BRIEF REPORT

ON

ADVANCED BIOLOGICAL ANALYSIS OF BIOCHAR

Submitted By:

Mr. VIKAS KUMAR

Assistant Professor, Deptt. of Bioscience
Shri Ram College, Muzaffarnagar

Submitted To:

JAIN CARBON INDUSTRIES, MUZAFFARNAGAR

2017 - 2018

CERTIFIED

Co-ordinator
IQAC, Shri Ram College,
Muzaffarnagar

Principal
Shri Ram College
Muzaffarnagar

7/1

Jain Carbon Industries

Mfs. of ACTIVATED CARBON, ACTIVATED CHARCOAL, CARBON BLACK

Off. : 31-State Bank Colony, Jansath Road, Muzaffarnagar-251 001 (U.P.)
Ph.: +91-131-2661051 • Fax : +91-131-2661051 • Mob.: +91-9412211935
E-mail : jaincarbon@yahoo.com • Web : www.jaincarbon.com

Ref.: J-KP/ 2017-18/28

Date: 23.01.2018

To

Dr Vikas Kumar
Assistant Professor
Department of Biosciences
Shri Ram College, Muzaffarnagar

Subject: Sanction of funds for Research Project "Advanced Biological Analysis of Biochar".

Dear Sir,

Please refer to our letter dated 21.12.2017 and submission of your synopsis on the above subjected project.

We are pleased to sanction Rs. 30,000/- 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: Principal, Shri Ram College, Muzaffarnagar.

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Co-ordinator
IQAC, Shri Ram College,
Muzaffarnagar

Works : Vill. Silajuddi, Muzaffarnagar - 251 001 (U.P.)
Delhi Off. : LSC-3, 3rd Floor, Rishabh Vihar, Karkar Dooma, New Delhi - 110092

Principal
Shri Ram College
Muzaffarnagar

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GOEL RAKESH & CO.
CHARTERED ACCOUNTANTS

57-A, Agarwal Market, First Floor
,Mahavir Chowk,
Muzaffarnagar (U.P) – 251001
Phone No. 0131-2622405

Utilization Certificate

S.N.	Detail of sanction of Fund with Project name and Duration	Amount
1.	90-Days project on Advance Biological Analysis of Biochar, Date of Sanction of Fund- 21.12.2017 as per Sanction Letter	30000.00/-
	TOTAL	30000.00/-

It is Certified that out of Rs. 30000.00/- (Thirty Thousands Only) of grants sanctioned by Jain carbons (P) Limited, Muzaffarnagar during the year 2017-18 in favor of **Shri Ram College, Muzaffarnagar,** a sum of Rs. 30000.00 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: 22.04.2018

For Goel Rakesh & Co.
Chartered Accountants

Rakesh Kumar Goel
(Proprietor)
M.NO. : 071858
FRN : 003374C

Co-ordinator
IQAC, Shri Ram College,
Muzaffarnagar

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Principal
Shri Ram College
Muzaffarnagar

Duration of Study

One year (Dec 2017 to Dec 2018)

Sanctioned Amount of Project

Rs. 30,000/-

Supervisor

Mr. Vikas Kumar, Assistant Professor, Department of Bioscience, Shri Ram College

Students engaged in project

2 students were involved in research and data collection for the project.

Expenditure

Head	Number of units	Amount (in Rs.)
Manpower	2 students	2x 5000 = 10000.00
Consumables	Analytical kits, Chemicals etc.	9880.00
Honorarium	Given to Project supervisor	10000.00
	Total	**29880.00**

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Muzaffarnagar

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Introduction

The influence of biochar (sample given by Jain Industries) on the dynamics of the microbial community during the composting of poultry manure (PM) and cow manure (CM) was evaluated by phospholipid fatty acid analysis (PLFAs). Changes in the PLFA patterns were related to key composting properties (C/N ratio, temperature, and bulk density) as the major drivers of the dynamics of the microbial community. At the beginning of the process, the fungal biomass was significantly greater in PM and CM than in the respective co-composted materials with biochar (PMB and CMB); this difference declined gradually during the process. In contrast, the Gram+ to Gram− ratio was increased by the presence of biochar. After 12 weeks of composting, factor analysis based on the relative abundances of single PLFAs revealed changes in the microbial community structure which depended on the original organic wastes (CM vs PM).

Methodology

1. Composting Process

Two mixtures were prepared: cattle manure (CM) (100.9 kg) or poultry manure (PM) with kitchen waste (76.8 kg), rice straw (9.7 kg), and rice bran (12.7 kg). For the other two treatments, 20 kg of biochar (equivalent to 10% of the total weight of the starting mixture) was added to each of the mixtures (CMB and PMB, respectively).

To promote composting, the mixtures were turned twice a week in the first week and once a week from the second week onwards. The temperature of the pile was monitored continuously during the process using a thermo-recorder. To maintain the microbial activity, the moisture level of the material was kept at around 60% by adding water. The composting process lasted approximately 100 days for the 4 piles. Three representative samples (triplicate) were taken: in the thermophilic phase (the first week of

composting, T1), in the mesophilic phase (after 6 weeks of composting, T6), and after the maturation (cooling) phase (after 12 weeks of composting, T12). These samples were collected from different parts of the piles, air-dried slightly, and sieved to 0.2 mm in order to homogenize the material for chemical, physical and microbiological analyses. Samples were stored at 4 °C for PLFA and chemical analysis within the first two days after sampling.

2. Chemical Analysis

The pH was measured in a 1/10 (w/v) aqueous solution and the organic matter (OM) concentration by loss on ignition at 550 °C for 24 h. The total organic carbon (TOC) and N were determined. The bulk density was measured by the method proposed in literature. The analyses were performed in triplicate.

3. PLFA Analysis

Phospholipids were extracted from 2 g of organic materials, using a chloroform-methanol extraction method. The fatty acids i15:0, a15:0, 15:0, i16:0, i17:0, cy17:0, and cy19:0 were chosen to represent the bacterial biomass and 18:2ω6 was taken to indicate the fungal biomass. The ratio of bacterial to fungal PLFAs represents the ratio of the bacterial and fungal biomasses. The Gram + specific fatty acids i15:0, a15:0, i16:0, and i17:0 and the Gram − specific fatty acids cy17:0 and cy19:0 were taken as a measure of the ratio of the Gram + and Gram − bacterial biomasses. The ratio of monounsaturated PLFAs to saturated PLFAs is expressed as mono/sat. All results are given in nmol g^{-1} . The PLFAs analysis was performed in triplicate.

4. Statistical Analysis

n order to determine significant differences among treatments at the same composting time, the data were subjected additionally to one-way ANOVA. Physico-chemical data and biomass indicators were subjected to correlation analysis. The factor analyses were made using the relative abundances of all

identified FAMES at each independent time. For the statistical analyses, R and Bioconductor packages was used.

RESULTS

Table 1
The chemical characteristics of the mixtures at different composting times.

Composting time	N ($g\,kg^{-1}$)	C ($g\,kg^{-1}$)	C/N	T (°C)	pH	OM (%)	BD ($g\,cm^{-3}$)
1 week							
PM	0.22d	3.82b	17.7a	57.5	5.8b	79.9b	0.49c
PMB	0.18b	5.01d	28.6c	62.0	5.8c	84.9c	0.41a
CM	0.19c	3.65a	18.8b	60.7	6.6c	75.9a	0.47c
CMB	0.16a	4.82c	30.0d	57.9	7.0a	79.7b	0.42b
6 weeks							
PM	0.33c	3.00a	9.1a	31.3	8.0b	60.2a	0.72c
PMB	0.25b	4.81c	19.4c	31.0	8.3c	74.4d	0.56a
CM	0.25b	3.00a	12.1b	30.5	7.7a	61.9b	0.60b
CMB	0.21a	4.40b	21.0d	31.1	7.8a	71.4c	0.57a
12 weeks							
PM	0.35c	2.88a	8.3a	21.2	8.2c	55.2a	0.81d
PMB	0.20a	3.92c	19.7c	21.8	7.8b	73.0d	0.57b
CM	0.26b	2.86a	10.9b	20.5	7.7b	59.7b	0.65c
CMB	0.20a	3.80b	19.0c	21.8	7.6a	68.8c	0.55a

T: temperature; OM: organic matter; BD: bulk density. PM: poultry manure compost. PMB: poultry manure blended with biochar. CM: cow manure compost. CMB: cow manure blended with biochar. For each treatment, data followed by the same letter are not significantly different according to the HSD test ($P \leq 0.05$).

Correlations between the different physical, chemical, and biomass variables.

	OM	pH	C/N ratio	C	N	Density	Gram+	Gram−	Fungi	Bacteria	Saturated
pH	-0.74^{**}										
C/N ratio	0.89^{**}	-0.65^{**}									
C	0.86^{**}	-0.43^{**}	0.92^{**}								
N	-0.84^{**}	0.67^{**}	-0.88^{**}	-0.72^{**}							
Density	-0.94^{**}	0.78^{**}	-0.89^{**}	-0.77^{**}	0.94^{**}						
Gram+	-0.61^{**}	0.60^{**}	-0.62^{**}	-0.58^{**}	0.41^{*}	0.50^{*}					
Gram−	-0.82^{**}	0.57^{**}	-0.75^{**}	-0.75^{**}	0.62^{**}	0.74^{**}	0.39^{*}				
Fungi	0.57^{**}	-0.68^{**}	NS	NS	NS	-0.51^{**}	NS	-0.43^{**}			
Bacteria	-0.69^{**}	0.65^{**}	-0.68^{**}	-0.65^{**}	0.47^{**}	0.58^{**}	0.99^{**}	0.51^{**}	NS		
Saturated	-0.49^{*}	0.45^{**}	-0.57^{**}	-0.57^{**}	NS	0.38^{**}	0.96^{**}	0.33^{*}	NS	0.94^{**}	
Monounsaturated	NS	NS	NS	NS	NS	NS	0.44^{**}	NS	0.54^{**}	0.40^{*}	0.65^{**}

N = 36; OM: organic matter; Gram+: Gram-positive bacteria; Gram−: Gram-negative bacteria.
* Significant at $P < 0.05$.
** Significant at $P < 0.01$.

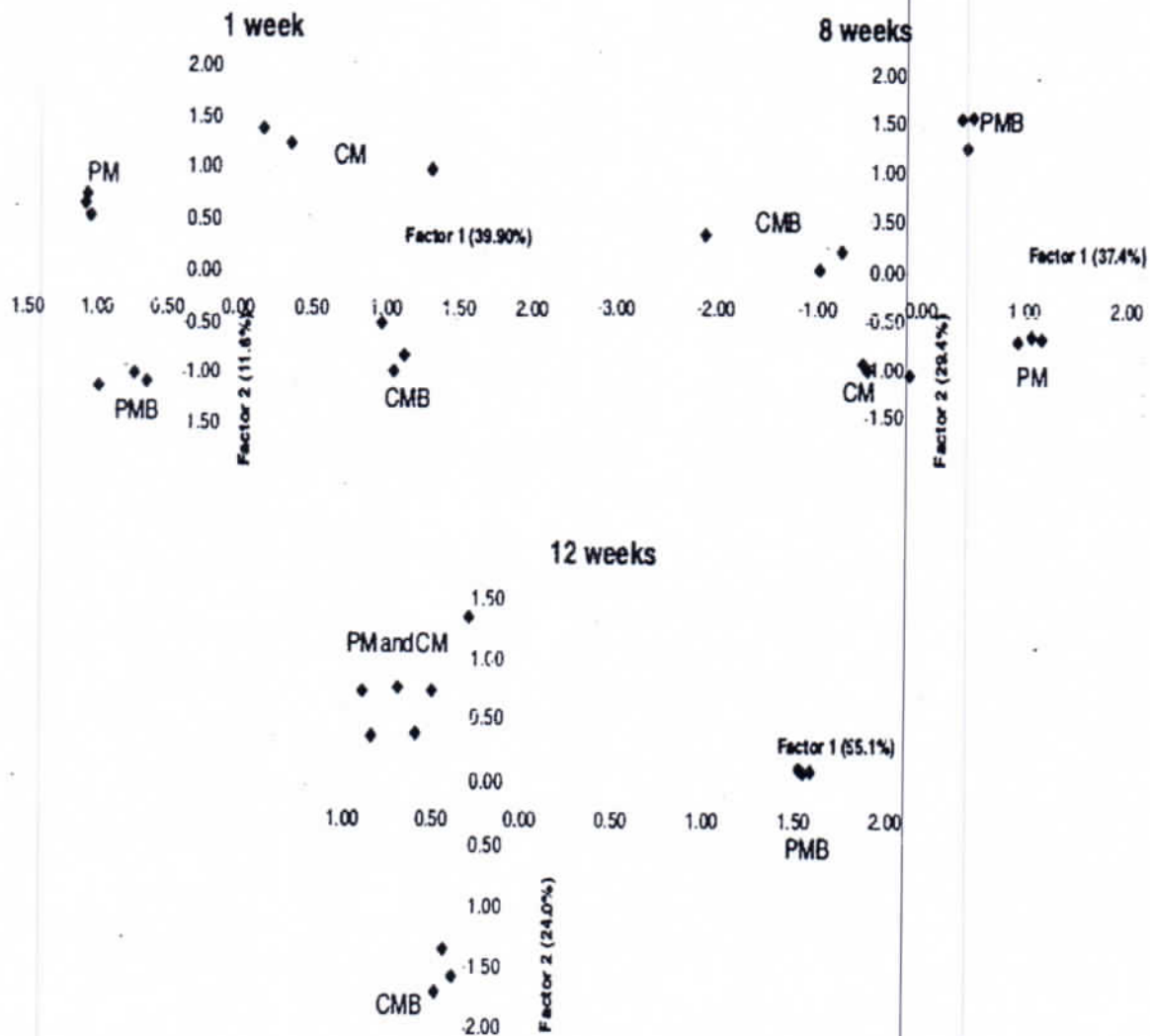

Fig. 1. Distribution of the treatments after a factor analysis using all the individual PLFAs analyzed at different composting times.

Conclusion

The addition of biochar to compost mixtures influences the microbial community structure during the composting process and these changes are related to the physical and chemical properties of the composting piles. Biochar induces specific changes in the microbial community structure, depending on the original organic wastes (cattle versus poultry manure).

Further studies are needed in order to evaluate how changes in the microbial community resulting from co-composting with biochar can affect the potential agronomic and environmental applications of such materials, with regard to their effects on plant development, soil fertility, and soil carbon sequestration.

(VIKAS KUMAR)

PROJECT SUPERVISOR

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