

Learning Activity Lesson Plan

Author Name: Gene Hilgenberg

Activity Title:	Batch Generation of Biogas
Goals/ Objectives:	Upon completion of the lab students should be able to explain the process of biogas production and construct a batch biogas digester.
Brief Overview:	Designed to have students construct a simple batch biogas digester and then monitor gas production produced by the digester. The students will need to know the basics of anaerobic digestion and the components needed to construct a generator and produce biogas.
Type of course this activity would be best suited for:	This lab activity would work for any class that deals with alternative energies, biomass management, or animal production.
Prerequisite knowledge:	Basic science with knowledge of gases, combustion, pathogens, aerobic and anaerobic microbial fermentation, and biomass feedstock.
Time Required:	1-2 hours to teach basic biogas production 1 hour to construct the digester.
Materials:	<ul style="list-style-type: none"> • Five gallon plastic bucket with lid. • Clear plastic 2 liter bottle with lid • ¼ inch flexible plastic tubing (3-4 feet length) • ¼ x ¾ hose barb • Mylar balloon • Silicone sealant • Biomass feedstock such as animal manure, food waste, etc.
Methods:	<p>Drill hole in the bucket lid the same size as the outside diameter of the flexible plastic tubing.</p> <ul style="list-style-type: none"> • Drill two holes in the lid of the 2 liter bottle. • Cut a 6 inch long piece from the plastic tubing and insert this tubing into one of the holes in the 2liter bottle lid to the depth of 1 inch. This should leave approximately 5 inches of tubing extending from the lid. Seal around the tubing and lid with silicone sealant. • Insert the remaining piece of plastic tubing into the second hole in the

	<p>2liter bottle lid to the depth that would cause the end of the tubing to be approximately 2 inches from the bottom of the bottle when the lid is in place. Seal this tube to the lid with silicone sealant.</p> <ul style="list-style-type: none"> • Insert the other end of the long piece of tubing into the bucket lid to the depth of 1 inch and seal the tubing to the lid with silicone sealant. • Fill 2/3 of bucket with feedstock and water. (Experiment with the ratio of solids to water. A good starting point is approximately 8% solid). • Seal bucket lid onto bucket with silicone sealant. Be sure there is an air tight seal. • Fill bottle ¾ full with water and seal lid onto bottle. • Attach hose barb on end of the short piece of tubing extending from the 2liter bottle and attach Mylar balloon to hose barb • Place digester in a warm environment such as a greenhouse. The more warmer and constant the temperature the more efficient the gas production. • Agitate the slurry once a day by lifting and swaying the bucket. • Gas production can be metered by measuring the Mylar balloon.
<p>References : (Copyright Free)</p>	<p>Lesson 1, A Classroom Approach to Understanding Anaerobic Digestion of Municipal Solid Wastes. USF College of Engineering. Jason Adams, Pete Stroot.</p> <p>Remade Scotland. Monnet, F. November 2003. An introduction to anaerobic digestion of organic wastes, Final report. Retrieved July 19, 2007, from http://www.remade.org.uk/documents/Reports/An%20Introduction%20to%20Anaerobic%20Digestion%20_27153953177.pdf</p>
<p>Extension Activities:</p>	
<p>Standards:</p>	