Results of a Value Adding Test to Produce Alternative Fuels and Raw Materials (AFR) for Industrial Purposes and for Household Energy Supply with Appropriate Technology

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BACKGROUND

The application of ***"Waste-to-Energy"*** is hardly practiced in developing countries. However, a utilization as ***"Alternative Fuels and Raw materials"*** (AFR), for instance in cement kilns or for household energy supply (e.g. for substituting charcoal) can be a viable option. Materials that can be utilized as AFR include biodegradable waste from agriculture and forestry, but also light density packaging and various plastic materials from Municipal Solid Waste, whereas the latter are hardly utilized in most developing countries so far. The recovery and utilization of AFR can open up new sources of income and can also help to reduce pressures on the local resource base.

Starting on September 3, 2008, a 100-days test to recover AFR was conducted at the central Material Recovery Facility (MRF) at Calahunan in Iloilo City. The test was conducted over a period of 100 days allowing to establish "routine like working conditions" and to derive impacts and lessons learned.

Within this test various options have been discussed to add more value to the recovered AFR, which could provide access to additional markets. Several value-adding processes were considered, for instance shredding and bailing of AFR, as well as pelletizing and briquetting.

MATERIALS UTILIZED IN TEST MIXTURES

- Shredded light packaging materials from MSW
- Carbonized Rice Husks (CRH)
- Saw dust
- Waste paper mashes
- Corn starch
- Water

MAIN FINDINGS

Light packaging materials as recovered at the central MRF of Iloilo City can be processed into pellets for industrial purposes together with organic waste materials, like CRH and sawdust. The particle size should be smaller than 0.25 inches (or 6 millimeters). The particle size of CRH and sawdust (also for the household fuel) must be much smaller than this, i.e. < 0.04 inch (or 1 millimeter). Using the hand driven pellet machine, an output per hour of 15 kg is possible, which corresponds with a daily output of 120 kg; far too low to be significant in terms of a potential application at the central MRF Iloilo City.

The production of briquettes for household purposes (for instance for cooking) is possible. The necessary ingredients are CRH, sawdust, cornstarch and water. Using a hand driven briquette molder as described above, a single person could achieve an output of approximately 5 kg/hour or 40 kg/day, respectively. The test further revealed that paper alone cannot replace starch as a binder.

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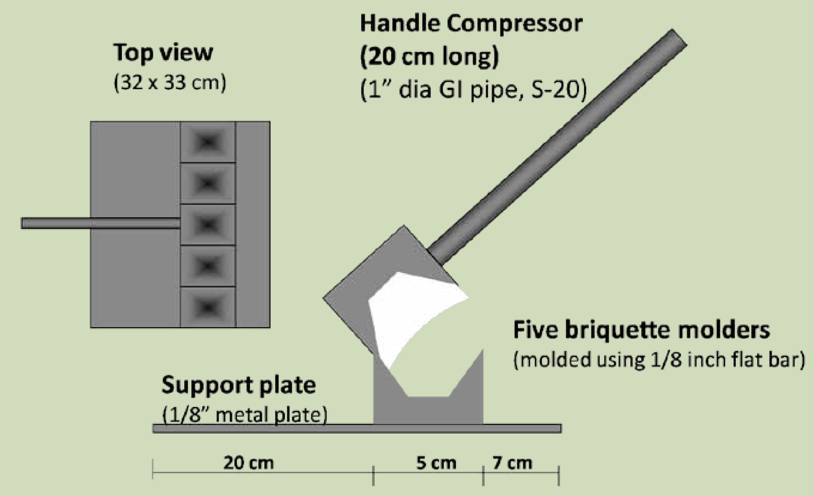
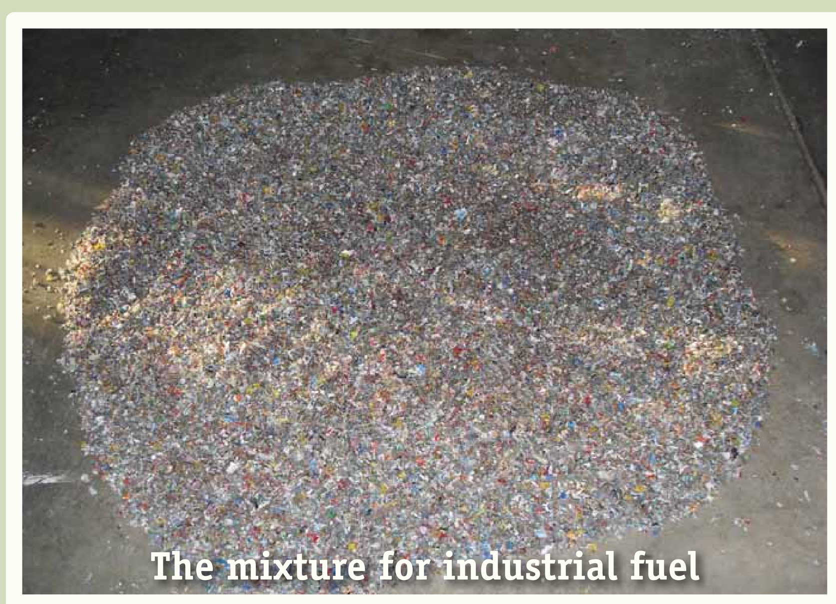
KEY ISSUES AND OBJECTIVES

Various packages, synthetic and plastic wastes can be recovered as AFR but must under no circumstances be burned in conventional or household stoves. However, AFR can be utilized by the cement industry with clearly set standards on content and quality of AFR. At the same time, the required quality needs to be attained locally without the use of sophisticated and expensive equipment, in order to allow a sufficient income generation. The presented research summarizes the findings of a value-adding test with the objective to identify suited mixtures for the production of either pellets for industrial use as AFR or briquettes for household application, whereas the latter only use wasted organic materials.

Schematic diagram household molder



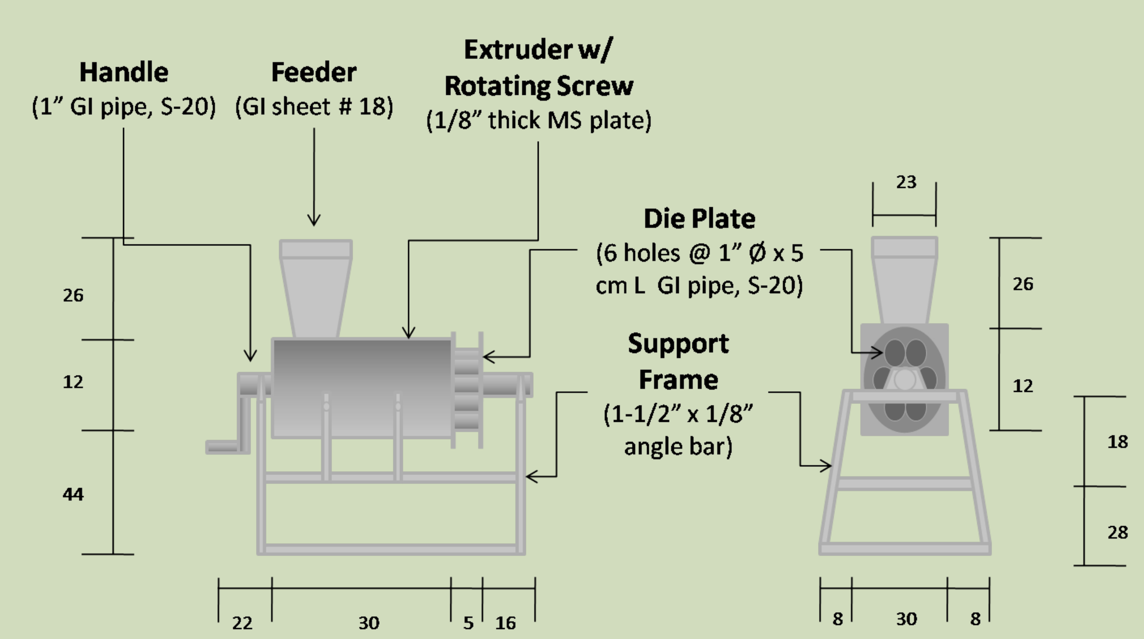

The mixture for industrial fuel


The household molder


The mixture for household fuel


The hand-driven pellet machine

Schematic diagram of hand-driven pellet machine



Right Side View of the Pellet Machine
(all units in cm, except when specified)

Front View of the Pellet Machine
(all units in cm, except when specified)

These Mixtures Were Tested

Plastic		CRH		Sawdust		Paper		Cornstarch		Water	
2500g	42%	500g	8%	500g	8%	/	/	2500g	42%	2000g	25%
2500g	39%	500g	8%	500g	8%	/	/	3000g	46%	2000g	24%
1500g	25%	2000g	33%	1000g	17%	/	/	1500g	25%	3000g	33%
1000g	18%	2000g	36%	1000g	18%	/	/	1500g	27%	3000g	35%
500g	10%	2000g	40%	1000g	20%	/	/	1500g	30%	3000g	38%
/	/	3000g	55%	1000g	18%	/	/	1500g	27%	2000g	27%
/	/	2000g	53%	500g	13%	/	/	1250g	33%	2000g	34%
/	/	2000g	47%	1000g	24%	/	/	1250g	30%	2000g	32%
/	/	2000g	50%	1000g	25%	/	/	1000g	25%	2000g	33%
/	/	2500g	50%	1000g	20%	1000g	20%	500g	10%	2000g	29%
/	/	2500g	50%	1000g	20%	1500g	30%	/	/	2000g	29%
/	/	2000g	40%	1000g	20%	2000g	40%	/	/	2000g	29%
/	/	1000g	20%	1000g	20%	2500g	50%	500g	10%	2000g	29%
/	/	1000g	20%	1000g	20%	3000g	60%	/	/	2000g	29%
/	/	/	/	/	/	5000g	100%	/	/	2000g	29%

These Mixtures Were Viable

Plastic		CRH		Sawdust		Paper		Cornstarch		Water	
5	39%	1	8%	1	8%	/	/	6	46%	4	24%
/	/	8	47%	4	24%	/	/	5	30%	8	32%
/	/	2	20%	2	20%	5	50%	1	10%	4	29%
/	/	/	/	/	/	10	100%	/	/	4	29%

CONCLUSIONS

The equipment used was designed to be affordable, low-tech, easy to handle and without intensive training need for application. All materials are locally available as waste and hence a production could be started easily. Based on the test results it seems feasible to continue with a field production test, perhaps for individual or micro-enterprise production and private household consumption.

NEXT STEPS

- Testing the physical and chemical properties of the pellets and briquettes (also including an oxidation analysis and determination of the properties of the ashes).
- Assessment of the risk of indoor air pollution using the household fuel.
- Testing of the viable mixtures on a larger scale.
- Replacing the binder by a cheaper material.
- Checking the use of the household fuel in combination to other technologies, especially energy efficient and smoke free stoves.
- Developing a toolkit for the household fuel production, which includes the briquetting machine, instructions on the production procedure and the mixing ratio/process.