

REVIEW ARTICLE

Consequences of Compost Press Mud as Fertilizers

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Received-1 March 2016, Revised-5 April 2016, Accepted-16 May 2016, Published-30 May 2016

ABSTRACT

Organic fertilizers derived from Sugar Press Mud (SPM) yields better production of crops. Sugar press mud or the sugarcane filter-cake is the residue of sugarcane industry which results from the processing of sugarcane where sugar mud is separated from the crush. The total supply of sugar press mud varies from (1-7) kg from the processing of 100 kg of sugarcane. Sugar filter cake is used as a suitable fertilising agent since it is rich in micro and macro nutrients along with organic carbon. It is eco-friendly and protects the plants from various soil borne diseases. Press mud compost does not include any substances which are unfavourable for microbial action. In certain cases, press mud is mixed with other organic fertilizers to yield enriched compost. Whatever the case, the resultant press mud should not be added to the soil directly as it affects the welfare of human health due to the fast growth rate of pathogenic fungi. These are the disease causing microbes whose growth rate must be inhibited. The review deals with the physical, chemical and microbial functions on the press mud resulting in excellent bio-fertilizers. Enriched press mud is mixed with gibberellic acid to inhibit the growth of toxic chromium which affects the metabolism of plants. The fields which are ineffective by the over use of chemical pesticides can be brought into control by constant use of bio-fertilizers such as press mud. Usage of chemical pesticides may destroy the insects causing damage to the fields, but its impact over the health of living beings is tremendous. Press mud, on the other hand, is safe and very effective in producing income and killing certain insects affecting the crops as well.

Keywords: Sugar press mud, Fertilizer, Compost, Pathogenic fungi, Soil borne diseases.

1. INTRODUCTION

[1] The organic effluents from sugar mills is called press mud which are utilised to provide a nutrient rich, high quality organic manure. It is used to maintain soil fertility and enhance crop cultivation. By applying this filter-cake, the affected land due to continuous and excessive application of chemical pesticides are brought under control i.e. such lands can be made good by treating it with organic enriched fertilizers. It generally nourishes plants and promotes plant growth. It is a suitable plant supplement for potted plants too. Since it is rich in sugar and mineral contents, it is also used as animal feed. The manufacturing of press mud is achieved by drying the residues to prevent any fungal or bacterial infection. It also includes plant growth regulators, hormones, auxins, enzymes and vitamins resulting in improvement of soil

aeration and better root proliferation. Since it is non-toxic, it can be widely encouraged and it helps to retain moisture content of the soil. [2] Only treated press mud should be used because fresh press mud may enhance the growth rate of certain pathogenic fungi which cause several diseases in humans. Press mud is the source of several nutrients which supports the growth of microorganisms in soil despite the growth of disease causing fungi. Several isolates of fungi are allowed to multiply in fresh and compost fertilizer of press mud and it is viewed that it encourages fungal growth causing health defects to humans. Treated press mud fertilizer limits the growth of such harmful microbes permitting the multiplication of beneficial fungi producing stable enzymes. [3] Sugar press mud can be pre-treated with hot water. This pre-treated mixture is used to form compost prior to its application in the

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Double blind peer review under responsibility of DJ Publications

<http://dx.doi.org/10.18831/djmicro.org/2016011005>

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fields. It shows considerable improvement in methane production. [4] For the massive production of entomopathogenic fungi, which are the microbes capable of killing certain insects, sugar cakes are used. This may not be harmful for human beings, but increase of such fungi may cause serious impact over the lives. Hence steps should be taken to limit the growth of entomopathogenic fungi. This is achieved by using treated press mud. [5] It involves the techniques of optimising the press mud to produce unlimited methane, where the press mud is pre-treated with sodium hydroxide. This includes the production of volatile fatty acids as well. It is concluded that due to the production of methane, the formation of volatile fatty acid is minimised and the ideal pH for fatty acid is around 5.

2. PRODUCTS OF CANE

All the by-products and co-products of sugarcane are worth considering. Filter cake is one of the by-products where fibre, slime, beet molasses and vinasse are its co-products. All the products are retrieved and recycled in cane sectors. The co-products of cane are widely used in biological industries. The residue of the cane after the extraction of sugar juice is called fibre which is used as cattle feed. Bagasse is rich in calories, which is employed as a fuel in industrial applications. The resultant product of filtration is slime that provides press mud which is solely concentrated in this review. Beet molasses are produced from boiling of sugar juice. It has its application in fermentation processes and also as cattle feed. Vinasse is the residue, a supplementary for beasts. Figure 1 shows the various products obtained from sugar cane [6].

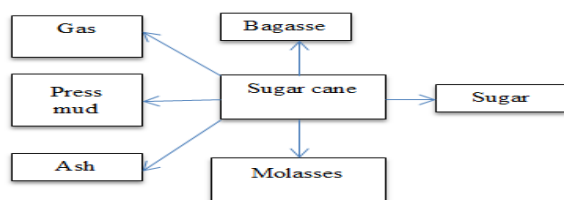


Figure 1.Sugarcane products

3. GENERATION OF PRESS MUD COMPOST

The main ingredients of sugarcane are sugar and biomass. [7] There were no proper techniques available for the utilisation of residues from sugar factories for many years.

This crisis has been overcome in recent years by the enhancement in technology. It includes aerobic or anaerobic composting to produce fertilizers from the by-product, press mud. The study focuses on the consequences of such fertilizers, producing constant growth of useful as well as harmful microbes, especially fungi. Growth of beneficial fungi can be encouraged as it provides good manure to the crops where growth rate of pathogenic fungi must be controlled as it manipulates human health. Since high quantity of press mud is generated, the production of fertilizer from press mud is not a serious issue. In fact, it is cost efficient too. Press mud contains almost all the required supplements for the growth of plants such as calcium, nitrogen, magnesium, traces of sugar and salts, fibre etc. Bacteria consume press mud which in-turn produces useful substances and thereby promotes decomposition of wastes to enhance the fertility of soil.

[8] The investigation is based on the addition of filter press mud in the soil. The core index of the soil is improved followed by increase in the total porosity and degree of saturation.

3.1. Nutrients of press mud

[9] Since sugar filter cake is rich in nutrients, its application to the soil as manure results in better yield. It is examined that there is increase in organic carbon. It leads to increase in clay and moisture content as well. In certain conditions, after the application of treated press mud to the soil, there is a slight decrease in the potassium level but enhancement in other nutrients including phosphorus and nitrogen is seen. The analysis shows corresponding improvement in electrical conductivity of the soil and thereby the uptake of iron by plants is lowered in some states depending upon the concentration of fertilizer. Proper measurement has to be taken about the presence of iron and potassium in the soil prior to the supply of filtered press mud to it.

Table 1.Nutrients of press mud

Compound	Percentage
Cellulose	11.4
Hemi cellulose	10.0
Lignin	9.3
Protein	15.5
Wax	8.4
Sugar	5.7
Na	0.22

Table 2. Compounds of press mud

No.	Nutrients	Ave amount/100g of press mud (%)
1	Organic compound	50
2	calcium	11
3	phosphorus	2-3
4	potassium	1-2
5	nitrogen	1
6	magnesium	1
7	sulphur	0.3
8	iron	0.05
9	copper	traces
10	manganese	traces
11	zinc	traces

[10] Press mud includes nitrogen, cellulose, lignin, protein and sugar which is suitable for bio-fuel and fertilizer production. The compounds present and their percentage in total of 100 grams are given in table 2 which is provided below.

Press mud can be used with other materials in order to improve its yield. [11] Copper and nickel play a significant role in plant growth. The deficiency of copper and nickel in plants result in retardation of plant growth. One way to balance this defect is by addition of press mud to the soil as fertilizer. This can be used along with other fertilizers as well. It is analysed that by using filter press mud, constant increase in copper and nickel could be noticed.

3.2. Control of weeds

[12] Weeds degrade crop cultivation. In spite of causing huge destruction to the planted crops, it may also lead to severe loss and decreases the overall efficiency of the system. Therefore weed growth must be limited. Certain insects harm the productivity of plants. In both the cases, press mud would be the remedy that prevents the growth of weeds and limits the multiplication of some types of roundworms. Hence use of pre-treated press mud is widely accepted and used by cultivators. Crop rotation methods can be implemented to limit the growth of weeds. [13] Several types of weeds consume large amount of organic matter which in-turn reduces the amount of in-take by crops. Press mud contains various chemicals which have the ability to destroy weeds. It is essential to apply this fertilizer at the beginning of cultivation session. This may even prevent the

germination of weed seedlings if used earlier. Along with press mud, neem cake is employed for the purpose of weed removal.

3.3. Chromium control

[14] One of the toxic substances affecting plant growth is chromium. It is naturally available in soil. When plants are grown in high concentration of toxic chromium, the rate of photosynthesis is decreased and the total productivity gets affected. Chromium is available in many forms such as soluble, stable and unstable states. Experimental research show that by using press mud as manure in fields, the effects of chromium gets depleted thereby constant decrease in the uptake of chromium by plants is noted. Generally press mud is used along with gibberellic acid to obtain maximum efficiency.

3.4. Merits of press mud

- To prevent the plants from soil borne diseases
- Increases microbial growth
- Effective weed management
- Decline the effect of toxic materials

3.5. Demerits

- Enhances the growth rate of pathogenic fungi
- Increase in the content of heavy metals may affect the soil composition.

3.6. Enrichment of press mud

To enhance the fertilizer quality, Single Super Phosphate (SSP) and Sulfur mud can be mixed along with the treated press mud to increase the phosphoric contents of the manure. Addition of phosphorous in the soil contributes to protein synthesis. Distillery spent wash is mixed with press mud to prevent it from any toxic effluents affecting the soil. By employing enriched press mud to the fields, maximum yield of products are obtained by upgrading the physical properties of soil. It also reduces soil erosion. [15] Enriched compost of press mud is mixed with chemical fertilizers which results in increase of productivity, where the press mud is enriched with trichoderma harzianum. Soil fertility is enhanced by the addition of enriched press mud. Significant differences are noted with the application of enriched press mud rather than using raw press mud. Enhancement in chlorophyll content, organic carbon and other

nutrients such as nitrogen, potassium, phosphorus and sulphur is examined.

[16] It is examined that press mud used without any pre-treatments results in degradation in soil fertility, thus leading to poor productivity. It brings effective results if pre-treated press mud is used and it offers the generation of micro and macro nutrients. Cations of calcium and magnesium are increased which further increase in the pH of the soil. Press mud is enriched by microbes such as enterobacter, stenotrophomonas, aeromonas, acinetobacter, klebsiella, Penicillium chrysogenum, Alternaria gaisen, Aspergillus flavus, Aspergillus awamori, Fusarium monoliforme. It is determined that the fertilizer enriched with such microorganism produces better results compared to the use of fresh press mud. The use of microbes in enrichment of press mud is widely acceptable due their availability and cost effectiveness.

[17] Enriched press mud is been integrated with chemical fertilizers. Studies are made by integrating chemical fertilizers with enriched and non-enriched filter cakes. It is concluded that efficiency is higher in case of using enriched ones.

4. CONCLUSION

Enormous amount of such filter cakes are released into environment every year. In spite of these available mechanisms, these by-products is not utilized properly leading to wastage of nutrients. This issue results in degradation of nature and future scopes must be framed in such a way to promote maximum utilization of press mud to increase the growth rate of useful microbes, which are the natural sources to modify the soil structure and fertility required for plant cultivation. [18] Crops are allowed to grow without press mud fertilizer, where it is examined to have poor crop growth and production. Notable increase in plantation is seen after the supply of enriched press mud fertilizer because by adding compost press mud, there is considerable increase in nitrogen, phosphorus and potash compounds. These compounds are essential for plant growth and retardation in crops is gradually decreased. Addition of press mud manure increases the moisture content of the soil which avoids frequent watering of plants.

Techniques should be implemented in terms of incorporating treated press mud to the soil by means of effective strategies. It is also recommended to prevent the growth of pathogenic microbes due to the exposure of such bio fertilizers. One way to prevent the growth of disease causing fungi is to add filtered press mud fertilizer to the cultivated soil. Certain bio-manures are mixed with press mud to lower the growth rate of such microbes. Extensive innovative methods are ought to be diagnosed and used for the better development of press mud based fertilizers. Press mud can be even used along with a small proportion of chemical fertilizers to promote the overall yields.

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