

Review Paper on Revitalisation and Sustainable Development of Villages by using Sludge Biogas Plant

Mr. Raju Bondre¹, Pranali Manuskar², Richa Jha³, Manish Lade⁴, Pavan There⁵, Sagar Gupta⁶

¹Correspondence Author, Assistant Professor, Dept. of Civil Engineering, Guru Nanak Institute of Technology, Maharashtra, India

^{2,3,4,5,6}Student, Dept. of Civil Engineering, Guru Nanak Institute of Technology, Maharashtra, India,

Abstract - India is slowly emerging as a global superpower and is pacing towards a being a developed nation amidst the world's gazes. But being completely engrossed in becoming a technological giant, the nation has somewhere in its journey has forgotten its own heart and soul – its villages. A country cannot be called a developed nation just on the parameters of technical advancements. The farmers and villagers face huge crisis due to a number of issues – high rate of pesticides and insecticides, poor production of crops, unavailability of healthy drinking water, lack of employment opportunities and unhygienic conditions. This leads to large migration of people to the cities, also leading to increase in the rate of poverty. Our main objective of project is to protect and promote human health by providing a clean fuel and environment, breaking the cycle of disease by interconnecting units of sanitation system and energy generation.

Key Words: Water Treatment Plant, Rainwater Harvesting, Sludge, bio-gas plant, Sewage Treatment Plant, anaerobic digestion, digestate, fuel.

1. INTRODUCTION

In India, there are 6,00,000 villages out of them 1,25,000 villages are backward. New technologies are introduced in towns and villages are left unaware of these developments. Approximately 80% of all illnesses in developing countries are caused by poor water and sanitation condition. It is normal for women and young girls to need to walk a few kilometers consistently to bring water for their families. They lack hygiene, cleanliness and accessibility. The proper facilities available in towns and cities are not provided to the villagers – improper sanitation, improper solid waste management as well as the treatment of waste water. This leads to water-borne diseases, health issues and even epidemic. The fertilizers and pesticides provided by the government are unable to reach the villagers. So, the farmers have to pay huge amounts to buy them. Even now, electricity is not available in many remote villages. People still use woods as a source of fuel for cooking. This causes discomfort while breathing, lung and eye irritation. Having these facilities are unavailable to the people; many of them are migrating to towns and cities, hence giving up farming. The fertilizers and pesticides are beneficial for the growth of crops, but in turn reduce the fertility of the soil. So, there is a need to develop & design a village as a sustainable village.

Hence, we plan to install all the units inter-connecting all the basic units for sanitation, water treatment and fuel production. This includes rainwater harvesting, water treatment plant, sewage treatment plant and biogas plant. This will not only provide the villagers with fuel and electricity, but will also improve the hygiene and cleanliness of the village. With this, we will be converting the generally large-scale plants into more convenient small-scale plants, thus overall cost of maintenance and installation of the plant. This will increase the employment opportunities in the village.

1.1 Water Treatment plant:

Treatment of water consists of three stages-Primary, secondary and tertiary treatment. Primary treatment removes large particles by screening. The water is then passed through bubbles to remove the oil particles in water in the floating time by adding alum. The sediments settle down at the bottom of the tank. It is then filtered by using filtration. Secondary treatment consists of aerobic and anaerobic treatment. Aerobic treatment removes organic substances by passing oxygen and bacteria. It also contains trickling filter containing stone bed, micro-organisms and bacteria to remove organic matter. Chlorination, use of UV light and ozonisation is used to remove micro-organisms by using tertiary treatment.

1.2 Rainwater Harvesting System:

The water shortage problem can be solved by using the concepts of rainwater harvesting. Rainwater harvesting system is the direct collection of rainwater from roofs and other purpose built catchments, the collection of sheet runoff from man-made ground or natural surface catchments and rock catchments for domestic, industrial, agricultural and environmental use (Che-Ani *et al.*, 2009). The rainwater is collected and is sent to a pit through a network of pipes.

1.3 Sewage Treatment Plant:

Sewage treatment involves the removal of contaminants from wastewater and household sewage, runoffs, coming from domestic, agricultural, commercial and institutional areas (Vrushali *et al.*, 2014). The process of sewage treatment includes three stages- Primary, Secondary and Tertiary treatment.

Primary process contains screening, flocculation, sedimentation and filtration. The larger floating particles are removed by screening. Next, bubbles are passed to remove oil particles in the floating tank by adding alum in flocculation. The heavy particles are then separated by allowing them to settle down at the bottom for a period of time in the sedimentary tank. The treated water is then passed through the process of filtration in which the dissolved particles are removed.

Secondary treatment removes the suspended and biological matter with the help of water-borne micro-organisms which are then later separated after completion of the process.

In tertiary treatment, the water is disinfected through physical or chemical (UV, chlorination and ozonization) means before discharging it into water bodies.

1.4 Sludge Biogas Plant:

Biogas can be produced from animal and human faeces, domestic wastes and wastewater sludge to produce methane (CH₄) and Carbon Dioxide (CO₂) along with digestate which can be used as a source of fuel, energy, electricity and fertilizers. The two main processes of sludge digestion are – aerobic and anaerobic digestion. Anaerobic digestion involves the digestion of digest slurries and solid wastes under the absence of oxygen under controlled conditions. The aerobic digestion is classified under two categories - dry and wet fermentation (Kapustina, 2010). Wet fermentation is one of the most common types of sludge digestion used.

The bio-gas plants involves at the least following elements

1) The production unit, which includes the manure removal system or waste water treatment plant, where sewage sludge produced, possibly and influent holding tank and/or a sanitation unit and the anaerobic digester

2) The safety and gas upgrading equipment,

3) The gas storage facilities.

4) The equipment for gas and manure utilization.

2. CONCLUSIONS

The topic of water demand is now the call of the hour. Not only is water shortage is a topic needed to be focussed, but water sanitation is one of the most talked about issues as the unhealthy water leads to the rapid spreading of various diseases. Even after the treatment of water, the treatment of sludge turns out to be a major problem as its improper disposal can be harmful to living beings. This can be done by connecting Rainwater Harvesting System, Water Treatment Plant, Sewage Treatment Plant and Sludge Biogas Plant.

The demand of water has been increasing day by day due to the population expansion, urbanisation, and industrialisation and growing agricultural needs. Hence, all these needs are satisfied by the introduction of the Rainwater Harvesting

System. It is the most economical type of water collection as it does not require high-cost equipments and handling by skilled workers, thus, reducing the burden for investing in the replacement of aged systems.

Before the water from water bodies is acceptable for drinking, it needs to be treated in the Water Treatment Plant. The water undergoes primary process (screening, flocculation, sedimentation, and filtration), secondary process (aerobic and anaerobic treatment of water, trickling filter) and tertiary process (Chlorination, using UV rays, ozonization). The sewage water needs additional treatment for meeting the basic drinking standards. The end product of the water or wastewater treatment is the formation of sludge as a product of removal of chemicals which cannot be taken.

The treatment of sludge can either be done by the process of digestion or the sludge can be treated through composting. The process of digestion (generally anaerobic digestion) is used as its end-products are fuel for providing energy and electricity as well as manure which can be used as a fertilizer as compared to only production of only composts in composting. Also, the harmful chemicals present in the sludge is broken down into fatty acids and various other compounds which is beneficial for the growth of plants.

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