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Evaluation of chemical properties of organic briquettes developed from slaughterhouse waste

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Abstract

Service slaughter houses in the country generate large quantities of animal blood, manure and rumen contents as waste material. Eco-friendly disposal of such waste often requires long time or expensive equipment. The study was conducted to develop organic briquettes using biomass originating from slaughterhouse wastes and to investigate its chemical properties to be used as an organic nutrient source in crop cultivation. Dried rumen contents were mixed with fresh blood collected after bleeding of animals in different proportions and dried using tray drier. The dried rumen content-blood (RB) mixture was further mixed with commercially available coir pith in 12 different proportions. The rumen content-blood-coir pith (RBC) mixture was formed into briquettes using a hydraulic biomass briquetting machine. Each organic briquette was five centimetres in diameter and had an average weight of 30-40 grams. The treatments were analyzed for organic carbon (OC), total nitrogen and carbon: nitrogen ratio. The organic briquette that had rumen content with 100 per cent blood and 80 per cent coir pith (T_{10}) recorded the highest total nitrogen (1.76±0.09 per cent) and lowest carbon: nitrogen ratio while highest organic carbon content (45.97±0.93 per cent) was noted in organic briquette that had rumen content with 80 per cent blood and 60 per cent coir pith (T_8). The study showed that there is considerable potential for development of organic briquettes that are compact, easy to transport and market, and ideal for grow bag cultivation and garden nurseries by using slaughter house wastes as sources of organic nutrient..

Keywords: *Organic briquettes, slaughterhouse wastes, rumen content, blood, coir pith*

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In Kerala, the total number of livestock handling units is 15680, and out of these, only 666 units operate with proper waste disposal methods. The total meat yield from cattle and buffaloes is approximately one third of the total live weight and the reminder constitutes various by-products and wastes. The major inedible wastes include rumen contents and blood which constitutes approximately 16 per cent and 4 per cent of the live weight of the animal respectively (Irshad *et al*., 2015). The current techniques for the disposal of rumen contents such as ensiling and drying using a fluid bed drier involves high processing and operational costs. Further, there are chances that blood would clog the pipes and led to the generation of a high-level polluting effluent, if let to the drains. The high protein content of blood makes it a difficult substrate for anaerobic digestion (Salminen and Rintala, 2002). Prevailing methods for industrial processing of blood to produce good quality blood meal requires sophisticated technologies that are cost intensive.

Coir pith is a by-product of the coir industry which not only helps in upgrading the structure of soil but also enhances the physical properties such as pore space, bulk density, hydraulic conductivity and infiltration rate of even the heaviest clay soils. The sponge like structure of coir pith aids in retention of water and it increases aeration in the root zone (Jeyaseeli and Raj, 2010).

Implementing technologically sophisticated operations to treat the complex waste (rumen contents and blood) would be exceedingly costly. Biomass briquetting is a process by which loose, high-volume, low-density material (with moisture content less than 10 per cent) like agro residues are compacted into low volume and high-density masses by means of compression. The organic briquettes thus developed could be stored and transported easily (Dubey *et al*., 2010). These briquettes could be ideal for application in pot cultivation of vegetables in rural and urban settings with space restrictions, especially in the context of the recent increasing popularity and acceptance of backyard and roof top cultivation in pots and grow bags. Investigations on the physico-chemical properties of briquettes developed from abattoir waste as an organic nutrient source is therefore a favourable proposition.

Materials and methods

Location of study

The study was conducted at the Meat Technology Unit, Mannuthy of Kerala Veterinary and Animal Sciences University and Agricultural Research Station, Mannuthy of Kerala Agricultural University.

Development of organic briquettes from rumen contents, blood and coir pith

Rumen contents and blood were collected from cattle and buffaloes slaughtered as per scientific slaughter procedures. Rumen contents were dried in a tray drier at 60^{O}C for 18 hours. The moisture level of the dried rumen contents was estimated to be less than five per cent (FCO, 1985). Fresh blood was added to the dried rumen contents at 60, 80 and 100 per cent levels (w/w) over and above the weight of rumen content and mixed thoroughly. The rumen content-blood mixture (RB) was spread on a polythene sheet and sun dried for six hours. The partially dried RB was further dried in the tray drier at 60^{0}C for nine hours. The moisture level of the combination was estimated to be less than five per cent. The mixture was ground using a pulveriser. Coir pith purchased had electrical conductivity about 9 dS/m. In order to reduce the electrical conductivity below 2 dS/m, coir pith was washed twice using tap water.

A mixture of washed and dried coir pith and pre-processed RB was prepared containing coir pith at 60, 70, 80 and 90 per cent (w/w) levels to obtain 12 different treatments as mentioned in Table 1. This final mixture was briquetted using a hydraulic briquetting machine to obtain briquettes which had five centimeter diameter and an average weight of 30-40 g.

The 12 different treatments were analysed for organic carbon (OC), carbon: nitrogen ratio (FCO, 1985) and total nitrogen (Kirk, 1950).

Statistical analysis

Data recorded were analysed statistically as per Snedecor and Cochran (1994) by using SPSS Software (Version 24.0). Physico-chemical properties of organic briquettes were analysed using one-way ANOVA.

Results and discussion

Organic carbon

Among the treatments under study, the organic carbon content was the highest for T_8 (45.97±0.93 per cent) and the lowest for T_1 (39.24±0.77 per cent). Khater (2015) observed an organic carbon content of 16.6 per cent and Tripetchkul *et al*. (2012) reported an organic carbon content of 29.32 per cent respectively in composted animal manure, while Nunes *et al*. (2014) reported an organic carbon content of 18.22 percent in bovine digesta mixed with tannery sludge. The reported values were lower when compared to the organic carbon content of briquettes used in the current study. Organic carbon content of cattle manure is scanty and the inclusion of lingo-cellulosic materials could equilibrize the under supply of carbon in cattle manure (Font-Palma, 2019). Coir pith has a high carbon content (Abad *et al*., 2002). The high organic carbon content of the treatments used in the present study could be attributed to the addition of coir pith in high proportions to the dried rumen content-blood mixture.

Total nitrogen

The organic briquettes, T_{10} and T_1 had the highest (1.76±0.09 per cent) and the lowest (0.92±0.09 per cent) total nitrogen content. The total nitrogen content of the briquettes under study increased with increase in level of the blood added. Cattle manure compost had a total nitrogen content of 0.95 per cent (Khater, 2015), which was lower than that of the organic briquettes used in the current study. This difference could be due to the addition of blood during the briquetting process resulting in an excellent protein source as it contains about 95 per cent protein (Salminen and Rintala, 2002).

Roy *et al*. (2013) observed high nitrogen content of 5.5 per cent in bovine blood-rumen digesta mixture in the ratio 3:1, which was higher than the values seen in the organic briquettes used in the present study. The lower nitrogen content observed in the current study could be due to the lower level of incorporation of blood in the rumen contents – blood mixture (1:1).

Carbon: Nitrogen ratio

The C: N ratio was the highest for T_1 (43.44±4.50) and the lowest for T_{10} (24.29±1.05). Organic briquettes made of bovine blood and

Table 1. Details of treatments

Treatments	Level of blood added to dried rumen contents (over and above the weight (w/w)) to prepare RB mixture (%)	Proportion of dried coir pith in RBC (%)
T_1	60	90
T_2	60	80
T_3	60	70
T_4	60	60
T_5	80	90
T_6	80	80
T_7	80	70
T_8	80	60
T_9	100	90
T_{10}	100	80
T_{11}	100	70
T_{12}	100	60

Table 2. Physico-chemical properties of different organic briquettes prepared by addition of rumen content, blood and coir pith

Treatments	Organic Carbon (%)	Total Nitrogen (%)	Carbon: Nitrogen ratio
T_1	39.24±0.77^{a}	0.92±0.09^{a}	43.44±4.50^{c}
T_2	42.21±0.56^{abc}	1.20±0.09^{ab}	35.53±2.98^{bc}
T_3	40.91±0.78^{abc}	1.21±0.09^{ab}	34.23±2.89^{ab}
T_4	39.97±0.62^{ab}	1.38±0.16^{bc}	29.56±2.95^{ab}
T_5	43.93±1.59^{cd}	1.38±0.01^{bc}	31.77±1.27^{ab}
T_6	41.76±1.07^{abc}	1.38±0.16^{bc}	30.84±2.86^{ab}
T_7	41.76±0.77^{abc}	1.47±0.24^{bc}	29.63±4.06^{ab}
T_8	45.97±0.93^{d}	1.57±0.18^{bc}	30.03±3.54^{ab}
T_9	42.69±1.34^{bc}	1.49±0.10^{bc}	28.92±1.74^{ab}
T_{10}	42.57±0.42^{bc}	1.76±0.09^{c}	24.29±1.05^{a}
T_{11}	42.24±0.82^{abc}	1.58±0.09^{bc}	26.83±1.42^{ab}
T_{12}	42.32±0.93^{abc}	1.48±0.18^{bc}	29.68±4.71^{ab}

Mean ± S.E. of different treatments of organic briquettes with different alphabets as superscripts differ significantly at $p<0.05$ %

rumen contents had a C: N ratio of 4.8 (Roy *et al*., 2015), while granulated cattle manure compost had a C: N ratio of 17 (Mieldazys *et al*., 2019). The values observed in the present study were higher than the values mentioned in the above reports. A wide C: N ratio in the current study could be due to the addition of high amount of coir pith. Coir pith has a wide C: N ratio of 100:1 (Prabhu and Thomas, 2002). The composting of raw coir pith with cattle manure and poultry waste could reduce the C: N ratio to 31.3 (Muthurayar and Dhanarajan, 2013). Physico-chemical properties of different organic briquettes are depicted in Table 2.

The present study sheds light on the process of preparing convenient and easy to handle organic briquettes using rumen contents and blood available from slaughter houses by mixing the blend with coir pith and compacting the mixture to prepare the briquettes. Treatment 10 had the best desirable properties for use as an organic nutrient source as it showed the highest total nitrogen and lowest carbon: nitrogen ratio. This study illustrates the possibilities for development of organic briquettes from abattoir wastes as a feasible eco-friendly process with the additional advantage of minimising the adverse environmental impact of slaughter house waste materials.

Conclusion

The present study highlights the possibilities of using organic briquettes as an effective means for nutrient supply in pot cultures for terrace gardening of vegetables. The importance of developing briquettes from slaughterhouse wastes is underscored by the fact that, the two waste materials of rumen contents and blood contribute greatest towards the environmental impact of service slaughterhouses and the consequent public dissent in Kerala. Large volume, cost effective equipment like solar driers could be utilised for pre-processing of rumen contents and blood. In smaller slaughterhouses, the dried rumen content could be directly used to receive blood from the bleeding animal in prescribed proportions, which would eliminate the problem of run off of blood into the drainage and to the outside of the slaughterhouse. The development of organic briquettes is a viable option in the present situation in Kerala where there is a dearth of practical ways and means for waste disposal and organic agriculture in Kerala.

Conflict of interest

The authors declare that they have no conflict of interest.

References

Abad, M., Noguera, P., Puchades, R., Maquieira, A. and Noguera, V. 2002. Physico-chemical and chemical properties of some coconut coir dust for use as a peat substitute for containerised ornamental plants. *Bioresour.Technol*. **82:**241-245.

Dubey, K., Upadhyay, V.K. and Pandey, A. 2010. Briquetting of biomass. *Everyman's Sci*.**10**: 223-226.

FCO [Fertilizer Control Order]. 1985. *Specifications of biofertilizers*. (1st Ed.). Ministry of Agriculture and Rural Development, Government of India, New Delhi, 91p.

Font-Palma, C. 2019. Methods for the treatment of cattle manure-a review. *J. Carbon Res*. **5**: 27-38.

Irshad, A., Sureshkumar, S., Shukoor, S.A. and Sutha, M. 2015. Slaughter house by-product utilization for sustainable meat industry-a review. *Int. J. Dev. Res*. **5**: 4725-4734.

Jeyaseeli, D.M. and Raj, S.P. 2010. Chemical characteristics of coir pith as a function of its particle size to be used as soilless medium. *Ecoscan*, **4**: 163-169.

Khater, E.S.G. 2015. Some physical and chemical properties of compost. *Int. J. Waste Resour*. **5**: 1-5.

Kirk, P.L. 1950. Kjeldahl method for total nitrogen. *Anal. Chem*. **22**: 354-358.

Mieldazys, R., Jotautienė, E., Jasinskas, A., Pekarskas, J. and Zinkeviciene, R. 2019. Investigation of physical-mechanical properties and impact on soil of granulated manure compost fertilizers. *J. Environ.Engng.Landsc. Mgmt*. **27**: 153-162.

Muthurayar, T. and Dhanarajan, M.S. 2013. Biochemical changes during composting of coir pith waste as influenced by different agro industrial wastes. *Agric. Sci*. **4**: 28-30.

Nunes, W.A.G., Menezes, J.F.S., de Melo Benites, V., de Lima Junior, S.A. and dos Santos Oliveira, A. 2014. Use of organic compost produced from slaughterhouse waste as fertilizer in soybean and corn crops. *Sci. Agric*. **72**: 343-350.

Prabhu, S.R. and Thomas, G.V. 2002. Biological conversion of coir pith into a value-added organic resource and its application in Agri-Horticulture: Current status, prospects and perspective. *J. Plant. Crops*, **30**(1):1-17.

Roy, M., Karmakar, S., Debsarcar, A., Sen, P.K. and Mukherjee, J. 2013. Application of rural slaughterhouse waste as an organic fertilizer for pot cultivation of solanaceous vegetables in India. *Int. J. RecyclingOrg. Waste Agric*. **2**: 6-23.

Roy, M., Das, R., Debsarcar, A., Sen, P.K. and Mukherjee, J. 2015. Conversion of rural abattoir wastes to an organic fertilizer and its application in the field cultivation of tomato in India. *Renew. Agric. Food Syst*.**31**: 350-360.

Salminen, E. and Rintala, J. 2002. Anaerobic digestion of organic solid poultry slaughterhouse waste–a review. *Bioresour.Technol*. **83**: 13-26.

Snedecor, G.W. and Cochran, W.G. 1994. *Statistical methods.* (8th Ed.). Iowa state University Press, Ames, Iowa, USA. 539p.

Tripetchkul, S., Pundee, K., Koonsrisuk, S. and Akeprathumchai, S. 2012. Co-composting of coir pith and cow manure: initial C/N ratio vs physico-chemical changes. *Int. J. Recycling Org. Waste Agric*. **1**: 15-23.

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