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Popular Article

Biogas slurry: Applications and Challenges

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A loss in crop output caused by the predominance of numerous abiotic and biotic stresses prompts a faster use of chemical fertilizers and pesticides in agricultural areas. Such chemical inputs not only represent a hazard to human life, but also have more severe environmental repercussions. Three significant issues surround the use of nitrogenous chemical fertilizers: rising costs, financial loss, and environmental risks. As a result, it is essential to switch from traditional practices to environmentally friendly ones while also encouraging the limited or optimal use of chemical fertilizers and organic farming.

Currently, organic farming has drawn attention from all over the world as a sustainable agriculture practice. However, there are still some issues that need to be resolved before such practices may be expanded. According to information from "The World of Organic Agriculture (Statistics and Emerging Trends 2020)" (FiBL survey 2020), 186 countries were engaged in organic activities in 2018 on 71.5 million hectares of land. However, according to data from 2018 and the FiBL Survey 2020, India is the nation that produces the most organic food globally (1,149,371). The main areas that need to be taken into consideration to further increase organic agriculture practices are the modifications made to biological resources to create organ mineral biofertilizers through the application of technical interventions such as microbiology, biotechnology, and nanotechnology.



Anaerobic bacteria absorb and digest organic materials like animal dung and wastewater to create bio slurry, which is then used to make fertilizer that is rich in nutrients. Anaerobic digestion is the breakdown of organic material without the use of oxygen, producing methane gas and a solid residue that is either light brown or dark green in color. To minimize any health concerns from exposure to pathogens and other contaminants that might be present in the organic material, bio slurry should be handled and treated properly. The macronutrients nitrogen, phosphorus, and potassium are all present in significant amounts in bio slurry, as are the micronutrients zinc (Zn), copper (Cu), iron (Fe), and manganese (Mn), among others. For agricultural crops, bio slurry is frequently utilized as a low-cost and sustainable source of fertilizer, especially in underdeveloped nations where chemical fertilizers may be prohibitively expensive or unavailable. Farmers can afford to use bio slurry since it is produced at a cheaper cost than chemical fertilizers. Additionally, the creation of biogas from bio slurry might offer rural populations a source of sustainable energy.

Applications

Environmentally friendly: The environment is being polluted and degraded by the use of conventional energy sources. Renewable energy options like biogas are the only choice. People may receive clean, efficient, and ecologically friendly power thanks to biogas, a renewable energy source. By transforming livestock manure into usable energy and refining it into organic fertilizers or bio-slurry, biogas serves as another link in the chain of environmental sustainability.

Energy production: Additionally, bio slurry can be utilized as a feedstock for the creation of biogas, which can produce renewable energy for the production of power and heat. Methane gas can be captured and used as fuel when bio slurry is subjected to anaerobic digestion.

Waste management: Anaerobic digestion in a biogas plant (BGP) produces bio slurry as a byproduct, which has a greater potential than creating any other fossil fuels. This byproduct is recycled organic waste, such as bovine dung, vegetable waste, and food waste. The waste that can be turned into fertilizer demonstrates that the bio-slurry stance is evidence that biogas almost completely eliminates waste.

Supply of nutrients: Today, bio sludge is employed as a productive source of fertilizer. It has high levels of the macronutrients—nitrogen (N), phosphorus (P), and potassium (K)—that are thought to be necessary for the thriving growth of plants. Micronutrients including zinc (Zn), copper (Cu), iron (Fe), and manganese (Mn) are also present in it. It lowers the price of organic natural fertilizer while raising the soil's fertility. BGS contains nutrients in proportionately balanced amounts and is a good source of slow-release minerals.



Composting: Compost can be supplemented with bio slurry to add nutrients and hasten the decomposition process. Compost, a nutrient-rich soil additive, can be made by combining bio slurry with other organic debris. You can use this compost to strengthen the soil and encourage plant development.

Soil health development: The structure, texture, and fertility of the soil can all be improved by using bio-slurry, a natural fertilizer that is rich in nutrients. It improves the soil's ability to retain water and nutrients by adding organic matter and vital nutrients. Therefore, it is ideal for land in fertile areas that gradually loses its productivity. A natural fertilizer that can bind soil nutrients and soften hard soil is called bio-slurry. BGS also enhances soil microbiota (nitrogen-fixing bacteria, phosphate-solubilizing bacteria (PSBs), efficacy against soil-borne and plant diseases, etc.) and cation exchange capacity.

Agricultural Use: By improving soil fertility and lowering the demand for synthetic fertilizers, bio slurry can be utilized as a natural fertilizer for crops. The nutrient-rich mixture can enhance plant development, resulting in higher crop yields. It is very helpful for crops that need a lot of phosphate and nitrogen.

Landscaping: Applications for bio slurry in landscaping include turfgrass management, fertilizing trees and shrubs, and caring for flowerbeds.

Bioremediation: In the process of bioremediation, which uses microorganisms to degrade organic contaminants in contaminated soil and water, bio slurry can be utilized. By eliminating contaminants and lowering the amount of organic matter in the water, bio slurry can be used to clean wastewater. This can lower the risk of contracting waterborne infections and enhance the quality of the water.

Aquaculture: Aquaculture facilities can make use of bio slurry as a source of nutrients for fish and other aquatic life. It may offer a less expensive and environmentally friendly option to commercial fish feed.

Economic viable: For small-scale farmers who cannot afford to purchase synthetic fertilizers, bio slurry is an economically affordable and readily available fertilizer.

Challenges

There are various uses and advantages for bio slurry, but in order to assure its safe and sustainable use, it is crucial to solve the issues related to its production and use. However, using it comes with a number of difficulties, such as:

Transportation and storage: Since bio slurry is a liquid, it may be harder to transport and store than solid organic waste. Spills, leaks, and other incidents that could be dangerous to human



health and the environment must be avoided with proper handling and storage. In order to avoid spills and leaks, bio slurry must be properly stored and transported. This might be difficult in places with poor infrastructure.

Contamination: Injurious microorganisms and poisons that represent a risk to both human and animal health can be found in bio slurry. Prior to usage, it is crucial to ensure that the bio slurry has been adequately cleaned and handled.

Odor: Particularly if the storage and application practices are improperly handled, bio slurry can emit unpleasant odors that can bother adjacent neighbors.

Pathogen risk: If not effectively controlled, hazardous organisms like bacteria, viruses, and parasites found in bio slurry could endanger both human health and the environment. So it's crucial to make sure bio slurry is correctly handled and stored before usage.

Heavy metals: Heavy metals may be present in some feedstocks used in anaerobic digestion, and these metals may build up in the bio slurry. If the bio slurry is used on agricultural land, it may contaminate the soil and perhaps harm plants and animals.

Nutrient variability: Crops may be over- or under-fertilized as a result of bio slurry's potential nutritional imbalance. Reduced agriculture production and environmental harm may follow from this. Depending on the type of feedstock utilized and the parameters of the anaerobic digestion process, the nutrient content of bio slurry might vary greatly. As a result, maintaining constant nutrient levels for use in agriculture may be challenging.

A significant resource, bio slurry can be applied in a number of ways to promote soil fertility and plant growth. However, bio slurry needs to be examined first to establish the nutrients it contains and the best application rates. By doing this, nutrient imbalances and environmental harm can be avoided. The creation of appropriate infrastructure for storage and transportation ensures the safe and effective handling of bio slurry with regard to environmental safety. In order to get rid of dangerous bacteria and toxins, bio slurry needs to be thoroughly cleaned and treated. So, despite its drawbacks, bio slurry makes a great organic fertilizer for sustainable agricultural and environmental management.

