BIOGAS
TECHNOLOGY BRIEF

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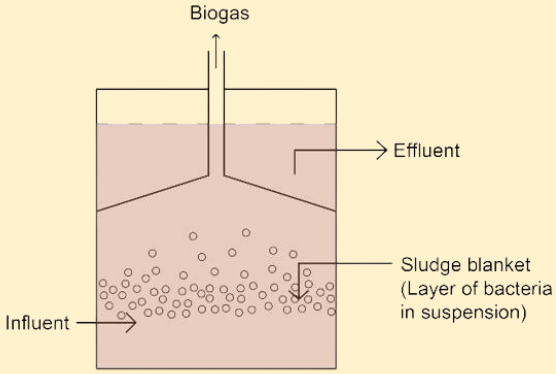
Upflow Anaerobic Sludge Blanket (UASB) Reactor

Introduction

UASB reactor was developed in the 1970s by Lettinga and his team at the University for Agriculture at Wageningen, the Netherlands. This type of high rate biogas systems are preferred for the anaerobic treatment of industrial wastewater with high organic loading rates.

Operating Principle

The influent wastewater is fed from the bottom of the reactor. This reactor contains a cylindrical tank. Bacteria convert the solids of the influent into a granular form. The formed granules, being solid, settle at the bottom of the reactor. With time, they develop into a sludge blanket, and remain at the bottom of the reactor. This sludge blanket gets dense over time. The UASB technology, which is a suspended growth system, facilitates the natural immobilization of anaerobic bacteria. The biological processes by the anaerobic bacteria take place at the sludge blanket of granules. The influent is made to flow upward through the anaerobic sludge blanket. The bacteria living in the sludge blanket consume the organic components of the influent & produce biogas. As biogas forms, some agitation takes place inside the reactor, which further induce bacterial actions & biogas generation. As biogas moves upward, the solids & liquids get separated by the inverted cone at the top of the reactor. The generated biogas gets collected at the top. This biogas is collected & stored in a gas storage tank & used as a form of energy. For granule formation and for good settling of the granular sludge, the reactor must maintain proper mixing through the liquid and gas flows.



Technical Details

- Height to Diameter (H:D) ratio of the cylindrical reactor ~ 2
- Loading rate ~ up to 40 kg/m^3/day COD
- Retention time ~ up to 3.5 hours
- Total Solid content of influent ~ up to to 3%
- Sludge Blanket's volume ~ 50% of reactor's volume
- Comparatively low maintenance

Applications

UASB reactor is a widely employed anaerobic system for sewage treatment in tropical countries. This technology is well-established in India with over 37 reactors being employed by 2014 for municipal sewage treatment, and Brazil with over 650 full-scale UASB installations by 2019.

Advantages

- Can withstand organic shock loads, thus lower reactor volumes
- Lower nutrient removal & sludge production
- High efficiency even at high organic loads
- Wide applicability (large and small scale)
- Shorter Hydraulic Retention Time (HRT)
- Lesser biosolids waste generation

Disadvantages

- Successive post-treatment may be needed to meet effluent standards, for pathogens removal & from a toxicological perspective
- Possibility of bad odour & corrosion issues
- Alkalinity addition can be required
- Longer start-up period
- Need to maintain temperature between 15°C–35°

References

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