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VERMICOMPOSTING OF PRESSMUD FROM SUGAR INDUSTRY

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ABSTRACT

India is one of the largest growers of sugarcane with an estimated produced of around 300 million tons in the marketing year 2009-2019. Sugar-distillery complexes, integrating the production of cane sugar and ethanol, constitute one of the key agro-based industries. There are presently nearly 400 sugar factories in the country along with around 300 molasses based alcohol distilleries. These include sugarcane trash, bagasse,pressmud and bagasse fly ash. Vermicomposting of pressmud is an efficient method of waste disposal, enabling recycling of organic matter.Vermicomposting of pressmud is one of the most promising technologies for solid waste treatment. The organic substrates in solid waste can be biodegraded and stabilized by composting and the final compost products could be applied to land as the fertilizer or soil conditioner. The present review paper deals with the following topics: Composting, vermicomposting of pressmud and various Physical and chemical nature of raw pressmud, , Characteristics of the vermicompost and its advantages.

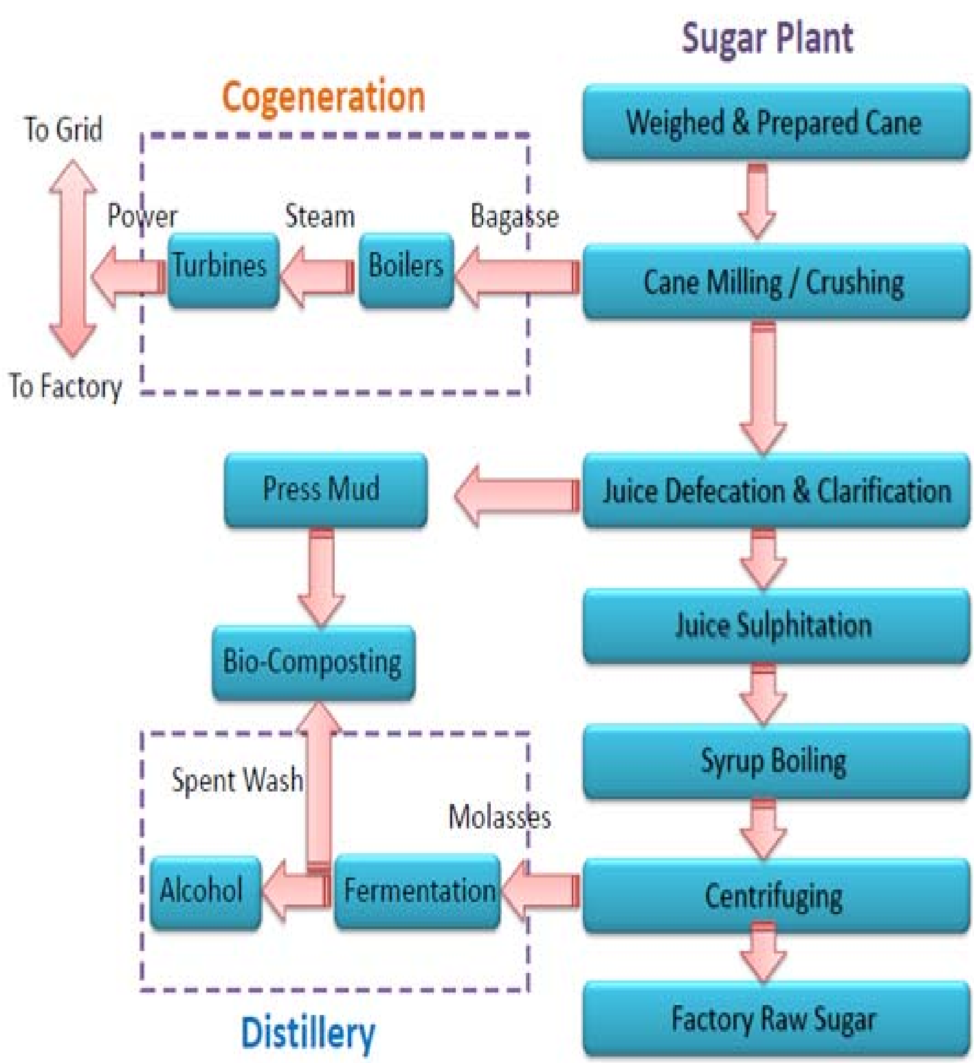
KEYWORDS- Pressmud, Eiseniafoetida,Eudrilluseugeniae, Nutrients

INTRODUCTION

In India 400 Sugar factories rank as the second major agro industry in the country. The Sugar industry has several co-products of immense potential value. The co products include pressmud, molasses and spent wash. Out of which pressmud produced during clarification of sugarcane juice about 3.6% to 4% of sugarcane crushed end up as pressmud. i.e. 36 to 40 kg of pressmud is obtained after one tone of cane crushing. Pressmud is a soft , spongy ,amorphous and dark brown material containingsugar , fiber and coagulated colloids including canewax , albuminoids ,inorganic salt,sand, soil particles. It consists 80%of water & 0.9%-1.5%sugar organic matter, nitrogen, phosphorus , potassium , calcium , coagulated colloids &other materials in varying amounts .When the cost of chemical fertilizer is skyrocketing and not affordable by farmers, pressmud has promise as a source of plants nutrients.

It is a good source of fertilizer. Sugar mills in India produce about 12 million tones of press mud (filter cake) as a waste from double sulphitation process. Usually the press mud is either disposed off in open fields or sold as immature compost to farmers. Dry pressmud can be exploited for generation of energy as it contains higher percentage of combustibles. It is also a good source of biogas as it contains about 5–15% of sugar. The pressmud is very useful for agricultural crops and horticulture because of its richness in various micronutrients.

A Schematic Diagram of Formation Of Pressmud Waste In Sugar Mill.



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General Composition of Pressmud

Composition	Amount Present
Sugar	5–15%
Fiber	15–30%
Crude wax	5–14%
Crude protein	5–15%
SiO	4–10%
CaO	1–4%
MgO	0.5–1.5%
PO	1–3%
Total ash	**9–10%**

A Typical Nutrient Contents Of Pressmud

Nutrients	Amounts (%)
Nitrogen	1.9
Phosphorous	1.8
Potassium	0.9
Calcium	4.3
Magnesium	0.7
Sulfur	3.2
Manganese	0.034
Zink	0.008
Copper	0.053
Sodium	0.1

VEMICOMPOSTING

Vermicomposting is stabilization organic solid waste through Earthworm consumption which converts the material into worm castings. Vermicomposting is the combined activity of microorganisms and earthworm. Microbial decomposition of biodegradable organic matter occurs through extracellular enzymatic activities, whereas decomposition in earthworm occurs in elementary tract by microorganisms inhibiting the gut. Microbes such as fungi, actinomycetes, protozoa etc. are reported to inhibit the gut of earth worm.The worm species that are commonly used in vermicomposting are Eisenia foetida, Eudrilus Eugenie and Lambito mauritii. 50kg of worms gives 50 kg manure per day. These worms are survived in the moisture range of 20- 80% and temperature range of 20- 40°C.

Vermicomposting is less labor-intensive than traditional plant composting because the worms do almost all of the work. All compost mixes microorganisms, organic matter and nutrients, but adding worms also improves soil structure. Due to the slime produced by worm bodies, nutrients stay in soil even after a good rain. Worm castings hold beneficial microorganisms longer than traditional compost. Worms can eat up to half of their body weight per day and--under optimal conditions--reproduce quickly, making vermin culture a self-sustaining business. Vermicomposting has applications that can reduce global warming. Using worms for composting has been shown to reduce the methane and nitrous oxide levels in landfills, which are worse for the environment than carbon dioxide gas.

General procedure for vermicomposting of pressmud

- The pressmud collected from the sugary industry.
- Vermi beds are prepared using 45cm*35cm*15cm plastic troughs .
- Ten number of worms introduced into the each troughs.
- Watering (to moist)
- Mulching (prevent evaporation).

Experimental troughs arranged in shadow to avoid direct sunlight

- Press mud and earthworms was cultivated in cow dung (CD)
- ratio of press mud and cow dung is 1:1
- Temperature required for composting 20-40◦C
- Moisture content is upto 20-80%
- Period-60 days
- Turns –After 15 days turn required

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Earth Worms

Vermicompost Production Tank

Vermicompost

Vermicompost Process

LITERATURE REVIEW

1.Physico-Chemical Characterization of Sulphidation pressmud Composted pressmud and Vermicomposted pressmud

Present study was undertaken to analyze the physical and chemical characteristics of raw press mud, it's compost prepared by using thermophillic bacteria audit's vermicompost which is prepared by using species Eisenia foetida. While comparing physical and chemical characteristics, it was found that vermicompost have lower temperature, water holding , pH and carbon content but higher electrical conductivity, available phosphorus and moisture content as compared to raw pressmud and its compost.

MATERIAL AND METHOD

Composting

Sulphidation pressmud was obtained from Bidvi Sugar mill, Saharanpur, U.P, India. It was composted by using thermophillic bacteria for a time period of 60 days. This was done in order to reduce the amount of wax content and temperature of the press mud, which proved to be fatal for the earthworm species Eisenia foetida. The raw pressmudand its compost so obtained were analyzed for physical and chemical parameters.

Vermicomposting

The species Eisenia foetida were procured from Shantikunj, Hardwar, India. The pre-composted pressmud was vermin composted using Eisenia foetida for a time period of 120 days. The temperature of the compost at the time ofVermitreatment was found to be 29.7C and moisture content was suitable for the species Eissenia foetida. The physical and chemical parameters of vermicompost obtained was analyzed and compared to that of press mud and its compost.

Microbial Analysis

- One gram of each sample was transferred to test tubes containing sterilized water, mixed thoroughly with a vortex mixer for20 min.
- This was used as inoculums and 1.0 ml was plated in triplicate on Nutrient agar media, Rose Bengal agar media for the counting of bacteria, fungi and actinomycetes, respectively using pour plate method, and incubated for 24hr, 72 hr. and one week.

Stastical Analysis

- Correlation of microbial population with reference to the vermicomposting was analyses and it is necessary to know the total microbial dynamics during the process.
- The harvested vermicompost was stored for 45 days in gunny bags.
- The total microbial counts done every five days up to 45 days using pour plate method.

RESULT

The physico-chemical characteristics of the compost inhabited by the worms (WOW) and those of compost without worms (WUW) are different. The pH showed a slight reduction in the WOW when compared with the WUW but the difference was not significant. The E.C., NPK, Ca, Mg, Fe, and Cu in WOW were higher than those of WUW, whereas, pH, OC, Na, Mn, S, Zn, C/P, and C/N were lower. The NPK contents higher in worm of compost**.**

NPK contents-

N – 1.63% ,P – 2.38% and ,K – 3.13% (WOW)

N– 1.03% ,P –1.70% ,K – 2.48%. (WUW)

The NPK contents lower in without worm of compost.

Physical chemical parameters of the press mud vermicomposting

Parameter	Initial	Eisenia foetida VC	Eudrilluseugeniae VC
pH	7.3	7.5	8.07
OM %	49.6	47	46.72
OC %	26.67	27.26	27.09
N %	2.17	2.23	2.4
P %	1.97	2.15	2.47
K%	0.52	0.61	0.66
Ca %	1.8	2.34	2.544
S %	0.7	0.54	0.404
Fe ppm	350	390	409
Zn ppm	353	354	361
Mg ppm	131.67	142	144.67

2. Optimization of vermicomposting technique for sugarcane waste management by using Eiseniafetida

Sugarcane industries generate large amount of waste in the form of bagasse and pressmud per day. Most of the part of these wastes are usually burnt in the field due to lack of proper management techniques, which creates severe environmental pollution and health hazards, hence it was thought to attempt use sugarcane pressmud and bagasse for cheap and eco friendly treatment methods like vermicomposting. It is the proces of compost formation by earthworms. Earthworms are crucial drivers of the process, by fragmenting and conditioning the organic solid substrate and dramatically altering its biological activity. In this study, both wastes were pretreated with an organic nutrient preparation Jeevamrutham (effective microbial suspension) for 15 days at 30°c than it was used to fill up in 2 kg capacity plastic tubs and earthworm Eiseniafetida was used to convert this raw materials into highly nutritive vermicompost. The process were subjected for optimization of parameters like temperature of vermireactor, pH of material, particle size of wastes and moisture content of reactor by using Eiseniafetida earth worm species for six weeks. It was found that 25°C temperature, pH 7.0, 1-2mm particle size, 80% moisture content were optimum parameters of vermicomposting of sugarcane wastes through this earthworm species. It was further found that vermicompost obtained by above method was rich in Nitrogen, Phosphorus, Potassium, Sodium, Calcium, Magnessium content i.e. 2.3, 2.57, 1.72, 3.34, 2.27 and 1.98 % respectively, while it was also rich in some micronutrients i.e. Iron, Zinc, Magneese, Copper, Boron and Aluminium content i.e. 1052, 163, 407, 167, 276 and 964 ppm respectively. Thus, vermicomposting of sugarcane waste is a cheap, excellent and ecofriendly method of sugarcane waste management.

BENEFITS OF VERMICOMPOSTING

Vermicomposting is an environmentally responsible process. The practice has several environmental, economic, and educational benefits. Vermicomposting makes the environment healthier as it reduces waste in a healthy, natural process.

1. Waste reduction:

Waste reduction is the primary benefit of vermicomposting. The average Canadian produces about a ton of waste each year, and third of which is organic and could be composted (Berry, 2011). There is also the environmental benefit of recycling waste on site, eliminating the need for transportation and storage. Vermicomposting can also be an effective method to reduce greenhouse gas emissions. Landfills are the largest source of methane in the United States (Associated Press, 2007). In a landfill situation methane is created by the decomposition of trash. Diverting as much material as possible reduces the amount of methane created by the landfill.

2. Soils and plants:

Worm castings are nitrogen rich fertilizers. When used as an additive it has many benefits to the plants and soil. For instance, plant growth with vermicomposting has enhanced germination, growth, and crop yield. Soil is nutrient enriched with microorganisms and also has an improved water holding capacity.

3. Economic:

Vermicomposting has a low capital investment and is a sustainable process. Once worm composting is started the worms will reproduce, never needing replacement. In fact, a successful vermicomposting may produce enough worms to supply others.

Much of our daily existence is spent in surroundings designed to conceal the processes that sustain life and which contribute, possibly more than any other factor, to the acute sensory impoverishment of our living environment" (Hough, 2004). Vermicomposting brings nature into the home, allowing occupants to observe the natural process and become more aware of the amount of waste their home generates. Vermicomposting is a simple, cost effective practice that has great potential for many environmental benefits.

POTENTIAL BENEFITS

- An increase plant resistance to pests, fungus and other deceasesthe recycling of wastes through vermicomposting reduces problems of disposal of agricultural as well as industrial wastes.
- It provides two useful products; the earthworm biomass and the vermicomposting. Vermicomposting/castings is an excellent product since it is homogenous, has desirable aesthetics, has reduced levels of contaminations and tend to hold more nutrients over a longer period, without adversely impacting the environment.
- Numerous harmful effects to soil were caused by the application of non-matured composts i.e. those within incomplete stabilization of their organic fraction. At the same time, excessive composting could lead to loss of nitrogen and polysaccharide-rides; and immobilization of nutrients mainly N and P, Hence the maturity of compost is a very important parameter for both compost production process and its application..
- Increases soil fertility and bacterial activity in the soil Increases micro grains in the soil and enhances water absorption capacity.
- Helps the plant root get air easily. Increases plant resistance to pests, fungus and other deceases.

CONCLUSION

A combination of pressmud and cow dung in a 1:1 ratiowas suitable to produce a valuable organic soil amendment through vermiconversion withP. Ceylanensiswithin 60 days**.** Vermicomposting has a low capital investment and is a sustainable processvermicompost can be generated in 1/3 the time as regular compost. vermicomposts was found to helps increase a plant's resistance to disease. The theory is that all the microbes present compete for the nutrients in the soil and make it harder for the harmful microbes to survive.Vermicomposting of sugar industry wastes with cow-dung signicantly reduced the C/N to »10 within 40 days.Vermicomposting has a low capital investment and is a sustainable process. Once worm composting is started the worms will reproduce, never needing replacement. In fact, a successful vermicompost may produce enough worms to supply others.

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