An scope for better utilisation of poultry droppings, by converting it into cattle feed and methane

By
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a) At present poultry farmers collect poultry droppings, dump them in the yard and dispose off to agricultural grower, as farm yard manure, at very nominal rates.

b) They do not know that they are throwing away lot of their money thereby. They could save this money if they knew more about it. The poultry owners can easily become wise, earn extra money out of this poultry excreta and still more; this presumably useless stuff can help to increase the egg and meat production by 10-20%. The size of eggs and chickens will improve if light is provided in the sheds at the night time. Light will come from bio-gas. Gas will come form poultry excreta.

c) Poultry farmers have no idea that they can produce bio-gas from chicken droppings and yet have solid residue behind, which will be rich fertiliser. It will return three time as much money as chicken droppings fetch and bio-gas will be free or an extra bonus.

d) This residue after digestion by anaerobic process can be used as a very rich feed for cows, buffaloes, goats and sheep with or without further treatment. It is the richest feed that animals can get.

e) This effluent residue can also be recycled in poultry feed.

f) While poultry droppings are thrown in a dump, it is attacked by aerobic bacteria which converts cellulose, fats, lipids, and etc., present in the droppings to various type useless gases which besides bad odours also escape to the atmosphere.

g) This way the total weight of dropping is reduced. In other words even if the oven dried droppings are thrown in the dump, they will reduce in weight to about 50% in three months.

h) Due to aerobic bacterial attack, nitrogen rich droppings lose their nitrogen value considerably by production of ammonia, which escapes to atmosphere.

i) By digestion of droppings in a bio-gas plant the nutrient quality of the residue is improved and it becomes richer in nitrogen, phosphates and potash.

j) Each 50 kg bag of dry material from digested effluent will be worth Rs.50.00 in term of nitrogen, phosphates and potash, assuming the present rates of fertilisers.

k) These fertilisers become chelated and crops give much higher response to them than ordinary manure and fertilisers.

l) As animal rich feed, the residue has value of more than Rs.3.00 per kg, three times its value as fertiliser.

How to do it.

It can be done by anaerobic fermentation of poultry excreta and other poultry wastes, which produce:

i) Bio-gas or 60% methane gas which is similar to bio-gas.

ii) Effluent which is separated into solids and liquids.

iii) Liquid contains some ammonia and it could be applied directly to any agriculture crops.

iv) Solids contain protein, which can vary from 37.5 to 60% protein and balanced would be lipids or fats, cellulose and hemicellulose which are carbohydrates, vitamins, minerals and trace elements.

How does this process work?

It is done in a digester called bio-gas plant which functions as stated here under:-

1) I installed the first such plant in 1960-1961 at Tandojam and experimented on it for many years as reported in Pakistan Agriculture for the month of September 1983. This plant utilised not only cow and animal dung but also a number of waste materials like poultry droppings, saw-wood, banana trunks, cotton stalks, kitchen wastes, corn stalks, burseem, lursene, paper, card-board and a number of other wastes. Further work on bio-gas has been done in past 3 years by me on a laboratory scale, pilot plant level commercial size digesters.

2) The methane gas requirement per person per day for kitchen purposes in an urban area is approximately 15 cubic feet or approximately 0.43 cubic meter, but bio-gas contain approximately 60% methane and 40% Co and therefore 25 cubic feet or 0.715 cubic meter per person per dy is the requirement. However, due to simpler rural living the bio-gas consumption in rural areas would be approximately 15 cubic feet per person per day.

3) A gas lamp would need approximately 2.5 cubic feet of gas per hour or approximately 0.07 cubic meter in six hours.

4) A diesel or gas engine requires approximately 16 cubic feet of gas or about 0.45 cubic meter per H.P. per hour. If a 15 H.P. engine is run for five hours at 100% load, gas requirement would be about 1200 cubic feet or about 34.4 cubic meters. A 15 H.P. engine is usually coupled to 10 KW electric generator.

5) The gas production on the average is 5-6 cubic feet per kilogram of chicken droppings. This quantity of gas could be increased and even doubled in our special designs, but those designs will apply to units having capacity of 1000 cubic feet of gas per day or more.

6) If for some reason the consumer wants gas, rich in methane and wants to eliminate carbon dio-oxide altogether, this could also be handled, although this may not be necessary most of the time.

7) In our specially designed digester one can use poultry wastes mixed with cellulose rich material like straw and rice husk, thereby producing more gas per Kg of material digested. It can be 8-10 cubic feet of gas per Kg of volatile matter.

8) Bio-gas could be utilised for heaters, irons, hot water tanks, diesel engines, boilers etc. Bio-gas can also run electric generators and power thus produced can be used to run electric fans, electric irons, radios, televisions, cassette players, electric bulb, tube-lights etc.

9) Lighting of poultry houses increases size of eggs, total annual egg production and also meat production. The gains thereby will be 10-20% in financial terms.

10) A bio-gas digester once in operation has four layers of material from top to bottom as given below:

    (a) Scum.
    (b) Supernant.
    (c) Slurry.
    (d) Bottom layer containing non-soluble materials.

    A supernatant zone is stomach of the plant where formation r digestion takes place. Slurry is mixture of farm yard manure and water. Scum is light material that floats on the top and sometime solidifies, stopping gas production. The bottom contains solid materials which accumulate gradually and in time choke the digester. Our special designs have over-come all these difficulties, by breaking scum periodically and mixing it with other influence materials without interrupting gas production.

11) The above is in brief the principle of construction of gas digester but detail-wise a number of engineering factors are involved, namely:-

    (a) Ratio of cross-section to be depth.

(b) Height and size of inlet and out-let pipes vis-à-vis the digester size.

(c) Height of the partition wall and arrangements to stop materials from sticking to each other.

(d) Design of the bottom to remove the insoluble heavy material collecting at the bottom.

(e) The depth of gas holder vis-à-vis its dimension.

(f) Provision of outlets to remove water or water trap, anti-explosion safety devices or flame arresters, pressure control system etc.

12) The solids in the digested material coming out from digester will have 50 to 100% more nitrogen and phosphate contents than the undigested solid manure in the input. This material could be used as fertiliser and is much superior to ordinary manure, which takes many months to ferment and release nitrogen and phosphates to the crops. In case of direct use of dropping as farm yard manure, organic matter is aerobically digested. In this process organic material is destroyed, nitrogen leaches down and some nitrogen is converted to ammonia and escapes to air. Some nitrogen also remains fixed in proteins. Thus less than 50% and some times quite small quantities of nitrogen becomes available to the plants and the rest is lost.

13) It is possible to use the material coming out from digester as cattle feed, after some minor treatment.

14) Some of our designs are modulars i.e., in case we begin with a 500 cubic feet gas out put per day, it could be easily raised to 1000, 2000, 3000, 4000 cubic feet and so on, by adding modules.

15) Once poultry manure is introduced in a plant is will take about 30 days to produce the gas. We have reduced this period by inoculation to about one week at the most.

16) We have put in a number of commercial size plants of these types in Sindh and they are giving satisfactory service.

17) After installation of the plant, monitoring is to be done for one year for its satisfactory performance. The whole process of fermentation is very tricky, for example the following may happens:-

(a) If pH falls below 6.6 no gas is formed.

(b) If pH is too high fresh manure needs to be added.

(c) If temperature falls at 15°C and blow gas production falls less than 50% as compared to that of 43°C.

(d) Above 43°C gas production drops and it again catches up between 50-58°C.

(e) If air leaks into gas holding drum, explosive mixture is formed and when gas is fired in kitchen, flame travels to gas holder, causing explosion, which will certainly blast up a portion of digester.

(f) If manure to water ratio falls or increases above or below the optimum in the input materials, in both cases gas production is affected. Only monitoring can over this difficulty.

18) I have developed and improved this technology myself with help of my office staff. We are in touch with specialists abroad, and have seen no failure at all. Some of my designs are unique in a way as no such designs exist else where in the world.

19) The cost of bio-gas plant will vary from place to place according to conditions of soil or rock formations, water table, cost of transport of materials etc.

20) The indicative prices of bio-gas plants of various sizes for Karachi should fall more or less within the following range:

Capacity in (cubic feet)	**For cooling needs of how many persons**	**Estimated cost in (Rs.)**
200	12	15,000
400	25	24,000
800	50	37,500
1600	100	56,000
2000	125	68,500