STUDIES OF LIVESTOCK WASTE MANGEMENT

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Abstract: Livestock sector plays an important role in the welfare of India's rural population. Livestock sector includes animal husbandry, dairy and fisheries. According to 19th livestock Census the share of different livestock were, 37.28 percent cattle, 21.23 buffaloes, 12.71 sheep, 26.40 goats and 2.01 percent pigs respectively. The overall contribution of livestock sector in total GDP is nearly 4.11 percent at current prices during 2012-13. The use of animal manure and other organic-based waste products as bio-energy for waste-to-bio-energy conversion processes would allow farmers to take advantage of new markets for traditional waste products. Composting is a naturally occurring process in which bacteria, fungi, and other microorganisms convert organic material into a stabilized product known as compost. Vermicomposting is a simple biotechnological process of composting in which certain species of earthworms are used to enhance waste conversion and to enhance a better end product. The production of methane occurs from livestock waste under anaerobic condition through biodegradation of organic materials The algae cultivation has several benefits i.e. rapid generation rates with biomass harvesting up to 50 metric tons /acre/ year/. The carbon dioxide is a major component in the product gases from anaerobic digestion and thermo chemical conversion processes from livestock waste which can be used for production of algal biomass. Cow urine and dung are the ingredients of "Panchagawya" capable of treating diseases.

Keywords- Algae, Composting, Carbon dioxide, Livestock Waste, Manure, Methane Production, Organic, Urine, Vermicomposting, Waste-to-bio energy .

Introduction: Livestock sector plays an important role in the welfare of India's rural population. Livestock sector includes animal husbandry, dairy and fisheries. It plays an important role in the socioeconomic development of the country (Kumbhar, 2011).

According to 19th livestock Census the share of different livestock were, 37.28 percent cattle, 21.23 buffaloes, 12.71 sheep, 26.40 goats and 2.01 percent pigs respectively. The livestock sector alone contributes nearly 25.6 percent of value of output in agriculture, fishing & Forestry sector. The overall contribution of livestock sector in total GDP is nearly 4.11 percent at current prices during 2012-13 (19th Livestock Census-2012). The total livestock population consisting of cattle, buffalo, sheep, goat, pig, horses, & yak in the country is 512.05 million (2012). During the last decade, the livestock keeping practices were changed from mixed farming system to specialized dairy farming with zero grazing under confinement. The system of livestock keeping is termed as confined animal feeding operations (CAFOs) which are specialized and intensive livestock farming. These trends of livestock keeping adapted to improve profitability. (Sunil and Mathews, 2015)

Livestock waste is major source of green house gasses, pollution, pathogens and odour. Forty percent of global methane is produced by agriculture and livestock by-products followed by 18% from waste disposal globally. In India, livestock wastes are managed generally in three ways .The waste excreted by livestock are removed by dumping into heaps nearby the cattle sheds. The heaps get converted into manure, which are spread subsequently in the fields as an organic manure. Much of the livestock waste is utilized for energy purpose in village level where waste are made into small cakes and dried and later used as fuel for cooking purposes.

Another method of livestock waste management is the establishment of bio-gas plant where waste is used for the production of methane gas under anaerobic (lack of oxygen) conditions. The methane gas is used for cooking purposes, and the slurry after methane extraction is used as farm manure (Gautam, 2006).

Importance of Livestock Waste Manure & Management: With the massive consolidation of confined animal feeding operations (CAFOs) over the past decades, there is need for new state of the art waste management systems that make animal operations economically viable and environmental benign. (Mc Nab *et al.*, 2007).

The use of animal manure and other organic-based waste products as bioenergy for waste-to-bioenergy conversion processes would allow farmers to take advantage of new markets for traditional waste products. In effect, livestock waste-to-bioenergy treatments have the potential to convert the treatment of livestock waste from liability or cost component into profit center. (Perlack *et al.*, 2005)

The manure from 200 dairy milking cows produces as much nitrogen as in the sewage from a community

of 5,000-10,000 people, or that the annual litter from a typical broiler house of 22,000 birds contains as much as phosphorus. Manure management is as old as human history and as new as the latest adaptation of time-bound practice.

Manure management encompasses manure collection, Storage, transport and land application. The goal of manure management must be to maximize the soil amending value of manure and minimize the potential for environmental degradation. Manure is a dynamic organic material, continually undergoing biological and chemical changes. The value of manure as a fertilizer depends on the quantity and form of nutrients present when it is applied to land. Application of manure to the land at the proper time using proper management techniques and proper amounts-recycles the nutrients through the soil profile, reducing the expense of commercial(inorganic) fertilizers as well as the need to add organic matter. Proper manure management improves water quality by preventing pollutants such as nutrients, organic, and pathogens from migrating to surface and ground waters.

Methods of Disposal & Animal Waste Management:

Composting : Composting is a naturally occurring process in which bacteria, fungi, and other microorganisms convert organic material into a stabilized product known as compost. Within the compost, anaerobic microorganisms work to degrade it, releasing fluids and odorous gases such as hydrogen sulfide and ammonia. These diffuse into surrounding bulking agent. In this bulking agent, aerobic microorganisms degrade these materials to odour-free carbon dioxide (CO_2) and water (H_2O).The Aerobic process produces considerable heat, causing the temperature of the compost pile to rise. The active bacteria in both the aerobic and anaerobic zones are heat tolerant. (Sunil and Mathews, 2015.)

Composting is often proposed as a method of stabilizing manure, and is technologically feasible. However, freshly collected manures are usually too wet to compost well, so either they must be partially dried first or a dry filler material added. Additionally, the carbon: nitrogen ratio of fresh manure is only 8:1 to 12:1; this is too low in carbonaceous matter to compost well.(Good composting requires an initial C:N ratio of 20 or 30:1). Thus when composting of pure manure is attempted there is either excessive loss of nitrogen or incomplete stabilization (Black, Eng, 1967).

Vermicomposting: Vermicomposting is a simple biotechnological process of composting in which certain species of earthworms *(Eisenia fetida, Eisenia Andrei, Eudrilus eugeniae Dendrobaenavene*. *Per onyx excavates)* are used to enhance waste conversion and to enhance a better end product. Vermicomposting involves bio-oxidation and stabilization of organic materials by the joint action of earthworm and microorganisms and (Dominguez and Edwards, 2010).

The earthworm eat the organic matter and excrete little pelleted material called "Vermicompost" During vermicomposting, the important plant nutrients, such as N, P, K, and Ca, Present in the organic waste are released and converted into forms that are more soluble and available to the plants. Vermicompost also contains biologically active substances such as plant growth regulators. (Sorathiya *et al.*, 2014)

Methane Technology: In this method, production of methane occurs from livestock waste under anaerobic condition through biodegradation of organic materials (used in biogas technology). Biogas plants helps in total recycling of organic wastes in an environment-friendly manner. This is the best alternate source of energy from organic waste. It is used as fuel for cooking and lighting purposes. The methane potential in manure assessed on the basis of the content of volatile solids in the manure and empirical standards for the production of methane per kg of volatile solids. The methane potential has been estimated to be 0.21m^3CH_4/kg of volatile solids in cattle manure. (Nasir *et al* 2012)

Gas production from anaerobic biomass digestion is a famous technology. Billions of biogas units have been already established throughout the world. India and China are the two leading countries using biogas technology. In rural areas biogas is used as a clean efficient and renewable source of energy, which can be used as substitute for the other non-renewable fuels in order to save energy. Pure biogas stored in cylinders is a marketable product hence, can be easily used any time anywhere as LPG cylinders. The compressed natural gas (CNG) technology has become easily available and therefore, bio-methane (or enriched biogas) which is similar to CNG can be used for all applications for which CNG is being used (Vijay *et al*., 2011).

Integration of waste treatment with algal cultivation. : The carbon dioxide is a major component in the product gases from anaerobic digestion (Vijay 2011) and thermo chemical conversion processes from livestock waste (Cantrell *et al* 2008) which can be used for production of algal biomass. Algae can utilize carbon dioxide ten times more efficiently than terrestrial plants and can generate algal biomass and intracellular oil (Miao 2006). The algae cultivation has several benefits i.e. rapid generation rates with biomass harvesting up to 50 metric tons acre/ year/ (Demirbas, 2001) The accumulation of large amounts of fatty acids

hydrocarbons; as well as the ability to play a role in waste treatment. (Cantrell *et al*., 2008).

Utilization of Cow Urine: Cow urine is basically an excellent germicide and a potent antibiotic. Distillate cow's urine is an activity enhancer and availability facilitator for bio active molecules (Mohanty *et al.,* 2014). Cow urine is one of the ingredients of "Panchagawya" capable of treating diseases and has been used extensively in ayurvedic preparations. (Pathak *et al*., 2003).

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