



Production of organic compost for plants and extraction of protein for animal feed from tea powder waste

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Abstract

India is second largest producer in Tea production, since ancient times Indian people consume tea as their most favorite beverage as is affordable. India is also known as "Chai Country" as 72% people regularly consume tea. On this rate of consumption, we can determine how much of waste is generated by tea powder. This tea powder contains proteins and tannins. As proteins are important nutrients in the animal feed animal husbandry. India is developing country there are many occupations practiced and from all of these is practiced on large scale, which is generating high demand for feed. So we can extract proteins from tea waste which can be used as source of high protein feed for animals. Fermentation by *Aspergillus niger* can significantly increase the protein availability and digestibility of tea waste, making it a suitable and sustainable protein source for cattle feed. Different fermentation conditions (temperature, pH, substrate concentration, and *Aspergillus niger* strain) will be optimized to maximize protein availability and digestibility. Tea waste contains 6.3% tannic acid which affects protein metabolism. Hence, we have to first eliminate tannic acid from this waste then we can extract the proteins from tea powder waste. Tea leaves contain high concentrations of antioxidants such as polyphenols, minerals, and vitamins which can improve animal health. Factory tea waste which contains tannic acid is one of the limiting factors for the utilization of this byproduct in livestock feeding. As tea powder waste is great source of animal feed but it can also serve as good source of organic compost as well.

Keywords: Tea powder waste, animal feed, *Aspergillus niger*, tannic acid, organic compost

Introduction

The tea plant is scientifically known as *Camellia sinensis*. It is an evergreen shrub this species is native to the Indian subcontinent, Southeast Asia and East Asia. However, it is cultivated around the world today, mostly in tropical and subtropical region. The tea leaves are further pulverized into powder and this powder is globally used as beverage. Tea leaves consist of tannic acid, proteins, antioxidants, polyphenols, etc ^[1]. Tea powder waste is the by-products formed after straining the tea ^[2]. Although tea powder waste are the by-products of tea after straining, they still contain more tea polysaccharides, theanine, tea polyphenols and other bioactive substances, which have antibacterial, antioxidant and anti-cancer functions ^[3] ^[5]. The use of tea powder waste in animal products improves the production performance, antioxidant capacity, and immunity of animals, as well as avoids the pollution of the environment when tea powder waste are discarded in large quantities ^[6] ^[7]. Adding tea powder waste to the feed enhances the immunity and intestinal health of laying hens, which increase their egg production rate, reduces cholesterol content in eggs, and improves egg quality ^[8] and also increases milk production in cattles ^[9]. In poultry feed and in cattle feed most of the research has been conducted on the use of tea powder waste as feed ingredients. So, the main objective of the current research was to use tea powder waste as part of a fermented feed by using co-fermentation with bacteria and enzymes.

Compost is rich source of nutrients with high organic matter content and use of compost can be beneficial to improve organic matter quality. As tea powder waste contains

sulfate, chloride, total phosphorus, available phosphorus, calcium, magnesium, organic matter and silica which are important constituent in many fertilizers as they are responsible for plant growth and yield, tea waste can serve as Biofertilizer ^[10]. This biofertilizer change the texture of soil and makes it more fertile. It also increases moisture content of soil which shows that the Tea powder waste compost is rich in nutrient content when compared with normal compost ^[36]. The amount of Potassium present in the Tea powder waste compost is high which is beneficial for use than the other compost ^[35] ^[50]. There is an increase in the amount of Nitrogen and Phosphorus present in the soil ^[38]. The Tea Powder Waste is a economically cheap organic compost which is good for the growth of plants ^[37] ^[40].

Materials and Methods

Removal of tannic acid from grinded tea powder waste ^[13] ^[14]

Select tea powder waste from cafeteria of K.J. Somaiya College, Kopergaon.

Sun drying was done of collected tea powder waste and throughout the process it was ensured that mold growth was prevented. Use covered mesh trays to allow airflow and prevent contamination.

Grind the dried tea powder waste into a fine powder.

88.18gm of tea waste powder was added in 250ml of sabouraud dextrose media and fermented it with inoculum of *Aspergillus niger* ^[6].

Separate the liquid extract from the tea waste residue by centrifugation 3200rpm for 10 Mins ^[11] ^[17].

Place the tea waste in the glass container. And cover it with hot (85°C) distilled water. The ratio of tea waste to water can vary depending on the desired tannic acid concentration. (1:10) 10 gram of tea waste to 100ml of water. Close the container and let the mixture steep for overnight then gently stir the mixture occasionally to facilitate extraction.

Strain the liquid through cheesecloth to remove the tannic acid from tea waste.

The remaining residues on cheesecloth was dried in hot air oven for 24 Hrs.

After the removal of tannic acid from sample, the residual sample was further used for protein extraction and also assemble pot assay to examine its role as a compost for plants such as *Trigonella foenumgraecum* and *Allium cepa*.

Pot assay

The effect of compost was studied in pots using pot trays at laboratory level. In the tray, each pot contained 55gm of agriculture soil. *Trigonella foenumgraecum* and *Allium cepa* are the two crop plants that were taken for the study. Pots were regularly watered. The height of growing plants was regularly moderated by measuring root and shoot length for the determination of plant height [26].

Extraction of protein [12]

Dissolved above tea waste residues in 1N NaoH solution and 100ml D/W. Stir it for 2hrs at 50° C temprature. This method utilizes the solubilizing properties of alkaline

solutions to extract proteins from Tea waste. Separate the liquid extract from the tea waste residue by centrifugation and filter the extract to remove any remaining particles [15] [16]. Adjust the pH of the extract to neutral by using hydrochloric acid. Precipitate the proteins from the neutralized extract using a solution ammonium sulfate. Centrifuge to collect the precipitated protein pellet [23]. Measure the protein concentration in the purified extract using methods like Folin Lowery assay [18].

Table 1: Physico-chemical Analysis of compost

Parameters	Control	Tea powder compost
pH	7	6.9
Conductivity	0.540ms	5.40ms
Sulphate	0.05%	0.5%
Chloride	0.7%	0.9%
Total Phosphorus	0.03%	10%
Available Phosphorus	0.02%	0.04%
Calcium	1%	12%
Magnesium	0.26%	0.54%
Organic matter	8%	42%

Table 2: Pot Assay

Parameters	Control		Test	
	I	II	I	II
Plant Height (cm)	8	7	9.5	8
Germination period (in days)	10	12	9	10

Note: I- *Trigonella foenumgraecum*, II- *Allium cepa*

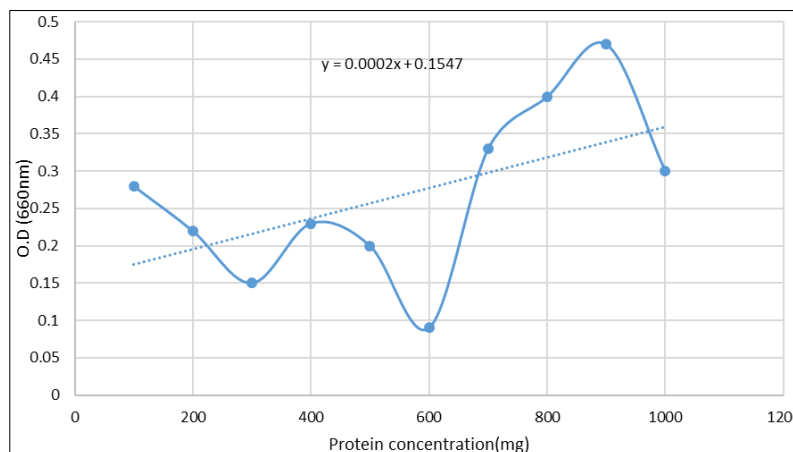


Fig 1: Graphical representation of Protein quantification (Folin Lowery)

Protein quantification by Folin Lowery method. An optical density (O.D) at 660 is plotted against protein concentration (mg).

Result

Through examine pot assay, plant height increased and germination period was decreased in the pot which contain tea powder compost rather than standard control. Protein quantification by Folin Lowery method detected sample OD was 2.14. 9926.5mg protein concentration was found.

Conclusion

The used tea powder is the suitable waste material for making compost. The pot assay results show the enhanced quality and growth of plant also which decrease germination period of seeds. Extracted proteins from tea waste which can be used as source of high protein feed for animals.

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