How to Build a Low-cost Ferrocement Biogas Digester

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FERROCEMENT IN WASTEWATER FACILITY CONSTRUCTION

Ferrocement is a highly economical method of making septic tanks, baffled reactors (shown here).
FERROCEMENT IN WASTEWATER FACILITY
CONSTRUCTION

Anaerobic filter tanks
BIOGAS QUICK FACTS

1. Mainly methane plus some CO$_2$ (25%-50%). Methane- greenhouse gas several times more potent than CO$_2$. One cubic meter = 0.5 litres diesel.
   One kg of compostable matter = theoretically 0.4m$^3$ biogas, but in practice only one-half to $\frac{3}{4}$ of this is attained.
How Biogas is produced in Digesters

1. **Hydrolysis and acid formation in waste** by acid-forming bacteria *(hardy, active)*

2. **Production of methane from acids** by methane bacteria *(sensitive)*.
ALL-FERROCEMENT BIO-DIGESTER (PCWS MODEL)
ALL- FERROCEMENT BIO-DIGESTER (PCWS MODEL) FEATURES

1. Volume = 1.2m³ displacement chamber, 3m³ digester/gas collector chamber.
2. Co-axial displacement vessel and digester; saves space and facilitate piping and maintenance.
3. Cost: PhP8,000 in materials (50%) and labor. This does not include professional fee of engineer.
4. Good for at least 8 pigs.
5. up-sizeable design to at least 25m³.
BUILDING THE ALL-FERROCEMENT BIO-DIGESTER
Laying the Patterns
Bending the mold rebars
Welding the molds

Digester mold welding
Displacement chamber mold

Walling-in culvert mold welding
Finished molds
After cutting, the panels are clad in wire mesh.
Here the digester mold is re-assembled and wrapped in polyester curtain cloth.
Meanwhile, the hole for the biogas digester is dug.

Gravel base course for the base
Wire reinforcement for the base is laid, then cement is poured.
The digester mold wrapped in cloth and standing on the fresh-cast base

First mortar coating of the digester.
Vertical wires reinforcement for the digester.

After the horizontal wiring is laid, a finishing mortar coat.
The digester is de-molded and finished inside.
The displacement chamber is made in the same way: wrapping the assembled mold in polyester curtain cloth.
The displacement chamber mold is set atop the digester.
After a coating of mortar, the reinforcing wires are laid, the outside is finished and after a day, the chamber is de-molded. The insides are then finished (not shown).
The sludge/solid waste box and the pipings are installed.
A lid is made for the box and manhole.

A biogas burner is made from some aluminum tubing and a beer can.
If the water table in a project site is low, the tanks can be prefabricated aboveground before setting into the excavation.
Finished but still needs leak testing, connecting to burner and operationalization.
PCWS Bio-digester Version 2: PVC Tarp Gas Collector

Why tarp?

1. Cheaper (PhP5,000 per 1.8m³ x 2m³ digester)

2. Does not require skilled mason for the ferrocement gas collector

2. Safer and easier to maintain.
PCWS Biodigester
Version 3
(for piloting):
Urban Bio-Digester

Small diameter of 120cm will fit into more spaces in congested urban communities
Urban Digester Mold System
SOME FUTURE PROSPECTS FOR BIOGAS AND OTHER LOW-COST WASTEWATER TREATMENT

1. Possibility of replacing petroleum fuels if means to utilize cellulosic wastes are developed.

2. High-energy manure such as from pigs will probably be more valuable if a process for turning them to aquaculture feeds is found.

3. Try out /develop even cheaper wastewater treatment innovations to make them affordable:

4. Innovations for retrofitting existing wastewater installations for biogas harvesting and more efficient wastewater treatment.
SUCH AS:

LARGE BAG IN THE GROUND DIGESTER (CONCEPT)
SUCH AS:
SUCH AS:
5. Prospect of Developing Bacterial Fuel Cells (Electricity Direct from Biogas or Digesting Microbes)
For more information please contact

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