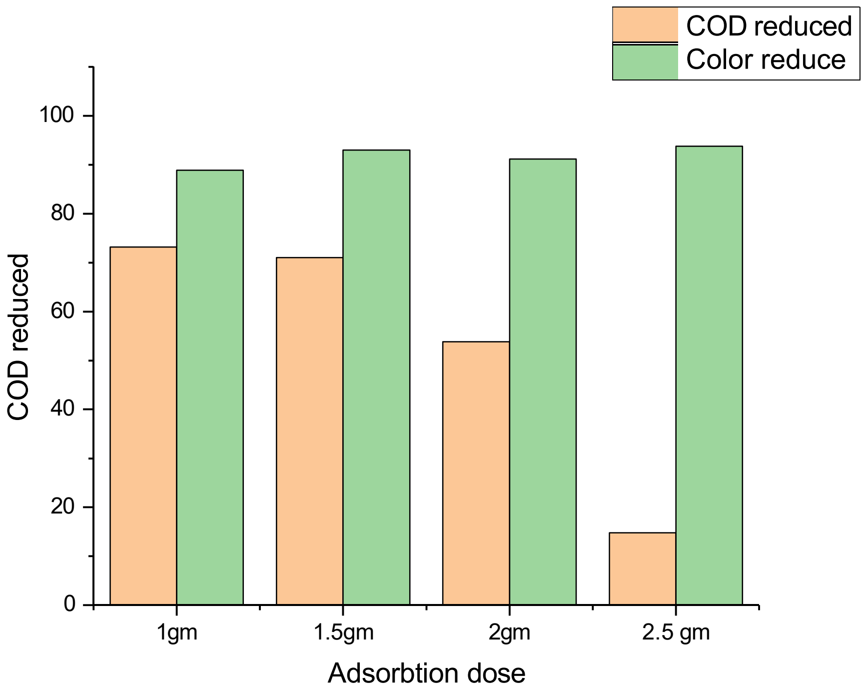



**Figure:-3 Canna indica stalk biochar adsorption doses vs. COD and color reducing**

## 3. Result and Discussion

### 3.1 Different Results

- This chapter should contain details about the results obtained and discussions based upon the results. All the supporting information like Graphs, tables and figures should be part of this chapter.

**Canna Leaves Biochar**

**Canna Stalk Biochar**

**Figure:4 Indicates the *Canna-Indica* Leaves and Stalks Biochar making in SS-Reactor**

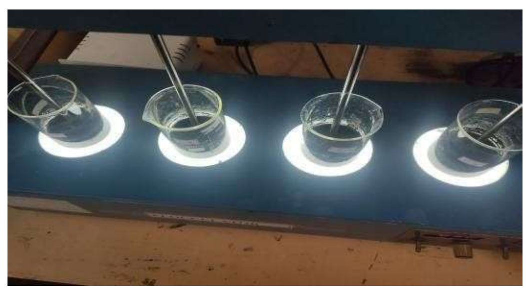
- Figure-4 indicates that the *canna-indica* leaves and *canna-indica* stalk biochar making in SS reactor based on previous mention process.

➢ From figure:-5 The first image is of canna stalk biochar, and the FTIR analysis reveals that the peak at 1436 cm1 indicates the presence of carboxylic acid as well as O-H bonding. Both of these properties can be seen in the biochar. In addition, image number 875 shows that the C-H group is there. This was still another piece of evidence.

➢ In the second photo, you can see the FTIR spectra of the biochar that was used in the study. These spectra were obtained by taking samples from canna leaf. It is important to take note that 1435 of the peaks might be explained by carbonate, stretching of Si–O, and out-of-plane bending of the aromatic ring C–H bonds, respectively.

Muffle Furnace with Nitrogen Cylinder

Stirring Equipment




Waste Water initial and Final Sample

**Figure:-5 Lab Analysis equipment and collected Sample**

- This graphic directly above it has a list of all of the different pieces of equipment that were used in the conduct of this experiment.
- The first piece of equipment is a muffle furnace, which also includes a cylinder of nitrogen.

- The picture below represents the first sample of industrial waste water as well as the final sample of waste water after the adsorption inquiry was done.

### 3.2 Material Cheking Report

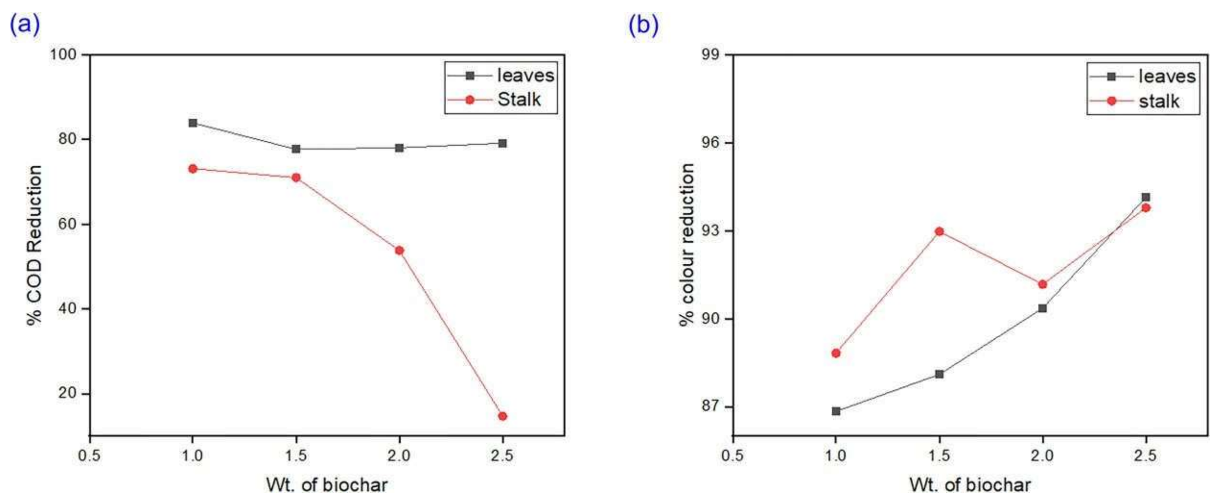
- Here we shows that all experiments lab analysis report of canna indica leaves and canna indica stalk biochar.
- Also here we put AAS report for finding how many metal are presesnt in our waste water and how much amount of metal reduction by experiment.

#### 3.2.1 Canna Indica Leaves Biochar as adsorbant, COD and Color Result

- As per COD result dated 29/12/2021(Vidhyabharti Trust GPCB approved Environment audit cell, Bardoli,Gujarat), it clearly mentioned that before treatment of water the COD is 2100 and after treatment fordosing 1gm COD reduce to 337.92, for dosing 1.5gm 468.48, for dosing 2.0gm 460.80, for dosing 2.5gm 437.46.
- Also Afteretreatment ph will increase from 6.65 to 7.7
- Color reduce from 1500 to 87.837

#### 3.2.2 Canna Indica Stalk Biochar as adsorbant, COD and Color Result

- As per COD result dated 26/01/2022 (Vidhyabharti Trust GPCB approved Environment audit cell, Bardoli,Gujarat), it clearly mentioned that before treatment of water the COD is 2100 and after treatment fordosing 1gm COD reduce to 564, for dosing 1.5gm 609, for dosing 2.0gm 924.
- Also Afteretreatment ph will increase from 6.65 to 7.9
- Color reduce from 1500 to 105.405




**<u>Figure:-6 COD and color Result graph of canna indica, leaves and stalk biochar</u>**

- Figure-6 indicates that the comparison of the COD removal capabilities of Canna indica leaves and Canna indica stalk biochar is shown in Figure a) At various dosages, such as 1, 1.5, 2, 2.5, and so on, we receive diverse results in COD reduction. The black line depicts the COD decrease caused by canna-indica leaf biochar.

- The comparison of the color removal of canna indica leaves and canna indica stalk biochar is shown in Figure b). The color decrease of canna-indica leaves caused by biochar at various dosages is shown by the black line. We see varying degrees of color decrease depending on the dosage, which may range anywhere from 1 to 2.5.

### 3.2.3 Initial and Final Waste water AAS report

- As per AAS (Atomic absorbtion Spectrophotometer) result dated 19/03/2022 (Vidhyabharti Polucone lab, Surat, Gujarat), it clearly mentioned that before treatment of water the the parameter in present like Nikel (Ni) and copper (Cu), level of 0.092 mg/l, 0.14 mg/l
- After treatment Ni is reduce from 0.092 mg/l to <0.02 mg/l and Cu is reduce from 0.14 mg/l to 0.092 mg/l.

## 4. Conclusion

When it comes to biochar production in an SS-reactor, there are a lot of different factors that might play a role. Since canna indica is such a versatile plant, we decided to treat our wastewater using canna indica biochar, which contains copper and can be created from both the stem and the leaves of the plant. According to the findings of the SEM investigation, the best absorption results may be achieved by using biochar made from canna indica leaves rather than biochar made from canna stalks. In contrast, we find that the biochar produced from cannabis indica leaf is more effective than the biochar produced from cannabis stalks in this particular investigation. Since this biochar is so good at lowering the COD and colour in waste water, more and more people are turning to it for that reason. It has been shown that implementing these strategies and making use of biochar may bring about a COD reduction that is as high as 80 percent. Not only does the colour of the water become much better when ozone is added to the mixture, but the colour of the water also improves significantly.

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