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# A Lost View of Sustainability in Agriculture: Revealed Through Vermicomposting Thermodynamics.

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**Abstract:**
Global warming, land degradation, nutrient loading are the issues emerged out of ignorance of humans towards the environment. This ignorance starts locally to globally. One of such issues of lost public awareness in agriculture has been converted. The nutrients can be cycled in agriculture in a directional way starting from plant litter ending at vermicast which is again in turn absorbed back by the plants. Burning involves fuel and oxidant hence the fuel here is a compound with higher potential energy. The potential energy of burning of compounds plant litre, cow dung, biogas plant effluent, vermicast has been calculated in the research work. And has been found highest to be in cow-dung compared to others. Ambiguity regarding presence of large molecular size compounds in humic acid has been partially ruled out.
**Keywords:** Vermicast, humic acid, biogas plant effluent.

**Abstract:**
Food quality, environmental safety and soil conservation have led to a substantial increase in the use of sustainable agricultural practices during recent years (Lazcano C and Dominguez J. 2011). Because of increasing population, rapid industrialization and trend of urbanization, problem of man-made waste products is increasing (Bharadwaj A. 2010, Hemlatha B. 2012, Amaravathi G., and Reddy M. R., 2015). Agricultural by-products are one of the part of the problems which are, manmade wastes in the environment, created to feed the increasing human population which includes use of chemical pesticides and fertilizers (Jamdar S. V. et. al.2016). Chemical fertilizers have their deleterious effect on the soil environment (Chaudhary D. R. et al. 2004, Stinner, 2007).This has consequently affected soil health and leads to bioaccumulation of heavy metals in human body.

In developing countries like India most population lives in rural areas and agriculture plays an important role in Nation's economy (Patil J. H. et al. 2012). Thus need of time is to develop farming technique that will be organic in origin and will lead to sustainability of humans as well as environment. Since 1990 demand of organic food in market is increasing every day (Willer et al. 2013). Vermicompost is a potential source of good quality organic manure its availability affects success of sustainable agriculture (Sailaja Kumari M. S. and Ushakumari K. 2002). Several studies established the viability of using earthworms as a treatment technique for numerous waste streams both physically and biochemically (Ndegwa P. M. et. al. 2000). Earthworms are called "farmer's friends" or "nature's plow-man" popularly (Esakkiammal B. et al. 2015). For vermicomposting to happen different raw materials like cow dung, water hyacinth, biogas plant-effluent can be used (Balasubramanian P. R. 1995). The amount of potential energy content of agricultural products has been pointed out in the present study.

**Material method:**
In the present study two raw materials, cow dung and biogas plant-effluent have been used and cross checked for their ash content along with plant litre. The contents 5 grams each of plant litre, cow dung, biogas plant effluent, vermicast were burned in a muffle furnace. All the by-products were collected from the same place at Kanjara Tq. Aundha Nagnath Dist. Hingoli. The plant liter belonged to plant *Cicer aritinum*. Anti-nutritional factors like Phytic acid in plant *Cicer aritinum* (Soetan K. O. and Oyewole O. E. 2009) reduce its digestibility reducing its food conversion ratio. Thus leads to a greater amount of cow dung. Animal dung is often used as a fuel in many house-holds of various countries of the world (Vankar A et. al. 2010). While collecting Vermicast efforts were made that no humic acid was let go out of the casting frame. As the organic compounds are defined as the carbon compounds which burn with sooty flame, the unburnt part implied the inorganic part content with almost zero potential energy using the formula:

Flammable matter= (amount taken- unburnt part)

Various observations were made keeping in view of potential energy of agricultural system as shown in diagram 1:

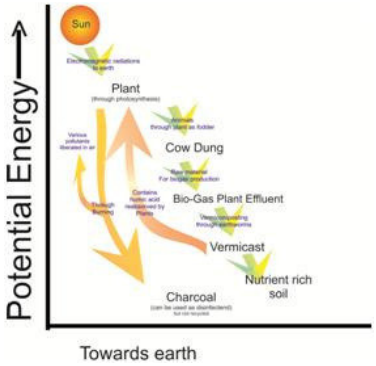


**Diagram 1**: Potential energy versus towards earth diagrammatic graph showing ways of recycling of agriculture by-products.

**Result:**

| No | Amount Taken | Unburnt part | Flammable matter= (amount taken- unburnt part) |
|---|---|---|---|
| 1. Cow dung | 5gm | 2.23 gm | 2.77 gm |
| 2. Vermicompost | 5gm | 3.37 gm | 1.63 gm |
| 3. Plant lit | 5gm | 2.45 gm | 2.55 gm |
| 4. Biogas slurry | 5gm | 2.30 gm | 2.70 gm |

**Table 1**: showing the type of agriculture by-products

The results during the research have been tabulated in table 1, showing highest amount of flammable matter present in cow dung and least in vermicompost. As no humic acids were let go out of Vermicasting nets vermicompost showed very good flammability although least of all implied presence of organic compounds of higher molecular weight with greater potential energy than mere charcoal. This result of our study has unrevealed the argument of Lehmann J. and Kleber M. 2015 which states: absence of large molecular size compounds in humic substances.

**Conclusion:**

Agriculture practices of famers to burn the plant litter and getting soil nutritional though artificial fertilisers which have already proven to be insufficient cover cost of production in cotton crops (Yilmaz I. el al. 2005). The insecticide spread are also causing various health hazards. Thus leading to global warming, land degradation, nutrient loading and pesticide pollution (Edral G. et al. 2007). In the present study different methods that can be employed by farmers in agriculture have been discussed with potential energy point of view. Farmers although have many alternative to go with which include use of plant litter as fodder, followed by use of cow dung as a raw material for biogas production. The biogas slurry can then be used as raw material to be consumed by earthworms as food in an artificial environment. The vermicast formed at the end is an ideal source of nutrients for the agricultural practices. Thus will lead to sustainable agriculture letting geological cycle unaltered. Literacy of farmers in the same context will lead to be a cause of reduction of Farmer's suicide in the region.

**References:**

Lazcano C. and Dominguez J. (2011): The use of Vermicomposting in sustainable agriculture: Impact on Plant Growth and Soil Fertility. In: Soil Nutrients. Nova Publishers. Inc.

Bharadwaj A. (2010): Management of Kitchen Waste Material through Vermicomposting. Asian J. Exp. Biol. Sci., Vol 1(1): 175-177.

Hemalatha B. (2012): Vermicomposting of fruit waste and industrial sludge. International Journal of Advanced Engineering Technology. 3(2):60-63.

Amaravathi G., Reddy Mallikarjuna R. (2015): Environmental factors affecting vermicomposting of Municipal Solid Waste. International Journal of Pharmacy and Biological Sciences. 5(3) 81-93.

Jamdar S. V., Kalyankar V. B., Rathod K. S., Deshmukh K. D. (2016): Comparatice effect of vermicast of species *Eisenia fetida* on plant *Prunus dulcis* over inorganic diet. Journal of Basic Sciences 4(1): 1-5.

Chaudhary D. R., Bhandari S. C., Shukla L. M. (2004): Role of vermicompost in sustainable agriculture- a review. Agric. Rev., 25(1): 29-39.

Stinner D. H. (2007): The scientific organic farming. In William Lockeretz Organic Farming: An International History. Oxfordshire, UK &

Cambridge, Massachusetts: CAB International. ISBN 978-1-84593-269-3.

Patil J. H., Sanil P. H., Malini B. M., Manoj V., Deepika D., Chaitra D.(2012) Vermocomposting of water hyacinth with poultry litter using rotary drum reactor. Journal of chemical and pharmaceutical Resarch, 4(5): 2585-2589.

Willer H, Lernourd J. and Home R. (2013): The world of organic agriculture: statistics and emerging trends. Research Institute of organic agriculture and the international federation of organic agriculture movements.

Sailaja Kumari M. S. and Ushakumari K. (2002): Effect of vermicompost enriched with rock phosphate on the yield and uptake of nutrients in cowpea. Journal of Tropical Agriculture 40: 27-30.

Ndegwa P. M., Thompson S. A., Das K. C. (2000): Effects of stocking density and feeding rate on vermicomposting of biosolids. Bioresource Technology (71) 5-12.

Esakkiammal B., Esaivani C., Vasanthi K., LakshmiBai L., Shanthi Preya N.(2015): Microbial diversity of Vermicompost and Veriwash prepared from *Eudrilus euginae*. International Journal of Current Microbiology and Applied Sciences. 4(9): 873-883.

Balasubramanian P. R. (1995): Recycling of cattle dung, biogas plant-effluent and water hyacinth in vermicluture. Bioresource Technology. 52(1) 85-87.

Soetan K. O. and Oyewole O. E. (2009): The need for adequate processing to reduce the anti-nutritional factors in plants used as human foods and animal feeds: A review. African Journal of Food Science Vol. 3 (9) 223-232.

Vankat A., Krepl V., Kara J. (2010): Animal dung as a source of energy in remote areas of Indian Himalayas. Agricultura Tropica ET Subtropica. 42(2): 140-142.

Lehmann J. and Kleber M. (2015): The contentious nature of soil organic matter. Nature 2015.

Yilmaz I., Akcaoz H., Ozkan B. (2005): An analysis of energy use and input costs for cotton production in Turkey. Science Direct. 30(2).

Erdal G., Esengun K., Erdal H., Gunduz O. (2007): Energy use and economical analysis of sugar beet production in Tokar province of Turkey. 32(1): 35-41.

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