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Vermiremediation of Saccharum officinarum Industrial Residues Using Eisenia fetida: Enhancing Vermicompost Biostability via Enzymatic Activity Profiling

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Abstract: ***Jaggery is also known as gul, gud, gur, vellum and bella, It is a golden - yellow, dark brown, medicinally active, traditionally used and unrefined sugar. Fresh Bagasse was obtained from Mornisa Bio organics pvt. Ltd., MIDC, Chalisgaon. Trays that measured 58cm x 42cm were filled with 1kg mixture of the waste (Plant waste, cow dung, Sample, Earth worm, Cow dung, plant waste in the ratio 1: 1: 1: 1: 1:) to serve as test experiment. The 10 glass petri plates were use for this experimental assay. When we compare test sample of set A and Set B, the length of shoot and root was much more compare with control. In all this observation length of root and shoot is much more in sample 1 contains vermicompost obtained from mud sample & Bagasse.***

Keywords: Jaggery, Mornisa Bio organics, vermicompost

1. Introduction

Jaggery is also known as gul, gud, gur, vellum and bella, It is a golden - yellow, dark brown, medicinally active, traditionally used and unrefined sugar, and it is obtained from hot concentrated sugarcane juice. Jaggary industry is one of the most ancient industry and placed important role in rural based cottage industries in India which provides jobs to the several rural, uneducated people in their vicinity with minimum capital investment. According to PMFME DPR on Processing of Jaggery Powder, "During the last couple of years India has produced more than 300 MMT of sugarcane out of which, about 79.91 % is utilized in producing white sugar, 11.29% in producing jaggery and khandsari, 8.80 % as cane juice, seed cane for the next harvest etc. Sugar recovery for different states in India lies in the range of 8.89 to 11.26% on cane, whereas, recovery of jaggery (gur) ranges from 10 - 13% depending upon the variety of sugarcane, sugarcane quality, soil texture, irrigation facilities, time of cane crushing etc."

"India is the largest producer and consumer of jaggery; out of total world production, more than 70% is produced in India. Jaggery along with khandsari has withstood competition protecting farmers' interests besides meeting ethnic demands. Jaggery prepared in all parts of the country. It is also known as gul, gud, gur, vellum and bella. Jaggery is among major agro processing industries in India. Nearly 20 - 30% of total sugarcane produced in the country is used for manufacture of about 7 million tonnes jaggery. This sector provides employment to about 2.5 million people" (PMFME DPR on Processing of Jaggery Powder) Bagasse is purely totally homogeneous composed material and it constitute 30 - 40 % of pith fibre and it obtained from central plant core it esteemed production is 0.25 - 0.30 ton per ton of sugarcane (Pessoa *et. al.*, 1997) During the process of sugarcane juice extraction organic waste is generated and which is rich in fibre it contains 50% cellulose, 25 % hemicellulose and 25 % lignin (Exhumalai and Thangavelu 2010) Due to lack of proper waste management techniques and lack of knowledge bagasse's are discharged openly or along roadsides or railway tracks or dumped in the sugar or jaggary industry premises (Parthasarthi et al., 2008) From the last few decades, proper disposal and management of industrial waste creats big problems to humans because of continuous increasing population, uncontrolled industrialization and intensive agriculture practices. Now a days number of food products are produced in industrial units by using agriculture material/by products as raw materials (Suthar et al., 2010). The organic waste generated by agro based industry has big environmental issues (offensive odors, contamination of ground water and soil) and waste disposal problems (Edwards and Bater, 1992) During the production of food items from agriculture based raw material, large number of waste is generated if this waste is not properly disposed then it spoil the aesthetic sense of local habitats and causes the environmental pollution. All this conditions responsible for disturbance of ecological balance. (Singh et al., 2010). In order to keep environment clean it necessary to follow the Sustainable waste management practices. Therefore, the disposal of different types of wastes has become very important issue for maintaining healthy environment (Senapati and Julka, 1993). Improper Disposal of jaggary industrial bagasse by dumping in a pit is an environmentally unhealthy process because it requires large area large of land and creatsaair, land and water pollution problems. In order to solve this issues bioremediation by using Earthworms is the good option to converting organic wastes into environmentally friendly products. It is a biochemical method involves biooxidation of organic waste by the combined action of worms and microorganisms. Earthwormsengulfs, breakdown and digest organic waste and converts it into fine, humidified, Biologically active material by the activity of

earthworms and microorganisms (Khwairakpam and Bhargava 2009). The final product of this process is a granulated material with high porosity and water holding capacity i. e. vermicompost. This study is focus on bioremediation of bagasse obtained from jaggary industry by using Brandling worm *Eisenia fetida.*

2. Material and Method

Bagasse, Cow dung, Dry plant leaves and Worm -
Fresh Bagasse was obtained from Mornisa Bio organics pvt. Ltd., MIDC, Chalisgaon, cow dung was obtained from Gawali wada Ghat road Chalisgaon, Dry leaves of various plants in the garden were collected and Earthworm i. e. *Eisenia fetida* with an average weight of 0.05gm were taken from municipal corporation Chalisgaon.

Experimental setup -

Vermibed preparation & Introduction of worms –
Trays that measured 58cm x 42cm were filled with 1kg mixture of the waste (Plant waste, cow dung, Sample, Earth worm, Cow dung, plant waste in the ratio 1: 1: 1: 1: 1:) to serve as test experiment. fifty worms with the average size of 5.5±0.1cm and average weight 0.05 gm were introduced into each of the four tray while the other one tray corresponding ratios served as control.

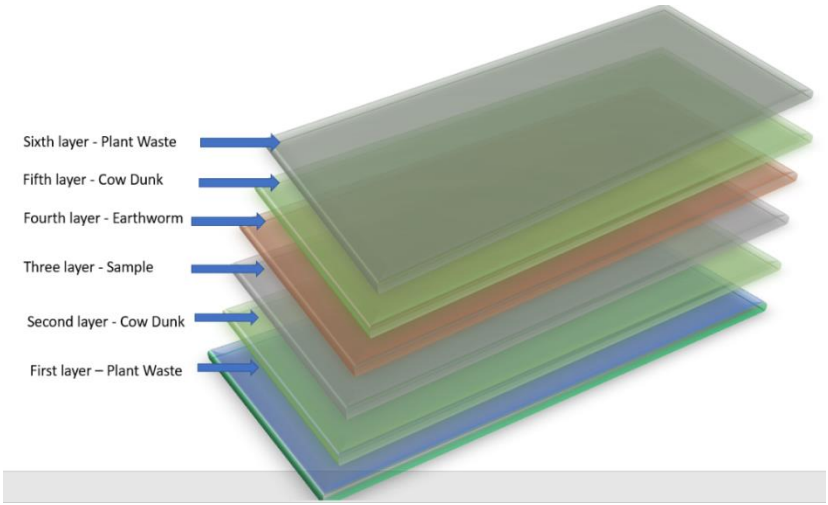


Figure 1: Experimental Setup

Petri plate Assay - The 10 glass petri plates were used for this experimental assay. In a set "A", 4 plates were used. Each petriplates were filled with 25 gm of vermicompost from tray 1, 2, 3, 4 respectively and seeds of Maize were planted in each petriplate.
Sample 1 =Vermicompost obtained from mud sample + Bagasse.
Sample 2=Vermicompost obtained from Bagasse.
Sample 3=Vermicompost obtained from mud.
Sample 4= Vermicompost from soil.

In a set B, 4 plates were used. Each petriplates were filled with 25 gm of vermicompost from tray 1, 2, 3, 4, respectively and seeds of Mung (Vigna radiata) were planted in each petri plate.

Plates were placed in controlled environmental condition under 16 hrs light/8 hrs dark at 25 ^{0}c.

3. Observation Table

Table 1: Shoot and root length of mungplant (Dicot)

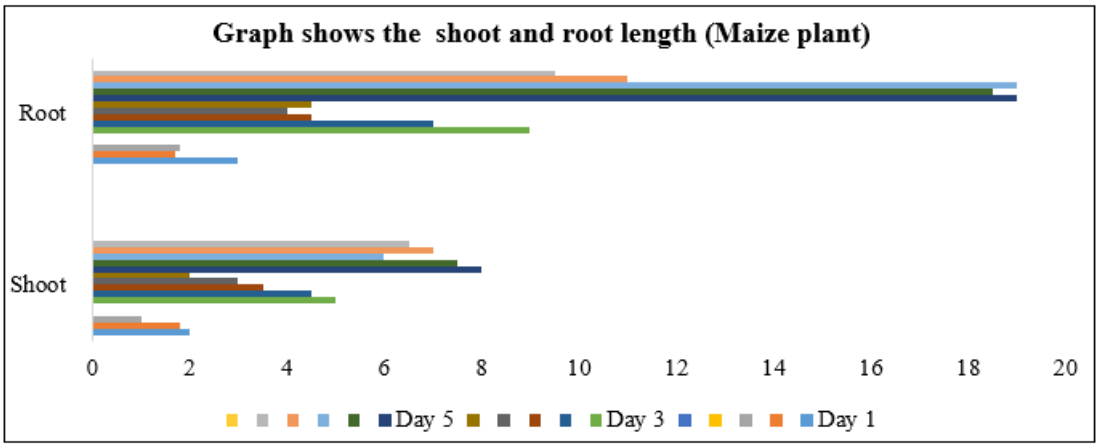
Length (cm)	Day 1					Day 3					Day 5				
Sample	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Shoot	0.8	0.5	0.6	0.5	-	4	4	2.5	3	2	10	9.5	11	11.5	7
Root	1.2	1	0.6	0.4	-	6	4.5	3.5	2.5	3	13	13	11	11	9.5

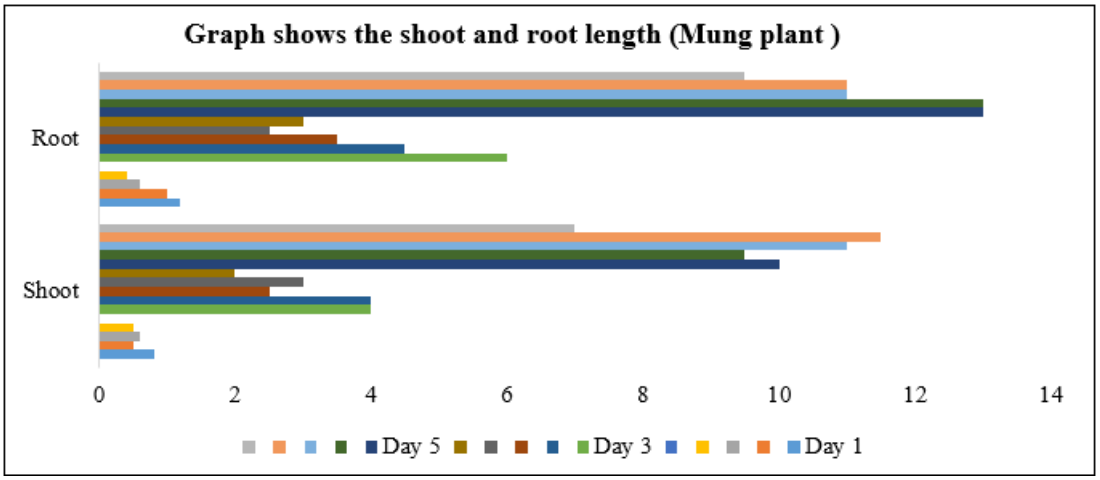
(' - ' = plantlets are not observed)

Table 2: shoot and root length of Maize plant (Monocot)

Length (cm)	Day 1					Day 3					Day 5				
Sample	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Shoot	2	1.8	1	-	-	5	4.5	3.5	3	2	8	7.5	6	7	6.5

(' - ' = plantlets are not observed)





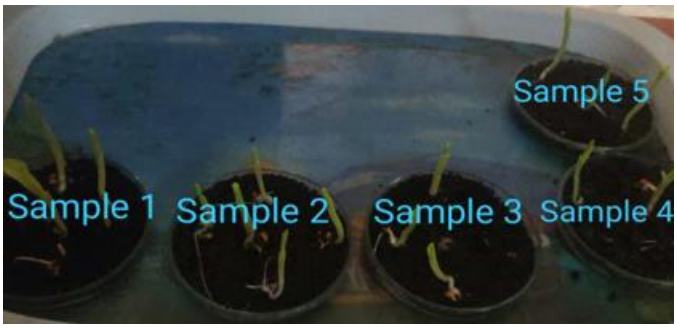
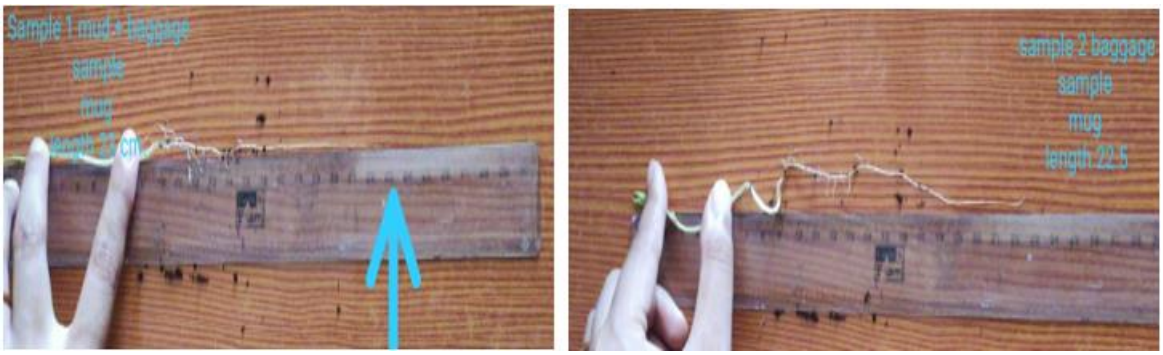


Figure 2: Growth of Maize and Mung (vigna) in sample 1, 2, 3, 4, and 5.



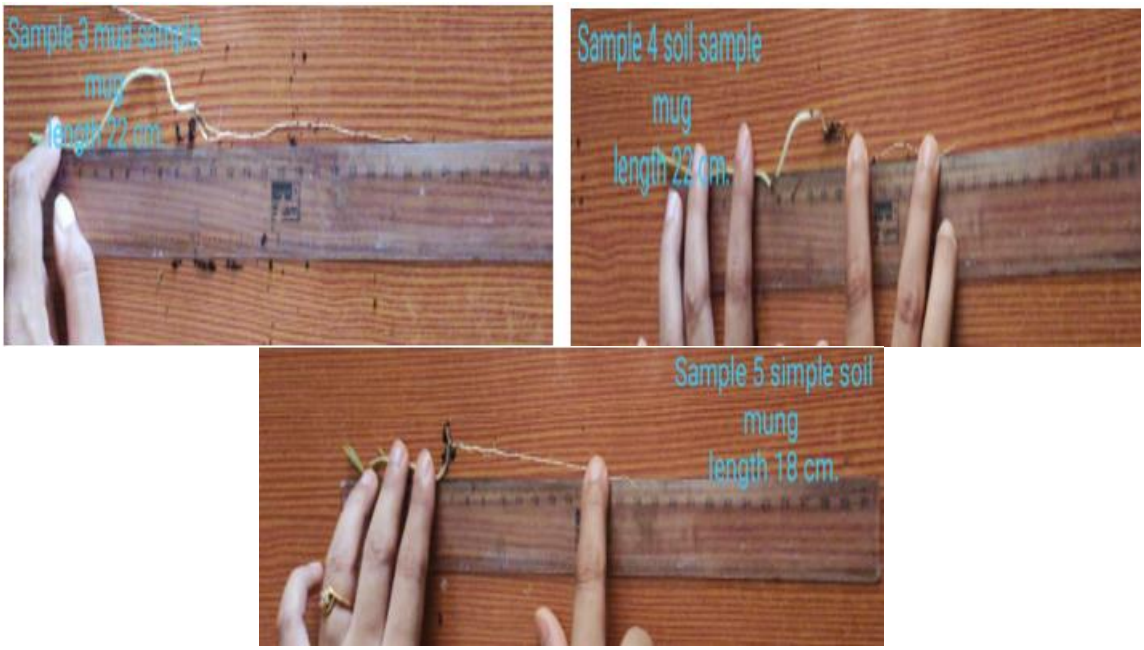


Figure 3: Photograph shows the Length of set B (Mung) roots in sample 1, 2, 3, 4 and control

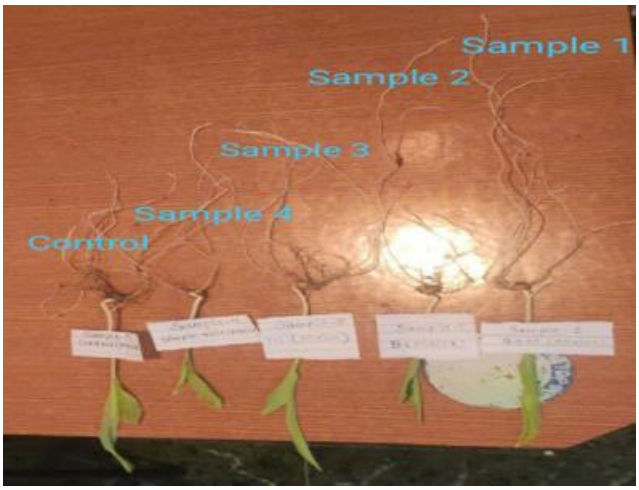


Figure 4: Photo graph shows the Length of set A (Maize) roots in sample 1, 2, 3, 4 and control.

4. Result and Discussion

In petri plate assay, different results was observed in set A plates and set B plates in respect to length of root and shoot. In set A maize seed was used, On the first day in sample 1, 2, 3, length of shoot was 2 cm, 1.8 cm and 1.0 cm respectively And length of root in sample 1, 2, 3 was 3 cm, 1.7 cm and 1.8 cm respectively. when we compare the result of day first with control length of root and shoot was more because of in control there is no growth was observed in control as well as in sample 4. On the day third, the length of shoot in sample 1, 2, 3, 4 sample was 5 cm, 4.5 cm 3.5 cm and 3 cm respectively whereas in control length of shoot was 2.0 cm. In case of root, The Length of root was in sample 1, 2, 3, 4 was 9.0 cm, 7.0 cm, 4.5 cm, 4.0 cm respectively and in control length was 4.0 cm. On day fifth the length of shoot in sample 1, 2, 3, 4 was 08 cm, 7.5cm, 6.5 cm, 07 cm respectively. While in control length of shoot was 06 cm. In case of root length of root in sample 1, 2, 3, 4 was 19 cm, 18.5 cm, 19 cm, 11 cm respectively whereas in control it was 9.5 cm.

In set B, assay was done on Dicot seeds to test the quality of sample 1, 2, 3, 4 and control. Seeds of mung were introduced into petridish containing sample 1, 2, 3, 4and control. On the first day length of shoot in sample 1, 2, 3, 4 was 0.8 cm, 0.5 cm, 0.6 cm and 0.5 respectively In case of root, in sample 1, 2, 3, 4 was 1.2 cm, 1.0 cm, 0.6 cm, 0.4 cm respectively. When we compare length of root and shoot with control there is no growth occurs in control. On the day third the length of shoot in sample 1, 2, 3, 4 was 04 cm, 04 cm 2.5 cm, 03 cm respectively, whereas in control length of shoot was 02 cm. In case of root length in sample 1, 2, 3, 4 was 06 cm, 4.5 cm, 3.5 cm and 2.5 cm respectively while in control it was 03cm. On the day fifth Length of shoot in sample 1, 2, 3, 4 was 10 cm, 9.5 cm, 11 cm and 11.5 cm respectively whereas in control it was 07 cm. In case of root length in sample 1, 2, 3, 4 root length was 13 cm, 13cm, 11 cm, 11 cm respectively while in control it was9.5 cm.

When we compare test sample of set A and Set B, the length of shoot and root was much more compare with control. In all this observation length of root and shoot is much more in sample 1 contains vermicompost obtained from mud sample & Bagasse.

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