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Biogas production through different sources and role of its residues in industries and agriculture-A review

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ABSTRACT

Fossil fuels like coal and petroleum are depleting in world, due to increasing a number of population day by day, so alternative sources of energy is the requirement of the present day for overcome these energy crises. One amongst the major challenging source of energy is biogas being produced from biomass. The aim of this study is to give a review of different sources of biogas production. For example sewage waste, fruits and vegetable, slaughter house waste, animal waste, flowers waste etc are commonly used in biogas production. This study is conducted to aware people about the magnificent benefits of biogas residue as fertilizer in the field of agriculture and energy production in industrial field. Distinctly in the rural areas where a massive amount of natural waste is accessible without proper usage, by utilizing these wastes material in manageable way we resolve the energy problem in the foam of production of biogas.

Key words: Fuels, Biogas, Waste, Animal

INTRODUCTION

Around the world energy is necessary for industrialization and economic enlargement. Right now, natural energy resources are pronto as fuel to find solutions in the world's cumulative energy need (Maghanaki *et al.*, 2013).

According to Ramachandra *et al.* (2004), energy is fundamental fragment of life and socio-economic development with increasing life style demands and discovered as important factor in the social and political progress of any nation. In the face of the increasing energy demands day by day, millions of people are still under privileged of primary energy amenity such as, liquid fuels, natural gas and electricity (Surendra *et al.*, 2014).

The wide-reaching desire is to develop alternative energy and power resources using organic and natural waste for the purposes of saving valuable natural assets, their consumption and air polluting of the environment (Eriksson *et al.*, 2014). Fast population growth rate and human activities consuming higher levels of energy, causes depletion of natural resources of and environmental exploitation (Surendra *et al.*, 2014).

According to Triolo *et al.* (2012), biogas production from natural waste is the most impressive alternate technology. Biogas has pale blue flam and also recognized as: dung gas, marsh gas, sewage gas and swamp gas (Dangogo and Fernando, 1986).

A huge amount of energy is being used in each and every sector of the society. Developed countries have the highest energy consumption per population hence they have rapid economic growth rate (Ozturk, 2010; Ozturk *et al.*, 2010). As fossil fuels cause addition of carbondioxide in the climate with the use of renewable energy it would be controlled (Tampier *et al.*, 2004; Bugwood, 2006; Ali *et al.*, 2016).

Carbohydrates are the main substrate of the anaerobic digestion that has been transformed into the biogas by degrading the natural organic mass (Khurshid, 2009; Ali *et al.*, 2016). Organic waste like animal manure, poultry and sewage waste are plentiful and easily available, making the biogas low cost resource.

To conversation the economic and environmental issues related with fossil fuels and to achieve the goal of reducing environmental exposures renewable energy sources are the best possible solution to overcome the energy demands (Yu *et al.*, 2011). Raheem *et al.* (2016) study predicts that Pakistan is expected to be the 5th largest nation of the world by population till.

Agriculture has backbone status in economic growth and development of Pakistan (Mirza *et al.*, 2008; Amer and Daim, 2011). Being a developing country, Pakistan is facing extreme deficiency of energy over the year. The energy depletion situation will become shoddier in future due to the rapid population growth and insufficient resource utilization policies. Hence there is a need to utilize a new energy sources to fulfill the present requirements (Amer and Daim, 2011).

The best solution to fulfill the country's energy demands for its progress is the development of sustainable and renewable energy source (Klass, 1998).European countries suggested that the utilization of sewerage, sludge, animal manure, organic waste for biogas production contributes to the supply of energy needed for heat and electricity production of world (Eurobserver, 2013).

We can overcome the energy crisis and demands by using biogas as an alternative energy source. The anaerobic digestion of animal and sewage waste produces clean energy in the form of biogas, and also renovates manure into bio fertilizers that can be used as a soil conditioner (Cestonaro *et al.*, 2015).

BIOGAS PRODUCTION

Karki *et al.* (2005) state that biogas is produced by anaerobic digestion (without oxygen) of biodegradable organic wastes, and produce as a result of food chain in which the sun's energy is trapped by plants that are consumed by the domesticated animals as fodder and humans to generate energy, fats, carbohydrates and proteins that the animals' body uses.

The anaerobic decomposition cycle contains physiological process of microbial and energy metabolism, as well as raw materials processing under specific conditions. Biomass has always been a major source of energy for mankind from the distant past. Presently, it donates around 10–14% of the world's energy supply (Ramachandra *et al.*, 2004).

BIOGAS PRODUCTION STEPS

Biogas produce is a multiple-stage process processed by these following steps: transesterification, pyrolysis, liquefaction, gasification, hydrogasification, anaerobic and alcoholic digestion and burning (Mirza *et al.*, 2008). Biogas fermentation is a complex process (Angelidaki and Ahring, 1993).

According to Al Arni *et al.* (2010) pyrolysis is a thermal process in which biomass is converted into gas, liquid, and solid in the absence of air. The product in biogas process is methane and carbondioxide with a small amount of other gases. Biogas usually contains about 55–65% methane, 30–35% carbondioxide, and some hydrogen, nitrogen and other impurities (Taiganides, 1987).

BIOGAS PRODUCTION THROUGH DIFFERENT SOURCES

Animal waste: Waste excreted by animals as a animal excreta is called animal manure, it include feaces and urine. In Pakistan, Cattle, buffaloes, goats, horses, camels and sheep are the common sources of animal manure. In addition to this, a well-established poultry sector exists in the country. This organic waste is also used to increase the fertility of soil. Biogas can be produced from animal manure through anaerobic digestion and solve the energy crisis (Raheem *et al.*, 2016).

Anaerobic degradation for biogas formation of animal manure is composed mainly of methane and carbon dioxide (Ahn *et al.*, 2010). Utilization of this natural organic waste not only partially solve the problem of energy deficit but also produce a large amount of soil conditioner and irrigational water (Salminen and Rintala, 2002). It is the extensively used despicable and hygienic renewable source yielding a good quality fertilizer (Albihn and Vinnerås, 2007; Cestonaro *et al.*, 2015).

Fruits and Vegetables: Fruit and vegetable wastes (FVWs) is a most abundant perishable landfill waste. It is found everywhere and easily decomposable (Viturtia *et al.*, 1989; Bouallagui *et al.*, 2005). The production of fruit and vegetable waste is also very high and becoming a good source of municipal trepidation due to its high biodegradability (Bouallagui *et al.*, 2005).Vegetable wastes are available in mess, hotels etc (Ranjitha and Vijayalakshmi, 2014).

The methane yield also depends on different parts of fruit and vegetable contained by the same variety (Saev *et al.*, 2009). In India fruit and vegetable waste include about 5.6 million tons annually and currently these wastes are disposed by throwing away on the outer edge of cities (Srilatha *et al.*, 1995). The main benefit of the waste process is to CH_4 generation for the production of electric power (Pipatmanomai *et al.*, 2009).

Flowers: Flowers waste is also being considered as a potential feed stock for the production of biogas. Wasted flowers are easily accessible in gardens, streets, flower markets etc. (Ranjitha and Vijayalakshmi, 2014). Flower waste had a high yield of biogas than vegetable wastes with low hydraulic retention time (Deepanraj *et al.*, 2015).

Sewage waste: Sewage waste is mainly cosmists of waste released from urban communities. The nature of waste and climatic condition of the area where it is generated affects the yield of biogas. Pakistan, like most of the developing countries, is also pebble dashing a solemn ecological hazards due to the huge amount of sewage waste production and its mishandling (Raheem *et al.*, 2016). About 55% of total collected sewage waste from cities is composed of organic material (Sosnowski *et al.*, 2003). The highly enviable fuel was obtained by fermentation of sewage as early as 1934 and was used for heating and initial combustion engine for pumping (White and Plaskett, 1981).

Slaughter house waste: According to Carpentier *et al.* (2005), the slaughterhouse waste is a good source of biogas production and could produce 225–619 dm3 kg-1, which corresponds to50–100% yield. On the other hand, slaughterhouse wastes is usually regarded as difficult substrates for anaerobic digestion, mainly because of their typically high protein and lipid content (Banks and Wang, 1999).

ROLE OF BIOGAS RESIDUES

Agriculture: Almost 62% population stays in rural areas and be reliant on agriculture. The usage of and implantation of biogas plant is economically feasible in Pakistan. (Ali *et al.*, 2016). Several studies have focused on the benefits of biogas residues as soil alteration and fertilizer with its encouraging properties of recurring of organic matter and keeping in the soil (Abubaker *et al.*, 2012), Organic residues can be used as organic property to some extent replaces as chemical fertilizer (Al Seadi *et al.*, 2013).

Industry: Organic waste utilization is considered the most suitable way for commercial exploitation of biomass in turn to produce electric power. Co-digestion technology, based on multiple and sequential use of a waste for generation of biogas, is a viable option for power generation in process industries such as sugar, paper and rice mills among others. Sugarcane biogases and sugarcane trash can provide a significant amount of biomass for electricity production, and the potential becomes much higher with advanced cogeneration technologies (Bridgwater *et al.*, 2002).

CONCLUSION

World is facing troubles due to inadequate source of energy. Energy demands increasing day by day and it is unfeasible to fulfill energy requirements from restricted sources. So it is essential to find out the cheapest and alternative sources to fulfill the energy needs. Biogas production from different sources like sewage waste, fruits, vegetable and flowers waste or other organic substances which are use in daily life. All these organic wastes produced a huge amount of biomass without proper handling and cause environmental pollutions .Fruits, vegetable and animal waste which dictates our naturally decomposable domestic waste can be converted into fuel for domestic and industrial applications. It has also been confirmed that byproducts (biogas residue) of this process could also be used as a soil conditioner in agriculture which improved organic manure for agricultural production. By using organic waste in manageable way we can overcome the energy problems.

NOVELTY STATEMENT

This study is to give a review of different sources of biogas production. For example sewage waste, fruits and vegetable, slaughter house waste, animal waste, flowers waste etc are commonly used in biogas production. This study is conducted to aware people about the magnificent benefits of biogas residue as fertilizer in the field of agriculture and energy production in industrial field. Distinctly in the rural areas where a massive amount of natural waste is accessible without proper usage, by utilizing these wastes material in manageable way we resolve the energy problem in the foam of production of biogas.

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