

Pilot Scale Design: Dry Anaerobic Bioreactors

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In order to meet the demands of the expanding global population, it is vital to provide energy and food with little environmental impact. Anaerobic digestion is a method for managing organic wastes that can break down proteins, lipids, and carbohydrates biologically in the absence of oxygen to generate biogas. Operation at TS concentration greater than 15% is categorized as dry (solid-state) anaerobic digestion, in contrast to wet anaerobic digestion. Compared to wet anaerobic digestion, dry anaerobic digestion has a number of benefits, including less fresh water use and a more favorable energy balance. Agricultural waste has a high TS content, such as lignocellulosic biomass.

This article presents the design of 2 types A and B pilot, solid, intermittent operation, anaerobic bioreactors, with working volume of 3 m³. The Type A bioreactor is a horizontal reactor, with an internal horizontal mixing shaft equipped with specially designed fins. The basic design consists of a double cone container. The design with such a basic shape, guides the concentration of the produced gas, in one point. Specifically, this point is in the center of the reactor, where there is a hatch with gas extraction equipment. The main chamber consists of double-walls. Hot water flows between the walls and keeps the temperature constant and controlled for the main chamber of the bioreactor. The fins of the stirring shaft, are fully adjustable (both in length and in shape). In this way, it is possible to stir the processed mixture and at the same time to climb it to the top of the container, in order to achieve better mixing. The rotation of the shaft will be controlled and guided both in terms of rotational speed and in terms of intermittent operation. The Type B bioreactor is a horizontal cylindrical rotating reactor. It is a different approach with a different mixing logic as a key element, with all the materials being stirred as the reactor body rotates. The bioreactors have a sensor and an automation system. The development of software and automation will allow the commercial and sustainable development of these units and the maximization of their efficiency, with the least possible requirement for personnel, skilled and unskilled.

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