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Study the Heavy Metal Accumulated Pithophora Algal Compost Nutrient Content, Heavy Metals and Biogas Production

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Abstract: ***Cyanophyceaen algae as nitrogen fixers have been used in different countries for a long time, are well known as biofertilizers. The potentialities of cyanobacteria to fix atmospheric nitrogen excrete a great number of substances that improve plant growth and productivity. The present study was conducted to use Pithophora algae to accumulate heavy metal, as compost supplier, especially nitrogen element and to encourage the compost microorganisms' activities. The management scenario for algal biomass reutilization, i.e. recycling nutrients and proteins back into the biosphere, via compost processing is proposed.***

Keywords: Pithophora, algae, compost, Heavy metals, nutrient value, biogas value

1. Introduction

To make compost is a current environmental and agricultural practice to not only to maintaining soil's organic matter and supplying plant nutrients but also helpful to reclaim degraded soils. Composting is the process by which organic substances are broken down by microorganisms (biological oxidation) and turned to sustainable material which is called humus or compost. Meanwhile it has no effect on plant growth and environment (Sarnavat, 2003). Compost should be supplied (especially for elements like N, P, K), in order to have a rich and suitable substance for plants growth (Gaur and Singh, 1995).

Algae especially nitrogen fixer cyanobacteria have been used in agriculture for many years. Algalization increases the organic matter content of the soil thereby enhancing its fertility and protects the environment (Cresswell et al., 1989). Mono-species cultures of green algae contain protein (over 50% of dry weight), nutrients (nitrogen, phosphorus) and may contain various bioaccumulated toxic elements. This is an advantage from the view- point of tertiary sewage treatment but a disadvantage if the intent is to use waste-grown algae for composting.

As in today's scenario chemical fertilizers being added are not optimally taken by plants and productivity is low along with other adverse effects on physico-chemical property of soil. Thus there is need to have a dynamic and living system of fertilization. Bio- fertilization techniques, which using algal extract are recommended for increasing the growth parameters of many plants (Adam, 1999). Researchers have clearly shown that one of the most effective nitrogen-fixing biological systems in the rice fields are certain blue-green algae that contribute about 25-30 kg N/ha/season (Venkataraman, 1979).

2. Materials and Methods

The mixture of fresh and heavy metals accumulated algae, cattle dung, dry and green leaves, vegetables waste, weeds were chopped into 2-3 inch size. The compost has been made by decomposting organic waste with natural and metal accumulated algal sps in following steps.

- Make slurry of the cattle dung with water.
- Add fresh/ metal accumulated algae with the layer
- Prepare 6" layer of organic wastes – plant residues, sweepings from the cattle shed, waste fodder, dried plants stalks and leaves etc. and sprinkle water to just moisten it. (Over watering should be avoided).
- Cover with the layer with cattle dung slurry and organic wastes.
- Repeat the process of putting such layers till the pit is full. Close the pit with waste fodder and then heap the soil till it gets convex shape and after 6 to 8 weeks compost is ready to apply to the fields.

In this compost microorganisms require digestible carbon as an energy source for growth, also nitrogen, phosphorous and potassium for protein synthesis to build cell walls and other structures. The compost is ready when the material is moderately loose and crumbly and the colour of the compost is dark brown. It will be black, granular, lightweight and humus-rich. After composting measure the heavy metal and nutrient contents. The nutrient content of the compost like C, N, P, K were estimated by standard practice. Organic carbon and nitrogen content were estimated by colorimetric method. Phosphorus was estimated by Olsun process. Potassium was estimated by flame photometric method (Jackson, 1973). The heavy metals like cadmium (Cd), chromium (Cr) and lead (Pb) content compost samples were digested with $HClO_4$, HNO_3 (1:4 V/V) and diluted with double distilled water. The various concentrations of metals were measured by using

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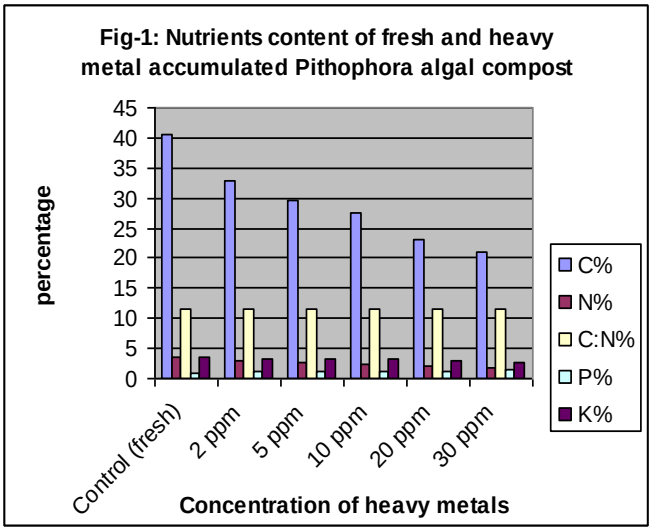
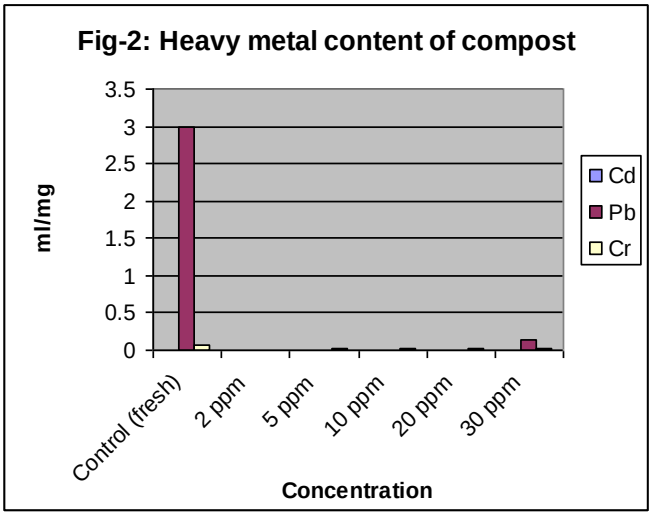
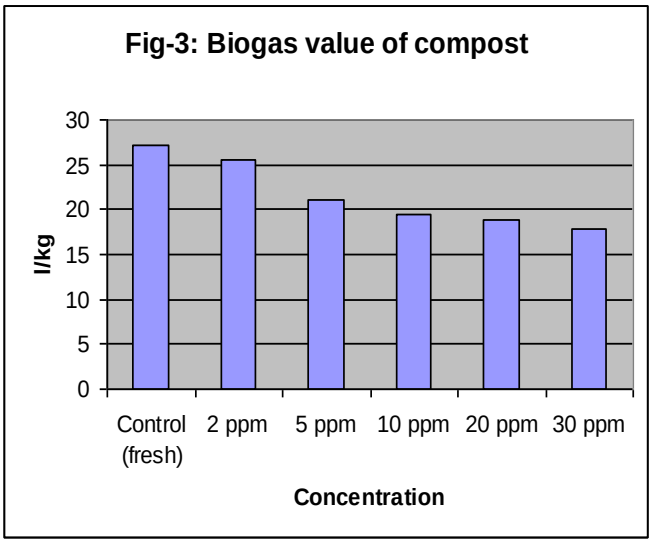
Inductively Couple Plasma spectrometer, Perkin Elmer Corporation (ICP optima 3300RL). These compost and cow dung slurry also gives biogas. The biogas was measured after 6 days, is one of the alternate sources of energy to meet the ever increasing demand of energy. The availability of cattle dung which is commonly used for biogas production is becoming scarce.

3. Figures and Tables







4. Results and Discussion

In heavy metal accumulated Pithophora algal compost highest nutrient content was observed at 2ppm and lowest nutrient content was observed at 30ppm. Biogas yield in Pithophora heavy metal treated algal compost was decreasing trend with increased metal concentration. After composting in Pithophora Cd level was found BDL, however Pb & Cr were found highest at 30 ppm (fig-2).

Hann (1981) reported that the concentration of the plant nutrients nitrogen, phosphorus and potassium are low (0.96, 0.75, 0.33% respectively) in municipal waste compost compared with farmyard manure (2.5, 1.60 and 1.70% respectively). In this present study, similar data observed of algal compost to compare with farmyard manure. Cattle dung contains higher amount of methanogenic bacteria and high biogas production. Higher rate of biogas production with addition of chopped weed residue with cow dung razing C/N ratio between 25-30 was reported by Hills and Roberts (1981), Hills (1979) and Thakur and Singh (2000).

De- Mule et al. (1999) and De- Caire et al. (2000) indicated that blue-green algae excrete many of substances (growth promoting regulators, vitamins, amino acids, polypeptides, antibacterial and polymers, especially exopolysaccharides), which induced a growth promotion of other microorganisms and increased the enzymes activities. Composting has enhanced the phosphate content in coffee husk in comparison with the same in untreated (Sathianarayanan et al., 2008). Sujatha et a. (2003) reported earthworm casting in the home garden often containing 5 to 11 times more nitrogen, phosphorus and potassium than surrounding soil.

5. Conclusion

The present study reveals that the heavy metal accumulated Pithophora algal compost have provide good nutrients and biogas. Thus it helps to remove heavy metals from the environment and provide energy in the form of biogas, to meet the ever increasing demand.

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