

Design and Flow Simulation of a Biogas Purifier

Aim of the Project

The aim of this project is to design a biogas purifier compatible for an anaerobic digester. Flow simulations in SolidWorks is to then be performed to optimize the design.

Objectives

- Research on different types of biogas purification processes is done in terms of complexity and efficiency.
- The design of the purifier must be compatible with the anaerobic digester.
- The creation of a SolidWorks assembly is made.
- Flow Simulations on SolidWorks are performed on parts of the assembly to optimize the parts.
- Attach the purification system to the anaerobic digester in SolidWorks.

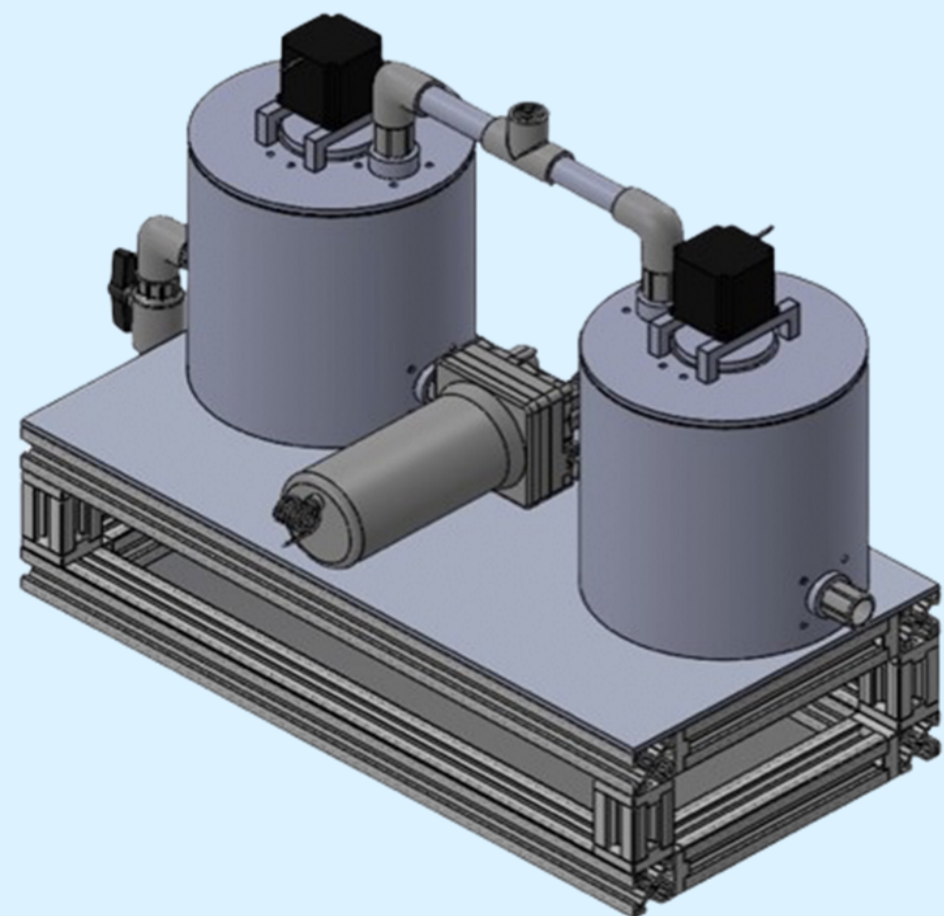


Photo of: 3D model of the Anaerobic Digester

Background

Anaerobic Digestion involves the breakdown of bio-material which creates biogas and biowaste. Biogas is a methane based gas that can be used as fuel for energy. Biowaste is the leftover bio-material that can be used as fertilizer.

The process usually takes place in a tank where the biowaste is slowly agitated over a prolonged period of time. Due to the types of material used, the fluids, and the length of time the process takes the containers used are generally made of high resistant material like stainless steel.

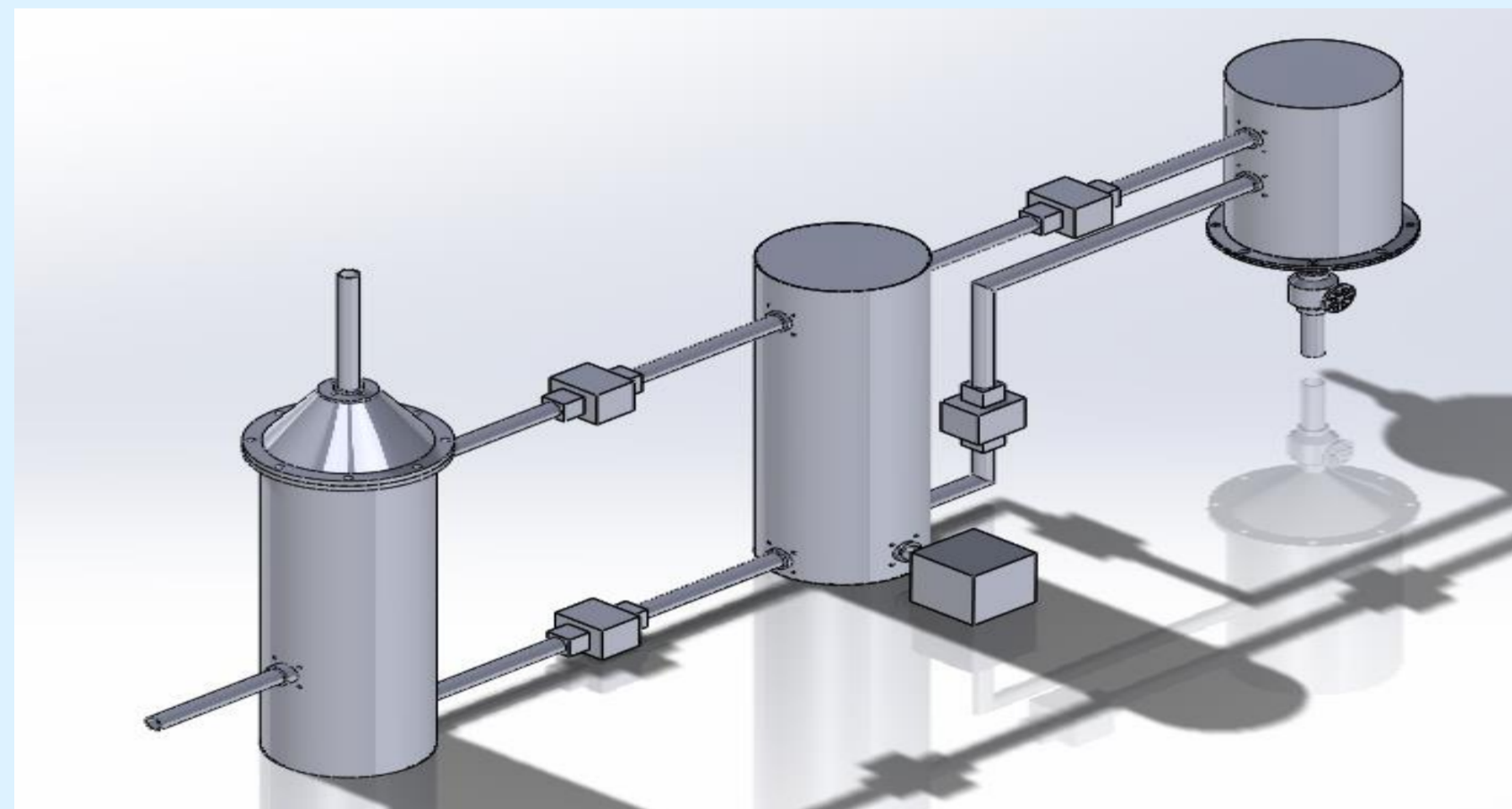


Photo of: SolidWorks Model of Water Scrubber

Flow Simulation

A flow simulation on SolidWorks is performed on the first tank to analyze the spread of the water introduced to the tank. Lids are created on the nozzles on the pipe to enclose the pipe. Parameters are set up to begin testing which includes units, physical features, defined fluids, wall conditions and initial conditions.

To determine the best spread of water three variables are changed throughout the tests:

- Volume Flow Rate (m^3/s)
- Nozzle Angle
- Velocity of Fluid (m/s)

The combination of these tests is the most efficient design for the tank and pipe.

Property	Fluid	Flow Rate	Angle	Velocity
Value	Water	0.5	68.2	0.15

Biogas Purification

Biogas Purification is a process that improves the biogas by making a higher concentration of methane in the gas.

Biogas purifiers can be scaled for residential for cookers or industrial uses as a product or to be used on the site.

There are four main types of processes:

Pressure Swing Absorption	Amine Solvents
Membrane Permeation	Water Scrubbing

Water Scrubbing

This is a simple purification process that involves cleaning the gas with water. It is a three tank process.

In tank 1, the gas is introduced and rises, from a pipe above water is spread around the tank collecting all the impurities in the gas. In tank 2 the water is pumped into it, where air is introduced to the water to clump up the impurities. In tank 3 the impurities rests at the bottom into a sludge where it exits the system. The water is now in a cycle.

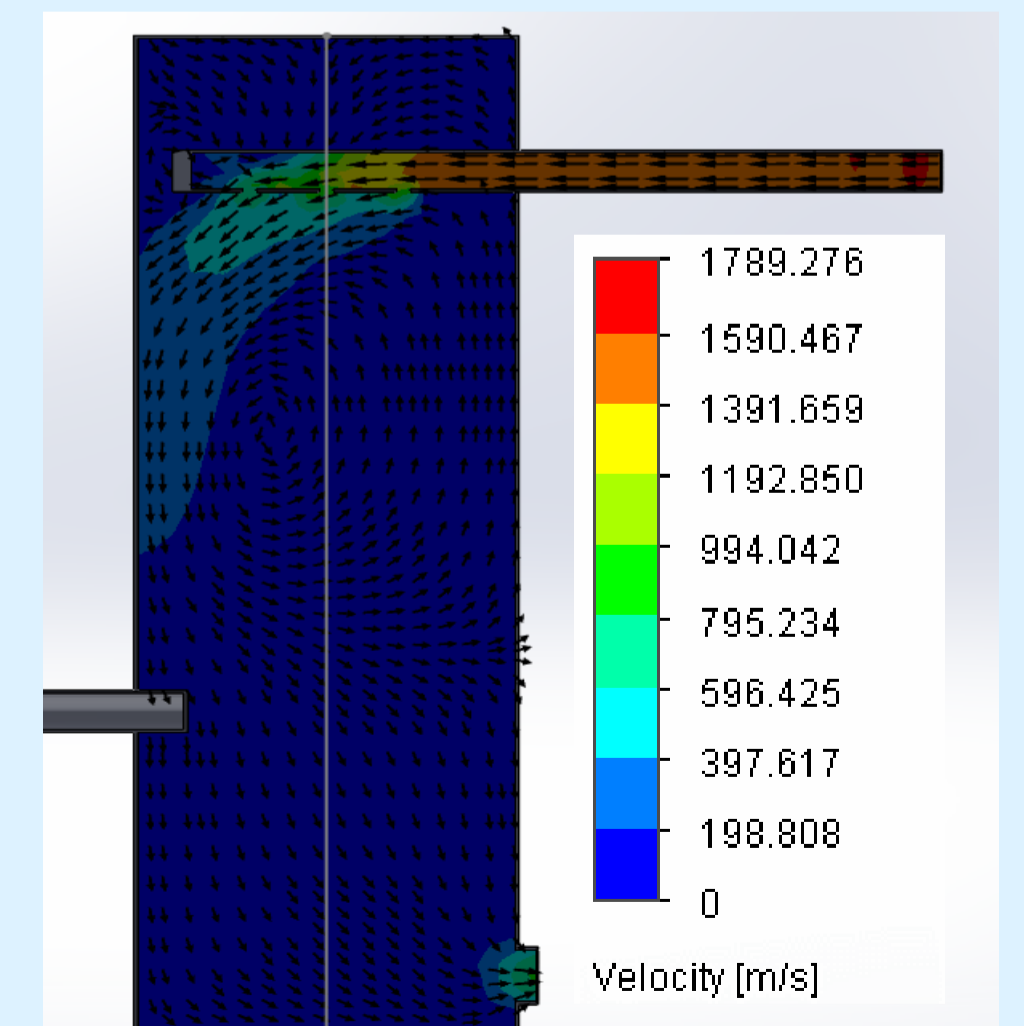


Photo of: Flow Simulation of Tank 1 with Results for Velocity