Zero Waste Management Under Integrated Biogas And Farming Technique

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Abstract - Integrated biogas and farming technique have a significant role to play in the development of agro ecological farming system. These system provide a valuable product slate from existing biowaste resources. The product slate will includes biogas, high protein algal animal feed, rich water for aquaculture and liquid fertilizer for aquaponics, hydroponics and field irrigation. It is the profit making process where the waste of each process becomes the feedstock for another process.

KEYWORDS - Biogas digester, Azolla, Fish farming, Hydroponics, Aquaponics, Foddercrop.

I. GENERAL

Integrated Biogas and Algal System. The use of biogas digesters anaerobic fermentation is well understood method for treating biowaste.There are over 15 million operational biogas digesters in the world as at 2005 . China has over 11million residential biogas systems installed – with over a million now being installed each year. The addition of algal pond technology to oxidise the waste water effluent from biogas digesters was developed in the 1970s, piloted successfully by the UNDP in the 1980s and subsequentlyimplemented in a number of countries including South Africa where a number of DWAF sponsoredWRC Studies have demonstrated its effectiveness for the processing of municipal waste water andother industrial bio-waste streams.

Harvesting Chlorella Micro Algae from an Integrated Biogas / Algal Pond System Integrated biogas systems are essentially zero waste systems that make optimal use of nature, in the form of plants, animals, bacteria, fungi and algae, to produce biodiverse-food, energy and nutrients in a synergistic integrated cycle of profit making processes where the waste of each process becomes the feedstock for another process.

A Simple Integrated Biogas System above indicates how the abundance of 'kraal' biowaste generated by small scale farmers and traditional rural households can effectively be processed into a number of useful commercial products. Worldwatch Institute, 2005 Golueke and Oswald, An algal Regenerative System for Single Family Farms and Villages, C.G. Golueke and W.J.Oswald, Compost Science 1973 Montfort Boys Town integrated biogas/algal pond, Fiji, a United Nations UNESCO UNU/IAS & ZERI project.China, Fiji, Mauritius, Brazil and Columbia under the guidance of Professor George Chan. In a fully integrated biogas/algal zero waste system, the energy rich biogas produced represents only about 15% of the economic potential of the system which produces a diverse product slate of high protein animal feed, zoo-plankton feed for aquaculture, fin fish and fresh water crayfish, liquid fertilizer, soil conditioning and pathogen free recycled water. A detailed life cycle assessment of this system reveals how zero waste agriculture can contributegreatly to mitigating climate change through the elimination of fossil fuel and N2O green housegasemission associated with conventional agricultural .

II. OBJECTIVE

- To produce the Biodiversefood,energy and Nutrients.
- To optimize the use of natural resources.
- The main objective is to make the profit where the waste of each process because the feedstock for another process.

III. METHODOLOGY

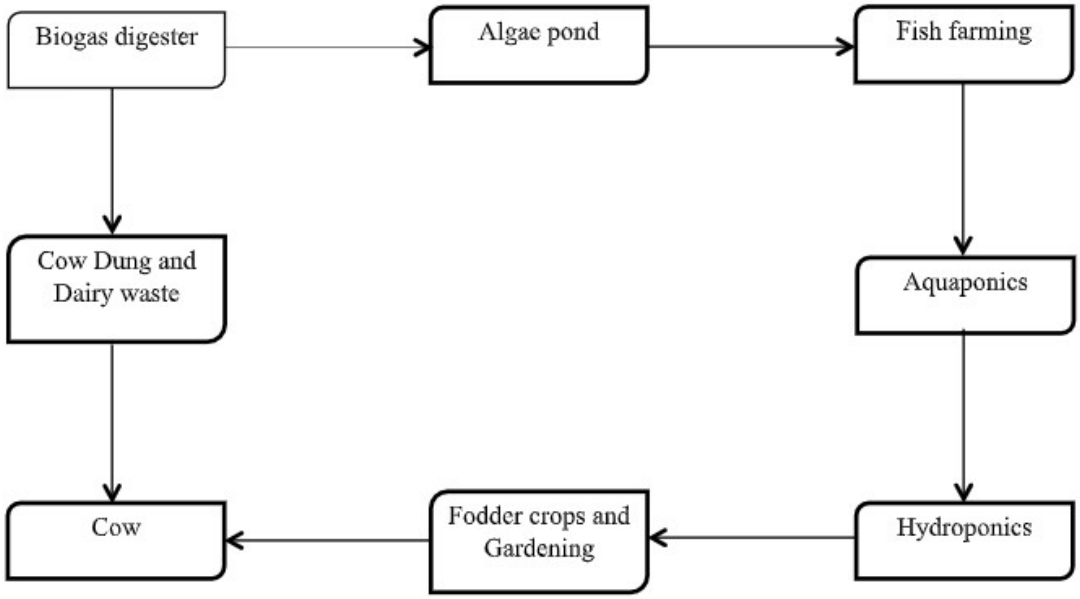
WORKING PRINCIPLE OF BIOGAS PLANT

Technology of organic materials conversion is made by means of biochemical decomposition (hydrolysis) of high-molecular compounds into low-molecular organic compounds (organic acids, salts, and alcohols).

$$\text{Organic compounds} + H_2O \rightarrow C_5H_7NO_2 + HCO_3$$

Further conversion of obtained dissolved compounds like organic acids and alcohols (C5H7NO2, HCO3) into gases – CH4, CO2. C5H7NO2 + HCO3 + H2O → CH4+CO2+NH4.Biological process of consecutive (phasic) conversion of organic compounds take place in anaerobic environment in oxygen-free tank (biological reactor). At the first stage of fermentation substrate hydrolysis take place under acidogenic bacteria influence. At the second stage elementary organic compounds come through hydrolysis oxidation by means of heteroacidogenic bacteria with production of acetate, carbon dioxide and free hydrogen.

FLOWCHART



The other part of organic compound including acetate forms C1 compounds.Produced substances are the feed tock for methanogenic bacteria of third type. This stage flows in two processes of A and B type the character which depends on caused by different bacteria type. These two types of bacteria convert the compound obtained during the first and second stages into methane CH_4, water H_2O and carbon dioxide CO_2.

MAINTENANCE OF ALGAE POND

The resultant biogas effluent (digestate) requires aerobic treatment before it can be released into aquifer.The use of integrated high rate algal ponds (HRAPs) has been demonstrated as a highly effective oxygenation of nutrient rich waters as algal photosynthesis yields large quantities of oxygen to support bacterial breakdown of the organic components whilst converting organic wastes and excess nutrients into protein rich algal biomass, using only on solar energy and, following algalharvesting, producing a high quality effluent. Algal photosynthesis in the HRAP will raise the pH of the treated waters to levels of 9.5 to 10 during the day which will effectively eliminate E.coli and most pathogenic bacteria and viruses. High Rate Algal Ponds (HRAPs) for the production of Commercial Algae

OPERATIONS OF AQUAPONICS

Aquaponics refers to any system that combines conventional aquaculture (raising aquatic animals such as snails, fish, crayfish or prawns in tanks) with hydroponics (cultivating plants in water) in a symbiotic environment. In normal aquaculture, excretions from the animals being raised can accumulate in the water, increasing toxicity. In an aquaponic system, water from an aquaculture system is fed to a hydroponic system where the by-products are broken down by nitrifying bacteria initially into nitrites and subsequently into nitrates that are utilized by the plants as nutrients. Then, the water is recirculated back to the aquaculture system. As existing hydroponic and aquaculture farming techniques form the basis for all aquaponic systems, the size, complexity, and types of foods grown in an aquaponic system can vary as much as any system found in either distinct farming discipline.

OPERATIONS OF HYDROPONICS

Hydroponics is the soil-less cultivation of plants in either of two ways. The term "hydroponic gardening" can refer to growing plants, usually vegetables, in a simple solution of water and nutrients. The term "hydroponics" also is used to refer to the cultivation of plants in an inert substrate or aggregate, such as perlite, vermiculite, sand or rock wool. In that type of hydroponic cultivation, plants receive nutrients from a solution that passes over their roots at regular intervals.

MATERIALS REQUIRED AND THEIR PROPERTIES

BARREL

A barrel or cask is a hollow cylindrical container with a bulging center, longer than it is wide. They are traditionally made of wooden staves and bound by wood or metal hoops Someone who makes barrels is called a "barrel maker" or cooper. Barrels are only one product of cooperage. Coopers also make buckets, vats, tubs, butter churns, hogsheads, firkins, kegs, kilderkins, tierces, rundlets, puncheons, pipes, tuns, butts, pins, troughs and breakers.

PVC PIPE

Polyvinyl chloride (PVC) pipe is made from a plastic and vinyl combination material. The pipes are durable, hard to damage, and long lasting. They do not rust, rot, or wear over time. For that reason, PVC piping is most commonly used in water systems, underground wiring, and sewer lines.

PVC was first developed in 1925 when a BF Goodrich employee, Dr. Waldo Semon, attempted to invent a method for bonding metal and rubber. After blending materials together to create a strong and flexible material, Semon discovered PVC. Nonetheless, the product remained virtually useless for another decade. In the late 1930s, it was found to have great shock absorbing abilities. This discovery led to the creation of long lasting PVC tire treads.

The smooth surface of pipe is also resistant to bacterial contamination, such as *E. coli*. Therefore, many water companies rely on PVC pipes in their systems in order to keep them free of contamination. For most uses, this type of piping is considered very safe. There have been some reported cases of the pipe shattering when used to transport high-pressured gases, however, and it is not recommended for this use in most circumstances. Studies also showed that PVC pipe produced before the mid-1970s could leach chemicals into the fluids flowing through them, but changes in manufacturing methods have reduced this risk significantly.

GATE VALVE

A gate valve, also known as a sluice valve, is a valve that opens by lifting a barrier (gate) out of the path of the fluid. Gate valves require very little space along the pipe axis and hardly restrict the flow of fluid when the gate is fully opened. The gate faces can be parallel but are most commonly wedge-shaped (in order to be able to apply pressure on the sealing surface).Common gate valves are actuated by a threaded stem that connects the actuator (e.g. handwheel or motor) to the gate. They are characterised as having either a rising or a nonrising stem, depending on which end of the stem is threaded. Rising stems are fixed to the gate and rise and lower together as the valve is operated, providing a visual indication of valve position.The actuator is attached to a nut that is rotated around the threaded stem to move it. Nonrising stem valves are fixed to, and rotate with, the actuator, and are threaded into the gate. They may have a pointer threaded onto the stem to indicate valve position, since the gate's motion is concealed inside the valve. Nonrising stems are used where vertical space is limited.Gate valves may have flanged ends drilled according to pipeline-compatible flange dimensional standards.Gate valves are typically constructed from cast iron, cast carbon steel, ductile iron, gunmetal, stainless steel alloy steels, and forged steels.All-metal gate valves are used in ultra-high vacuum chambers to isolate regions of the chamber.

TUBE BENDS AND JOINTS

Tube bending is any metal forming processes used to permanently form pipes or tubing. Tube bending may be form-bound or use freeform-bending procedures, and it may use heat supported or cold forming procedures.Form bound bending procedures like “press bending” or “rotary draw bending” are used to form the work piece into the shape of a die. Straight tube stock can be formed using a bending machine to create a variety of single or multiple bends and to shape the piece into the desired form. These processes can be used to form complex shapes out of different types of ductile metal tubing. Freeform-bending processes, like three-roll-pushbending, shape the workpiecekinematically, thus the bending contour is not dependent on the tool geometry.

GROWING TRAY

A grow tray is a container designed to hold one or more plants in a hydroponic growing system. Depending on the type of hydroponic system in use, these trays may have leach valves to allow water to drain out of the growing medium when necessary A grow tray is also known as a hydroponic tray.

NET POT

Commonly used in hydroponic gardening, net pots are used to anchor the plants in the system. They can be used with or without a grow medium. Hydroponic net pots are often reusable and made from rigid plastic mesh to promote drainage and air circulation. Net Pots allow liquid to flow freely past the roots of the plants they contain, facilitating the uptake of nutrients. As the plant grows, the roots extend out of the holes in the net pot and grow down through the pots in search of water.

RESULT AND CONCLUSION

Due to increase in population the extraction of natural resource also increased. Too much extraction will leads to degradation of environment, due to the environmental degradation and increase in population the demand for energy source and natural resource also increases. In future biogas has the ability to replace fossil fuels as a source of energy.By using biogas as the major source of fuel,global warming and greenhouse effect can be reduced in the upcoming years. As we head into the 21st century, awareness and education will most assuredly continue to be the most important ways to spread use of biogas. This project will help the people to understand that biogas is a better source of energy and how the waste from one energy can be utilized as the main source of producing another energy. In short, with the emergence of new technology the energy scenario would be changed in the coming years.This project is eco-friendly and it can be used for variety of purposes to meet the future needs of the people.

OVERALL SETUP

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