

PROJECT REPORT
ON
ACTIVITY OF BIOCHAR AS ADSORBENT



Submitted By:

Dr. Ashwani Kumar

HoD, Deptt. of Bioscience
Shri Ram College, Muzaffarnagar

Submitted To:

**JAIN CARBON INDUSTRIES,
MUZAFFARNAGAR**

2015 - 2016

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I/OAC, Shri Ram College,
Muzaffarnagar


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Shri Ram College
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JAIN CARBON INDUSTRIES

MANUFACTURERS OF: ALL TYPES OF ACTIVATED CARBON & CARBON BLACK

Head Office : 31, State Bank Colony, Jansath Road, New Mandi, Muzaffarnagar-251 001 (U.P.)

Works : Vill. Silajuddi, Distt. Muzaffarnagar (U.P.)

Mobile : 9412211935 + e-mail : jaincarbons@yahoo.com

Ref.: J-KP/ 2015-16/ 315

Date: 28.12.2015

To

Dr Ashwani Kumar
Head, Department of Biosciences
Shri Ram College, Muzaffarnagar

Subject: Sanction of funds for Research Project "Activity of Biocher as Adsorbent".

Dear Sir,

Please refer to our letter dated 18.12.2015 and submission of your synopsis on the above subjected project.

We are pleased to sanction Rs. 10,000/- as the expenses to be incurred on the Project. You are requested to complete the work within stipulated period.

Thanks & regards,


For Jain Carbon Pvt. Ltd.
Muzaffarnagar

Copy to:-

1. Principal, Shri Ram College, Muzaffarnagar.

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Utilization Certificate

S.N.	Detail of sanction of Fund with Project name and Duration	Amount
1.	90-Days project on Activity of Biochar as Adsorbent, Date of Sanction of Fund- 18.12.2015 as per Sanction Letter	10000.00/-
	TOTAL	10000.00/-

It is Certified that out of Rs. 10000.00/- (Ten Thousands Only) of grants sanctioned by Jain carbons (P) Limited, Muzaffarnagar during the year 2015-16 in favor of Shri Ram College, Muzaffarnagar, a sum of Rs. 10000.00 has been utilized for the purpose of the project for which it was sanctioned and that the balance of Rs. Nil remaining unutilized at the end of the year has been surrendered. The Extra amount (If any) is met out by Shri Ram College.

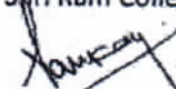
2. Certified that we have satisfied our self that the conditions on which the grant was sanctioned have been duly fulfilled/are being fulfilled and that we have exercised the following checks to see that the money was actually utilized for the purpose for which it was

sanctioned.

Kinds of checks exercise-

- 1 Checking of cash book
- 2 Checking of payment vouchers.
- 3 Checking of expenses bills.

For Shri Ram College


Secretary
Place: Muzaffarnagar
Date: 06.04.2016

For Goel Rakesh & Co.
Chartered Accountants



M.NO. : 071858
FRN : 003374C

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Introduction

The removal of the most prevalent heavy metal ions [cadmium(II), lead(II), copper(II), and zinc(II)] by adsorption on 2 Biochar samples has been investigated, following the determination of physical and chemical adsorption properties of biochar.


The efficiency of adsorption of heavy metal ions [cadmium(II), lead(II), copper(II), and zinc(II)] on biochar was studied at different concentrations of heavy metals [onefold maximum contaminant level, twofold maximum contaminant level, fivefold maximum contaminant level and dosages of biochar (1.6-140 g) at constant pH of leaching solution, temperature, and contact time.

Adsorption capacity of biochar samples was assessed by the application of extended *Freundlich isotherm*. In this study, biochar was evaluated as a potential adsorbent to efficiently reduce concentration of heavy metal ions in metal-contaminated water (Sample taken from Kali Nadi). The maximum adsorption capacity were reached of copper(II) on Biochar Sample 1 (128.7 Ig g^{-1}) and of zinc(II) on Biochar Sample 2 (107.0 Ig g^{-1}). Adsorption capacity of lead(II) on sample 1 and sample 2 varied from 1.29 to 3.77 and from 2.37 to 4.49 Ig g^{-1} , respectively.

Research methodology

- 2 Samples of Biochar were provided by the Jain carbon Industries labelled as Sample 1 (S1) and Sample 2 (S2).
- Physical properties such as Determination of bulk density was based on dry matter weight and the occupied volume ratio.
- Chemical properties such as concentration of heavy metal, pH, total carbon content were analyzed using described protocols in literature.

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- Adsorption capacity was measured using leaching solution and column test.
- In order to model the biochar adsorption capacity using Freundlich isotherm and to compare adsorption capacity between different types of biochar, each column was filled with a different dose of biochar.
- Each analysis was prepared and analysed in duplicates. The measurements were carried out three times and the average of the results of measurement errors was calculated. The statistical analysis was performed using Excel program. The results of arithmetic mean values with values of standard deviation were presented in graphical expression of the results.

Results

Table: Physical and chemical properties of Biochar samples

	Temperature of thermal treatment (°C)	Thermal treatment duration (min)	Porosity (%)	Specific surface area (m ² g ⁻¹)	Density (g cm ⁻³)	Apparent density (g cm ⁻³)	Bulk density (g cm ⁻³)	pH	CEC (cmolc kg ⁻¹)	TC (%)
S1	450 (±5)	120.0	77.4	9.16	0.275	0.520	1.21	8.56 ± 0.02	3.41 ± 0.24	96.3 ± 0.01
	700 (±5)	45.0	77.3	10.4	0.279	0.499	1.23	8.52 ± 0.01	2.40 ± 0.21	95.8 ± 0.01
S2	450 (±5)	120.0	79.2	5.92	0.444	0.804	2.14	8.69 ± 0.02	5.09 ± 0.42	95.0 ± 0.01
	700 (±5)	45.0	73.1	7.17	0.453	0.682	1.68	9.27 ± 0.01	5.71 ± 0.07	96.6 ± 0.01

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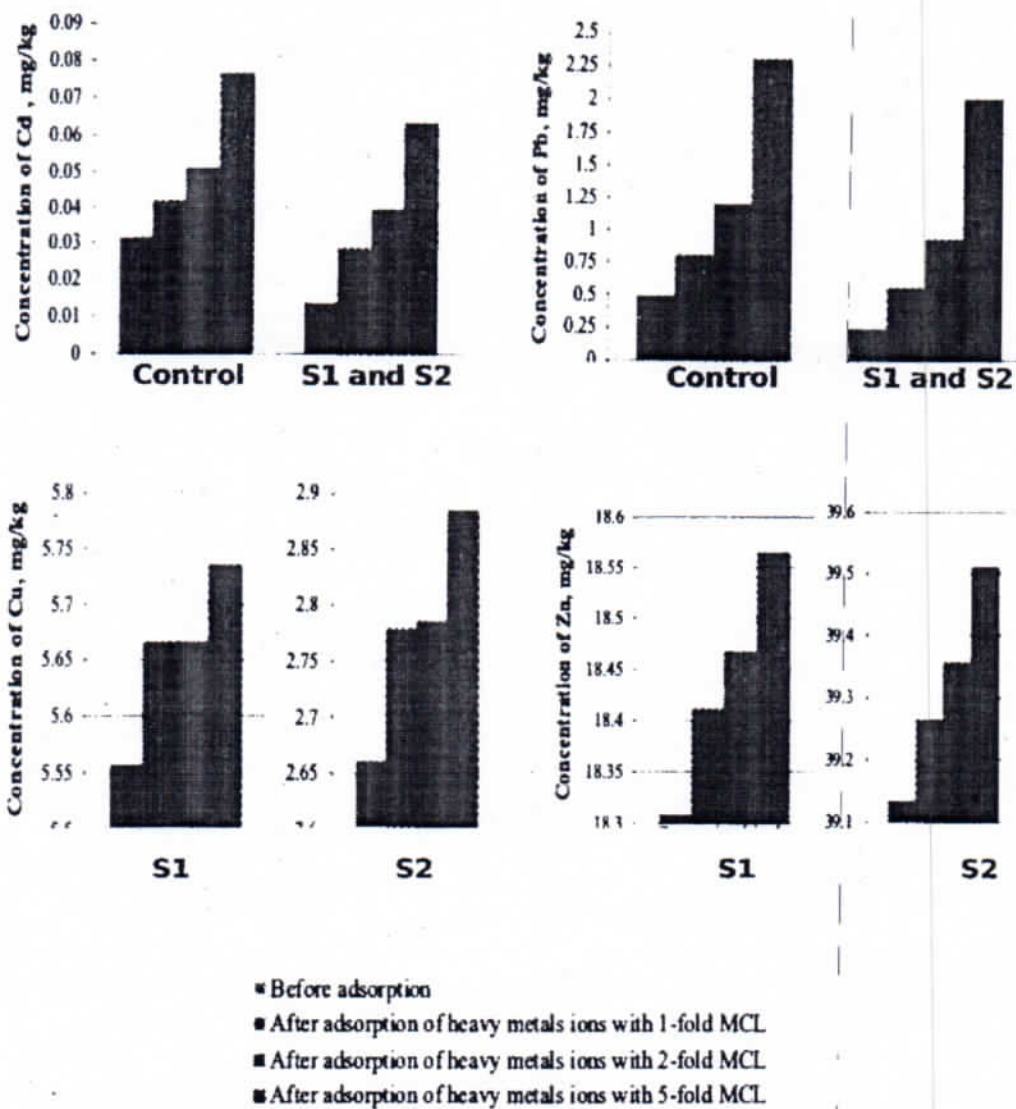


Fig: Concentration of heavy metals (Cd, Pb, Cu, Zn) in biochar samples before and after adsorption

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Conclusion


- Due to advantageous physical and chemical characteristics (such as porous network and cation exchange capacity) of biochar, the interest towards adsorption processes and efficiency of various pollutants on different types of bio-char has increased in recent years.
- Due to higher pH of S1, pH of eluate resulted from elution through S2 biochar slightly increased more than pH of eluate resulted from elution through S1 biochar.
- The attention should be focused on highly alkaline biochar, which could increase pH of treating water above the limits.
- Adsorption efficiency of both types of biochar decreased with increased initial concentration of heavy metals ions.
- The adsorption of heavy metal ions increased, when the dosage of adsorbent increased.
- The capacity and intensity with which biochar adsorbed heavy metal ions from leaching solution had been modelled by the application of extended Freundlich isotherm. It reflected the heterogeneous properties of the surfaces and favourable adsorption process.


(Dr. Ashwani Kumar)

Project Supervisor

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