Identification of the Potential Usage of Biogas as an Alternative Bioenergy Source at Kotelawala Defence University Premises

Food wastes are generated in large quantities all over the world. Management and disposal of food wastes is one of the major issues in Sri Lanka since it creates serious environmental problems due to its high biodegradability. Dumping of food wastes on open lands leads to land pollution and releases odorous compounds such as VFA s which affect public health and ecology. Millions of tons of food wastes disposed of in landfills emit large quantity of green house gases such as methane, carbon dioxide, sulphur dioxide; hydrogen sulphide etc. thereby leading to air pollution. The effect of methane atom on ozone layer depletion is 21 times greater than that of carbon dioxide atom and heavily affects global warming. Disposal of solid and effluents of food waste pollute inland water bodies causes eutrofication and increases biological oxygen demand (BOD) and chemical oxygen demand (COD) in rivers, lakes and water streams. Organic pollutants greatly affect the general public by means of land water and air pollution posing a severe threat to human health.

Although different solid wastes treatment techniques are available, anaerobic digestion is considered as a sustainable technology for its environmental foot print and potential use of biogas as an alternative bio energy source. Anaerobic digestion is a biological process by which a wide variety of organic molecules can be metabolized in to methane and carbon dioxide gases in the absence of oxygen. Based on Anaerobic Digestion Model No 1 (ADM 1) proposed by Batstone et al., (2002) there are four major phases of hydrolysis, acidogenesis, acetogenesis and methanogenesis. Organic materials undergo above four phases and form acetic acid, hydrogen and carbon dioxide. By means of cleavage of acetic acid or by redaction of carbon dioxide with hydrogen as a result of anaerobic eubacterial and archeal microbial population. (Omstead et al., 1980).

The pilot scale 40m3 biogas project was launched and the research was carried out as an outcome of pilot scale biogas project which was set up at at Kotelawala Defenec University premises to treat biodegradable canteen food waste (Cadet mess waste) of 400kg per day. The project consultent was Mr. G. K. Upawansa who is known to be father of the biogas sector Sri Lanka and empirical research was carried out. The objective of the project was to co-operate theoretical and practical knowledge and experience of biogas expertise in Sri Lanka, and to identify the potential usage of environmental friendly biogas instead of high cost LP gas and to study the reactor limitations in field scale in terms of process failures and technology management.

This leads to replacing the existing LPG and gaining economic benefits. The reactor type is known as Lanka Tunnel model which has been designed according to the plug flow principle consisting of inlet, outlet, tunnel shape digester and its special feature is the presence of a multi functional hydraulic chamber. The capacity of the biogas digester is 40m3 which was determined based on wet weight basis organic loading rate (OLR) of 8.75-10kg/m3/day. 400L of innoculum/ seed sludge was initially fed in to the biogas reactor which was taken from a successfully functioning plug flow type biogas rector at "Mahamewna Asapuwa", Polgahawela. A semi continuous feeding pattern was practised and incremental biogas volume was measured using G2.5B Chinese model biogas flow meter. pH was continuously monitored at inlet and outlet of the digester. A stable reactor operation was confirmed by burning of biogas. Continuous biogas burning over 24 hrs started after 84 days of feeding. The average pH value inside the digester was 6.2. The average biogas volume was 18.81m3/day. The average biogas production was 47.1% from the capacity of 40m3 digester. Therefore, it can be concluded that this is an above average biogas production comparing with other continuous, semi continuous and batch type biogas digesters in Sri Lanka.

The digestate from anaerobic digester contains essential plant nutrients and can thus be used as plant fertilizer and soil amendments. This will solve severe environmental problems arising due to agro-chemical inputs in state agriculture.

Practical experiences and data obtained could be used to promote and develop large scale biogas reactor technology in Sri Lanka.

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