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ORIGINAL ARTICLE **OPEN ACCESS**

A comparison on Physico-Chemical Character of Cow Dung and Vegetable Waste

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ABSTRACT

Vegetable wastes and cow dung have high pollution potential as far as environmental health is concerned. Unscientific disposal methods cause heavy damage to every component of environment. Butproper management of waste with the help of digester it's an environmental friendly and an attractive economic plan. The influence of physico-chemical composition of cow dung and vegetable waste were measured. Samples were collected from different zone of Bhilai Nagar, Chhattisgarh. Different physico-chemical parameters were analyzed by biogas digesters which have monitoring system. The percentage of CH_4, O_2, CO, H_2S were 60±1.43, 11.6±0.98, 16±1.21, 12.3±0.96, 0.1±0.0 and 64±1.51, 16.3±0.75, 2.2±0.92, 17.5±1.02, 0.0±0 in cow dung and vegetable waste, respectively. In chemical composition Crude Protein, Crude Nitrgen0.92, fiber, fat content, Ash content, carbohydrate, total solids, volatile solids were analyzed and value were 6.38±0.83, 0.84±0.072, 7.65±0.73, 0.286±0.058, 3.39±0.43, 77.14±1.13, 82.72±2.51, 55.25±1.64 and 2.83±0.47, 0.542±0.14, 33.6±1.6, 21.02±1.47, 9.14±0.6, 33.49±1.66, 52.65±1.44, 41.78±42in cow dung and vegetable waste, respectively. These results pointed out the importance of cow dung and vegetable wastes were valorisation and the development of strategies for their re-utilisation. Hence, if composting process is introduced, the food waste and cow dung have the potential to increase soil fertility.

Key word: *Composting; Fertility; Improvement; Population.*

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INTRODUCTION

Now a days, increasing population pressure and demand of food resources, there is a need of introducing a chemical fertilizer, pesticides and insecticides to the soil, which are disturbing the soil physiochemical properties including soil texture, porosity, and water holding capacity and also disturbed the soil microbial population [1]. As well as MSW includes both domestic and commercial waste account for a relatively small part of the total solid waste stream in developed countries [20, 6].

Accumulation of a large amount of waste may create several problems to inhabiting populations. It requires application of some effective strategies for proper disposal of (MSW) [21, 23]. A study performed by Baawain et al. [3] confirmed that food waste commonly disposed of in landfills or dumping sites, causing environmental problems.

Cows dung is a most important source of bio-fertilizer but at the same time cow's urine, cow's horn and a dead body of a cow can be used for preparing effective bio-fertilizer. The farm animals (cows, bullocks and milk buffaloes) provide dung and urine to enrich the soil, while crop residues and fodder form the bulk of the feed for these animals [12, 13]. Cow dung is play major role in maintaining the production capacity of soil and enhances the microbial population. Moreover, 40–60% solid wastes in India are of organic nature and open dumping of such garbage creates the issue of environmental pollution [8]. So, municipal organic waste also used as biofertilizer after composting [23, 10, 9] by microorganisms under aerobic conditions during the composting process and a humus material, which can be used for soil improvement [14] and also converted in to converted into some useful products for agriculture and industries, if processed through cost effective technique [9]. This study assesses the relationship between physico-chemical parameters of cow dung and vegetables waste which can be used as raw materials for composting.

MATERIAL AND METHODS

Sampling area: Bhilai is a city of Chhattisgarh, in eastern central India. With a population of 1,064,077, Bhilai–Durg is the second largest urban area in Chhattisgarh (Fig 1).

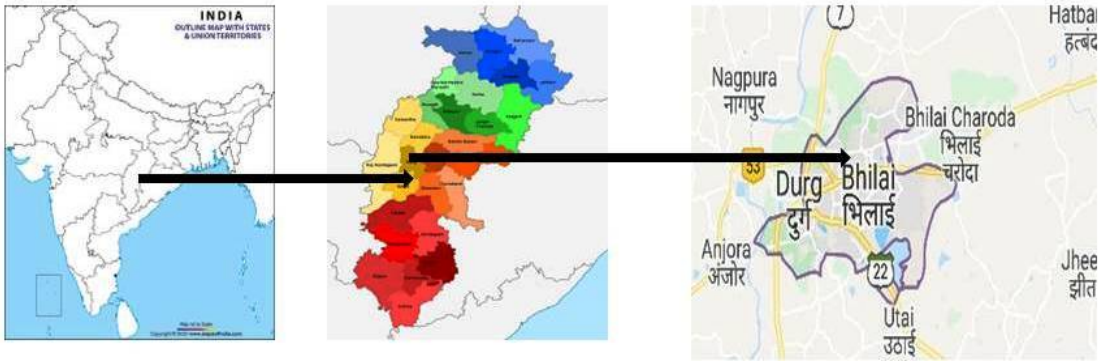

Fig 1: Location of Sampling

Collection of sample: Vegetable and cow dung were collected from different sector of Bhilai area, Durg, Chhattisgarh. Collected Wet sample were air dry, grind and Storage was done at refrigeration temperature. The analyses were carried out at laboratory level within the School of Science, ISBM University, during the period of March-June 2020. Different physical and chemical analyses were carried out [7].

Sample preparation: The animal waste was separated from inorganic materials. The waste was fed into the digester with water in the ratio 1:1 and the mixer was engaged to ensure intimate contact between the microorganisms and to improve the fermentation efficiency. The waste was allowed to decompose in the digester for 14 days. The kitchen waste was collected and was grinded into smaller pieces. The waste was allowed to decompose in the digester and value of the parameters was recorded over the period of digestion [19].

Chemical Analysis:

The measuring parameters of the system were determined and noted as the waste was undergoing fermentation and the amount of biogas produced was recorded [6]. The performance evaluation was carried out in order to access the performance of the biogas system based on the biogas parameters and the data obtained from the monitoring system. Various data was collected from the system such as the temperature, humidity and pressure in the system and the equivalent biogas yield was evaluated [15, 17].

Here two different systems were used:

1. Non-technical (Digesters, gas chambers and compost collectors)
2. Technical (Temperature sensors, Humidity sensors Pressure sensor)

Dry matter (DM) content was determined by drying the samples at 105°C overnight and ash by igniting the samples in muffle furnace at 525°C for 8 hs and crude protein content was measured by the Kjeldahl method [12]. Ether extracts (EE) were determined by the method of Crude fiber (CF) was determined according to the method of Van Soest and McQueen, 1973. Carbohydrate %=100 − (moisture content+crude fiber+ash+crude protein+fat) %. Prior to analysis, samples were agitated for 3 min using a drill mixer to ensure the incorporation of any settled solids. Bulk density was measured based on the sample mass in a 100 mL graduated cylinder (Jackson, 1967). TS and VS were determined following gravimetric procedures found in standard methods [11, 15]. Different carbon content was determined by Walkley and Black, [24].The substrate was taken individually and fed into the digester.

Physical Analysis: Various data was collected from the system such as the temperature, humidity & pressure in the system and the equivalent biogas yield was evaluated.

RESULT AND DISCUSSION:

Colour of cow dung is greenish to Dark brown because the undigested residue of plant matter which has passed through the animal's gut and in air exposer its convert to dark brown [10]. Colour of vegetable waste yellowish is due to presence of pigments [17]. pH (potential hydrogen) of a sample is refers to its hydrogen ion activity and is expressed as the logarithm of the reciprocal of the hydrogen ion activity at a given temperature. pH of the cow dung is 7.0 and vegetable waste was 6.21 as presented in Table 1. The variation occurred in the pH values due to change in the values of CO_2, carbonate, and bicarbonate ion in vegetable waste [3]. The lower values of pH may cause tuberculosis. Higher values may produce incrustation, sediment, deposition, and some difficulties in chlorination for disinfections of water [1].

Odour of cow dung is due to presence of bacteria in dung which performing a fermentation [5]. But initially in vegetable waste microorganism was absent but in exposer of air, a different type air microbe was attached and starts growing [22]. Temperature value of cow dung and vegetable was 38˚C and 29 ˚C, respectively.

The percentage of CH_4, O_2, CO, H_2S, Crude Protein, Crude Nitrgen0.92, fiber, fat content, Ash content were 60±1.43, 11.6±0.98, 16±1.21, 16.3±0.75, 2.2±0.92, 17.5±1.02, 0.0±0, 2.83±0.47, 0.542±0.14, 33.6±1.6, 21.02±1.47, 9.14±0.6 in cow dung and vegetable waste, respectively (Table 2). Moisture content of cow dung and vegetable waste was 17.53±0.68 and 25.21±2.78, respectively. Cow dung have low moisture content because it's a digested food material and polysaccharide like cellulose, starch which present in food is breakdown in oligosaccharide or monosaccharide [4]. And due to similar reason fibre content is high in vegetable as compared to cow dung (Table 2). Fat content is high (21.02±1.47) in vegetable waste and lowest in cow dung because ruminant rations as high fat levels negatively influence rumen chemistry and biology [13]. Ash content represents the incombustible component remaining after a sample of the furnace oil is completely burned [14]. But Ash content is high in vegetable waste and low in cow dung (fig 2). Cow dung ash is achieved by drying and burning of cow excreta [16]. It is bulky and has a large ash content contacting a nitrogen rich material, potassium, phosphorus and calcium [18].The carbohydrate, total solids, volatile solids were 77.14±1.13, 82.72±2.51, 55.25±1.64 and 33.49±1.66, 52.65±1.44, 41.78±42 in cow dung and vegetable waste, respectively.

Table-1: Physical analysis of vegetable waste and cow dung

S. No.	Parameter	Cow dung	Vegetable waste
1	Colour	Dark brown color	Yellow, brown
2	Odour	Rotten eggs	Foul
3	pH	7.9	6.21
4	Temperature (˚C)	38˚C	29 ˚C

Table-2: Chemical analysis of vegetable waste and Cow dung

S. No.	Parameters	Cow Dung	Vegetable Slurries
1	CH4 (%)	60±1.43	64±1.51
2	O2 (%)	11.6±0.98	16.3±0.75
3	CO (%)	16±1.21	2.2±0.92
4	CO2 (%)	12.3±0.96	17.5±1.02
5	H2S (%)	0.1±0.0	0.0±0
6	Crude Protein	6.38±0.83	2.83±0.47
7	Crude Nitrgen0.92	0.84±0.072	0.542±0.14
8	Moisture Content	17.53±0.68	25.21±2.78
9	Fibers	7.65±0.73	33.6±1.6
10	Fat Content	0.286±0.058	21.02±1.47
11	Ash Content	3.39±0.43	9.14±0.6
12	Carbohydrate	77.14±1.13	33.49±1.66
13	Total Solids	82.72±2.51	52.65±1.44
14	Volatile Solids	55.25±1.64	41.78±42.33

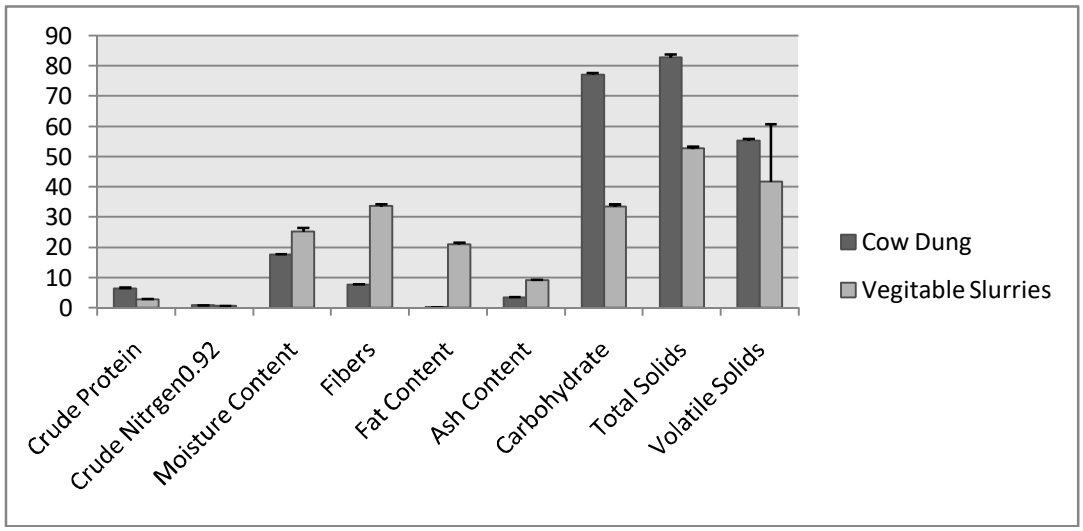

Fig 2: Physico-Chemical analysis of vegetable waste and Cow dung

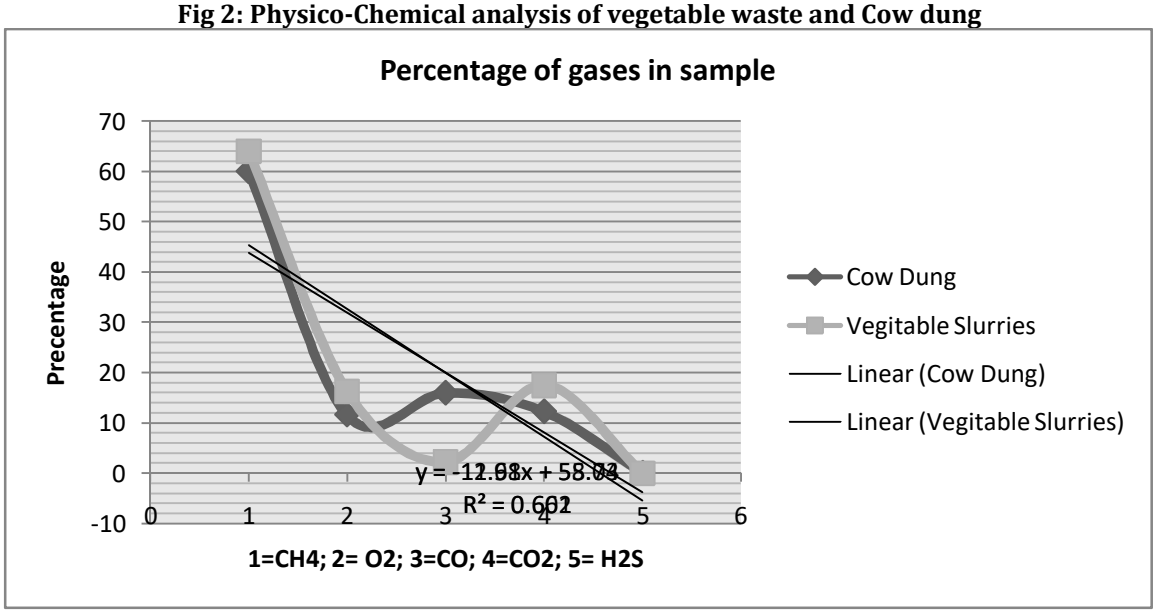

Fig 3: Percentage of gases released in cow dung and vegetable sample

CONCLUSION

Cow dung has preeminent for increasing soil fertility. The effective and efficient utilization of Cow dung would reduce the cost of chemical fertilizer, increase farmers' profits. As well as vegetable waste have great potential but further processing will required, and its help in waste management and the reduction of environmental pollution. Hence, more research needs to be carried out in this field. So wehave implemented the monitoring system for biogas plants for controlling theactivities of different contents in biogas plant.

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