

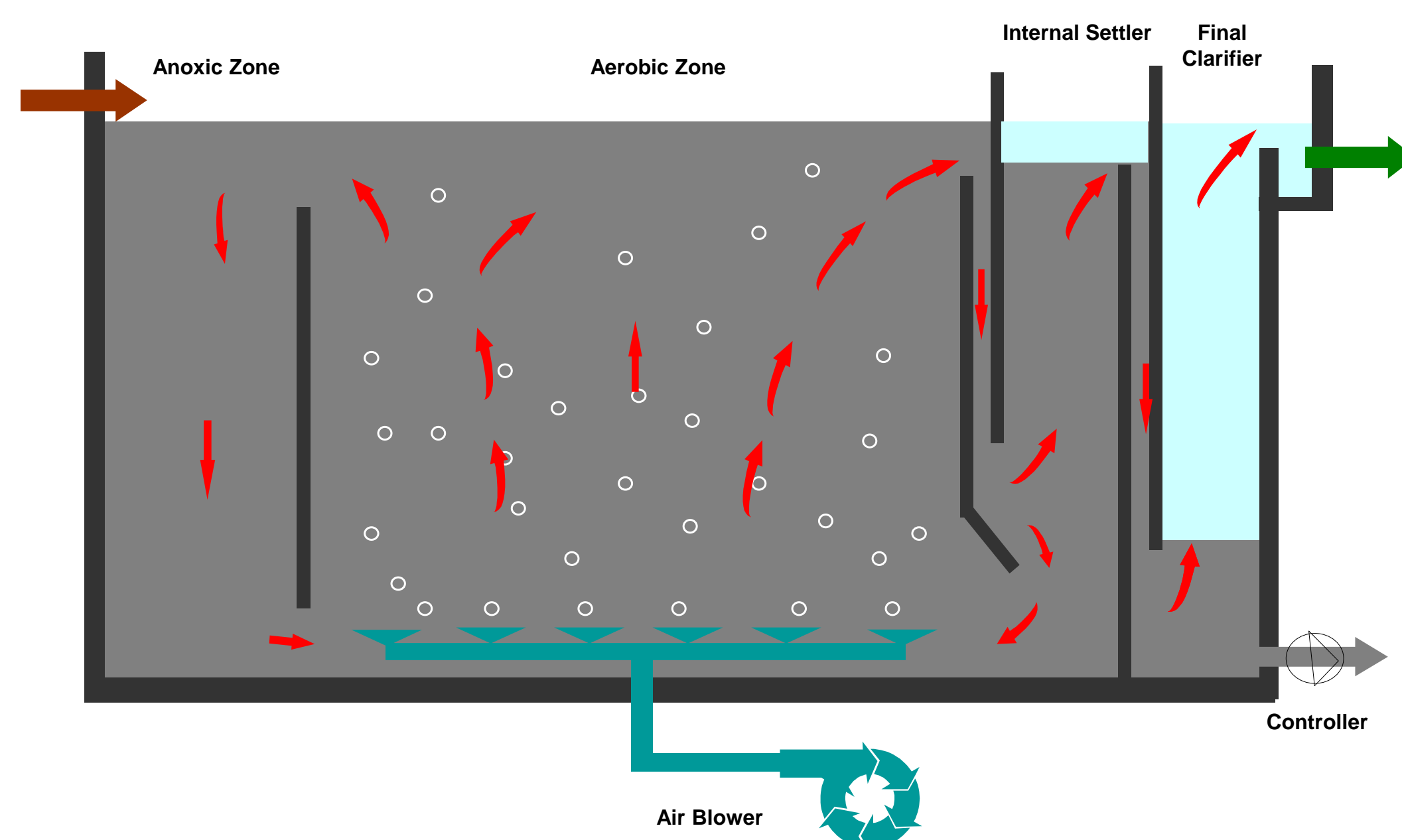
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About Frontier

Frontier Environment Technology is an emerging environmental solutions company primarily focused on advanced wastewater treatment and reclamation. Our innovations represent a sophisticated approach to age old hydraulic principles to allow for effective and efficient treatment of wastewater by a number of means.

Our research began in 2008 with the development of the Baffled Bioreactor, initially intended to provide deployable water treatment for the U.S. Army. The technology evolved over the course of four years and Frontier now has a portfolio of wastewater and water treatment technologies that include the following:

- Internal Settler – Automatically retains sludge in aerobic treatment basins resulting in higher biomass concentration, reduced operational cost and decreased loadings on clarification.



- Surge Pumps – Modified airlift pumps designed to mix and transport fluid using large-diameter bubbles that minimize oxygen transport to the fluid. These pumps provide reduced operational costs over conventional means of mixing and transport. The Surge Pump represents the key innovation of the Self-Mixing Biogas Generator.



Reinvent the Toilet Fair Prototype



The prototype Self-Mixing Biogas Generator on display at the Reinvent the Toilet Fair represents the size of the reactor needed to treat waste from one individual at 20° C – approximately 60 gallons. If the temperature of the reactor is raised to 35° C the same size reactor can treat waste from two individuals. The temperature of the reactor in the field could be raised by passive solar heating while installation below grade provides insulation at night.

The air stone providing fine-bubbles at the bottom of the prototype represents nucleation of methane bubbles that would occur naturally during anaerobic digestion of fecal matter and organic waste. No energy input is needed to operate the mixing function.

Advantages of the Innovation

The Self-Mixing Biogas Generator has several advantages over conventional designs. These include:

- Automatic mixing without any energy input and mechanical moving parts
- No sludge buildup at the bottom of the reactor
- Significantly reduced scum accumulation

All these advantages make our biogas generator much more efficient but without any maintenance needs, therefore is applicable for single families, small communities, and large installations all over the world, from developing countries to developed countries.

By reducing the size of the reactor necessary to treat waste from a single family by approximately 75% we can eliminate the need of on-site fabrication. The reactors can be mass-produced at a centralized facility and shipped to the installation site. This reduces cost and the dependence on unskilled or partially-skilled labor to construct the reactor – which may contribute to poor construction and operational problems.

The amount of gas produced by each reactor is dependant on the operating temperature of the reactor and the quality (i.e., activeness) of the feed. Current estimations suggest that a single family of four individuals could generate the equivalent of 3 kWh of electricity in biogas each day. However, it's likely that the biogas produced by the reactor in developing countries would be used directly as a heat source in cooking or boiling water for disinfection. Entrepreneurs could further refine the biogas by removing moisture and CO₂ and sell the methane to be used along with natural gas for a variety of purposes.

