How to Build a Low-cost Ferrocement Biogas Digester

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

Anaerobic filter tanks

Diagram of 2.2 m³/day Anaerobic Filter (ferroconcrete, built in A1629) with details like layers of gravel, stones, and support structures.
FERROCEMENT IN WASTEWATER FACILITY CONSTRUCTION

GENERAL BIOGAS PLANT

Possible places for latrine connection

Compost pit 1

Compost pit 2

PLAN

GROUND

E

20

90

Inlet

Turret

Composted

Dome

Outlet

LEVEL

15

35

50

H

35

D

40

60
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: PhP12,000 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.
BIOGAS PIPING & BURNER

optional flame head
(say plum G sheet)

kettle

burner housing
(say old LPG stove casing)

moisture drain:
at low point pipeline
PVC tee; caulked w/ chewing gum
plastic faucet w/ positive locking
(cathode wire caulked; cathode reinforced by polyester sewing thread)

called PE pipe:

pe valve:

GAS VALVES:
2 plastic faucets w/ positive locking & nozzle; one as on/off faucet & the other as flow control
**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**

3. **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:
5. Prospect of Developing Bacterial Fuel Cells
   (Electricity Direct from Biogas or Digesting Microbes)
For more information please contact

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