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PRODUCTION OF HOME MADE METHANE FROM FOOD WASTES

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ABSTRACT

Food waste represents a significantly fraction of municipal solid waste. Proper management and recycling of huge volumes of food waste are required to reduce its environmental burdens and to minimize risks to human health. Food waste is indeed an untapped resource with great potential for energy production. Utilization of food waste for energy conversion currently represents a challenge due to various reasons. These include its inherent heterogeneously variable compositions, high moisture contents and low calorific value, which constitute an impediment for the development of robust, large scale, and efficient industrial processes. Although a considerable amount of research has been carried out on the conversion of food waste to renewable energy, there is a lack of comprehensive and systematic reviews of the published literature.The present review synthesizes the current knowledge available in the use of technologies for food-waste-to-energy conversion involving biological (e.g. anaerobic digestion and fermentation), Food waste is indeed an untapped resource with great potential for generating energy. Some one third of all food produced around the world gets discarded uneaten, and environmentalists, energy analysts and entrepreneurs are beginning to take notice. Diverting even just a portion of this waste to so-called waste-to-energy (WTE) systems could free up large amounts of landfill space while powering our vehicles and heating our homes, and thus putting a significant dent in our collective carbon footprint. Perhaps that's why WTE is one of the fastest growing segments of the world's quickly diversifying energy sector.In order to decrease food waste and mitigate climate changes a method is introducing in this paper The competitive advantages of these technologies as well as the challenges associated with them are discussed. In addition, the future directions for more effective utilization of food waste for renewable energy generation are suggested from an interdisciplinary perspective.

Key words:
Food waste, Anaerobicdigestion, Fermentation, Incineration, environmentalists, waste-to-energy, diversifying energy.

FOOD WEASTAGE IN INDIA:

Food wastage is fast assuming serious dimensions. According to the Food and Agriculture Organization (FAO), a staggering 1.3 billion tons of food is being wasted annually. The FAO report further states that one-third of the total global food production is wasted, costing the world economy about $750 billion or Rs47 lakh crore. This alarming increase in food wastage is generating nearly 3.3 billion tonnes of greenhouse gas emissions, thereby severely impacting the environment. The wastage of rice in particular has serious ramifications for the environment as decaying rice releases methane, a potent global warming gas.

Food wastage is an issue that has a global scale. According to a report by the National Resources Defense Council (NRDC), 40 per cent of the food goes uneaten in the US, whereas in Asia, India and China cause a loss 1.3 billion tons of food wastage every year. In terms of overall food waste — agricultural produce, poultry and milk — India ranks seventh, with the Russian Federation at the top of the list. India's lower ranking is because most of the countries ranking above it utilize much of their land in raising poultry, while a major chunk of land in India is under agriculture and this explains the highest wastage of cereals, pulses, fruits and vegetables that occurs in India.

A recent study conducted by Indian Institute of Management, Kolkata, revealed that only 10 per cent of foods get cold storage facility in India, this factor, accompanied by inappropriate supply chain management, has resulted in India becoming a significant contributor towards food wastage both at pre and post harvest waste in cereals, pulses, fruits and vegetables. India ranks 63 among 88 countries in Global Hunger Index with 20 crore Indians sleeping hungry on any given night, but in spite of this, nearly 21 million tonnes of wheat are wasted in India each year instead of reaching the needy.

Apart from the wastage of the food produced, the resources lost in the form of inputs during food production are also considerable. For instance, 25 per cent of fresh water, used to produce food, is ultimately wasted, even as millions of people still don't have access to drinking water. In addition, approximately 45 per cent of India's land is degraded primarily due to deforestation, unsustainable agricultural practices, and excessive groundwater extraction to meet the food demand.

Besides this, nearly300 million barrels of oil used to produce food is also ultimately wasted. Taking all of it into consideration, the actual worth of money per year in India from food wastage is estimated at a whopping Rs58, 000crore.

The Government has made many efforts to rein in food wastage but clearly, the depth of the problem is such that the impact of these efforts is hardly up to the mark. In order to make progress in reducing the burden of this problem, the Government needs to primarily contain the excessive wastage in transportation and improve storage facilities that are currently 50 per cent less than required. Besides this, the Government must also focus on food processing technologies that are both advanced and affordable so that food preservation practices can be encouraged thereby saving food from wastage.

India should also take a cue from global practices that are both unorthodox and innovative in order to tackle food wastage problem. For instance, France has passed unanimous legislation requiring supermarkets to either give unsold food to charity or send it to farmers for use as feed and fertilizer.

Similarly, institutions in Canada are recovering unused and unspoiled food from retailers, manufacturers, restaurants and caterers and sending them to charities, in the process delivering ingredients for over 22,000 meals daily. These powerful initiatives have made a big difference in how these countries have approached a vexing issue.

India can effectively use technology to script a new chapter in prevention of food wastage. The Government can speed up research in Nano technology with the help of which eco-friendly and healthy food preservation applications can be invented that are helpful in preserving food for longer duration and keeping farm produce fresh.

In addition to these efforts, the Government must make it mandatory for the food retailers across the country to adopt technology standards that allow incentives for the customer to purchase perishable products that are approaching their expiration dates. This will help reduce food wastage, maximizes grocery retailer revenue, and effectively reduces the global carbon footprint.

The World Economic Forum warns that food shortages represent one of the biggest risks to global stability over the next decade as countries are increasingly affected by climate change. Even though the world produces enough food to feed twice the world's present population, food wastage is ironically behind the billions of people who are malnourished. It is time to recognize this colossal scale of waste and take appropriate action that not only benefits humanity but the environment as well.

PRODUCTION OF METHANE GAS

Objectives:

Learn about methanogens
Understand the chemistry behind the production of methane from food waste
Identify the gas or gases produced during the reaction

Background:

Biogas is 60-80% methane and is created by a process termed anaerobic digestion,leaving behind a nutrient- rich substance termed dig estate. Anaerobic digestion is carriedout by arange of bacteria in the absence of oxygen. Initially carbon dioxide is producedaerobically by the decomposing organic matter until an anaerobic environment is created.After the initial digestion a group of bacteria known as methanogens convert thefeedstock into methane and carbon dioxide.

Anaerobic digestion has a number of environmental benefits including production of'green' energy and natural fertilizers. The process of converting organic feedstock into biogas can serve as a substitute for fossil fuels and artificial fertilizers, reducing theamount of greenhouse gases released into the atmosphere. The problems associated withwaste disposal are also alleviated by the generation of useful products and decreasedrelease of the potent greenhouse gas, methane, from landfill sites.

Methanogens are obligate anaerobes that cannot grow in the presence of oxygen. Theyuse CO2 as the final electron acceptor and Hydrogen as a source of electrons. Thereduction of CO2 produces methane gas as a byproduct of cellularmetabolism. Methanogens are abundant in swamps and sludge water. They play animportant role in biomass degradation and CO2 consumption.

$$\mathbf{CO_2 + 4\ H_2\ CH_4 + 2\ H_2O}$$

Methane is a colorless and odorless gas and the main component of natural gas (over75%). Methane is combustible and is a major source of fuel for heat, cooking andelectricity production. Natural gas is a fossil fuel that is not renewable. Although thereare still huge deposits of natural gas in the US, extracting them is expensive and isenvironmentally destructive, and finding alternative renewable sources of methane (biogas) is a high priority.

Methane burning consumes oxygen and produces carbon dioxide and water.

$$\mathbf{CH_4 + 2O_2\ CO_2 + 2\ H_2O}$$

Methanogens are abundant in anaerobic freshwater such as swamps, the stomachs of ruminants, and sewage sludge. Methane is produced naturally by the anaerobiccomposition of organic matter. (Think swamp gas.) Finding new organisms that canefficiently convert biomass into methane is an active area of research.

Using food waste and garbage to produce methane appears to be an ideal way to usebiology to solve two societal problems - to produce fuel while getting rid of garbage.In this experiment food waste is incubated with sludge water in a tightly sealedcontainer. Aerobic decomposition occurs first and CO2 is produced while Oxygen isconsumed. Once the oxygen has been depleted the methanogenic bacteria start growingand consume the CO2 to produce methane.

Therefore, one should expect an initial increase in CO2 production followed by a decreasein CO2 and a steady increase in methane production. The biogas obtained at the end ofthe reaction will be a mixture of CO2 and CH4 . The CO2 can be monitored using aCO2 detection probe. The methane can be identified by burning it. The biogas will becollected in a balloon and burned under the hood.

Materials:

A water tin of 25 lits with stopper, PVP pipes of required lengths, Cutters, Gas tubes ,Angular of tubes , Valves, Tire tube ,Food wastes , Water ,blenders

Procedure:

Fill half of the blender with food waste from your kitchen add water, Turn on the blender. Add enough water to obtain a mixture that has the consistencyof a hearty soup: thinner than chowder but thicker than bisque.Add the waste mixture two each BOD shaped bottles.Label one flask: Sludge and the other water (control),Use a graduate cylinder to add bacterial sludge (now 20% by volume of thetotal),Add the same amount of tap water.Check the pH. It should be around 7. If necessary add some base to increase pH to 7.Seal the tin with a stopper (Wet the stopper first to make it easier to push intothe bottle).Next fixing the PVC pipes as its inlet and outlet then fixing of gas tube to the head of the tin at one end and at another end it is to be fixed to the tire tube and in the middle a V shaped gas valve is to be fitted which would be the outlet of the gas after the equipment is ready Incubate the set-up at 37ºC.Measure CO_2 produced using the method you have chosen.After 5 to 7 days see the tube would be expanded .Then open valve of the gas outlet lighter was taken in front of its mouth which would be flammable. At the end of the experiment check the pH of the solution.Add bleach to liquid waste and discard, Throw solid waste into burn box.If time permits you can dry and weight the solid waste.

CONCLUTION:

As many researches were carried out on the production of methane gas from food wastes on large scale ,but the maximum of food wastes were from the domestic houses or habitats and it would be difficult for the government or any organizations for collection and the production of energy from food wastes in any ways, thus in this paper a method was discussed for the production of methane gas in the houses itself as this method would the be better way for food waste management as well as a source energy.

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