

## Experience on domestic waste segregation in Ghana

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**ABSTRACT:** Pollution from domestic wastes is a major environmental challenge in Ghana and many developing countries. Most of these countries depend almost entirely on landfills for waste management, which has proved to be expensive, inefficient and unsustainable. A sustainable solution to this problem is productive use of waste such as recycling. The main challenge that may limit recycling in Ghana and some of these countries is that a chunk of the wastes are littered on the environment, and the rest is collected in bulk in the same waste bin, thereby mixing them. The cost of collecting littered wastes, or separating mixed wastes could be prohibitive, making recycling uneconomical. In order to productively utilize wastes, adequate and separate waste bins must be provided for collecting the different components of wastes. However, budgetary constraints may not allow many countries to purchase expansive waste bins for the different components of wastes. Consequently, a simple waste bin, comprising a metal frame on which polypropylene sack (pp-sack) can be hanged to collect inorganic wastes has been developed by the author. The waste bin (new bin) can be manufactured industrially using plastic or fabricated by local artisans at an affordable price. This document describes the new bin. Experience in collecting organic and inorganic wastes generated in a house in separate waste bins (waste segregation) for the past 16 years is also highlighted.

**KEYWORDS:** Domestic wastes, waste bin, recycling, pollution, waste segregation.

### 1 INTRODUCTION

A major environmental problem in many countries is pollution from domestic wastes, particularly polyethylene wastes. A sustainable solution to this problem is recycling, but recycling rate is very low in many countries. Out of the about 5 trillion polyethylene bags that are used per annum in the world; only 1% is recycled [1], [2], the rest end up in landfills and other parts of the environment. Two main factors could limit large scale recycling of wastes in Ghana and many developing countries. Firstly, these countries use the bulk method of waste collection, in which the same waste bin is used to collect all the components of wastes (plastic, organic, glass, metals etc) thereby mixing them. Secondly, a chunk of the wastes is littered on the environment, particularly along road sides, city streets and gutters. The cost of separating the mixed wastes or collecting and cleaning the littered wastes could make recycling unprofitable. These countries therefore, depend almost entirely on landfills to manage domestic waste, which has proved to be expensive and inefficient. In Ghana, waste management companies often have difficulties in acquiring new landfill sites to dump wastes. This shows that waste management that depends entirely on landfills is not sustainable. Other problems associated with dumping wastes in landfills are vegetation damage, unpleasant odours, ground water pollution, air pollution and global warming [3]. The root cause of littering in Ghana is that there is inadequate and often complete absence of waste bins in many homes and public places. It has become a normal practice in the country for people to drop wastes on the ground. Of greater concern is the fact that there are no waste bins in playing and feeding grounds of many schools in the country. If this situation persists, children from these schools will acquire the habit of littering, which could be difficult to change when they grow old.

A sustainable solution to the domestic waste problem is productive use of wastes such as recycling. This can succeed only if separate and adequate waste bins are provided for collecting the different components of wastes as done in advanced countries. This will reduce the cost of salvaging the different components of wastes, and make recycling profitable. Waste

bins are inadequate in Ghana largely because they are very expensive. The common waste bins used in the country are made of plastic. Some landlords in the country collect wastes in polypropylene (pp)-sacks/bags and other containers when their plastic waste bins are full (figure 1 right).



**Fig. 1. Feeding ground of a school in Ghana without waste bin, littered with polyethylene wastes, (left). Wastes in pp-bag and other containers at an entrance of a house in Ghana (right)**

This shows that it is feasible to collect wastes in pp-sacks. However:

- The sacks are not covered therefore the wastes emanate strong stench and breed houseflies.
- Stray domestic animals often pull the sacks down and scatter the wastes in them, creating unsightly situation.
- It is not convenient for one person to open and fill a sack with wastes.
- A sack on the ground cannot serve as waste bin at public places.

Different types of frame on which bags are hung for collecting wastes are used in many countries. However the known frames are complex to fabricate. Furthermore such waste bins are not used in Ghana and most developing countries. This document is on a new bin (developed by the author) comprising a metal frame on which a sack is hung for collecting inorganic wastes. The frame is very simple compared to the existing frames and can be fabricated locally at an affordable price. The document also highlights experience on waste segregation at the household level and how it can be promoted.

## 2 DESCRIPTION OF THE NEW BIN

The new waste bin comprises a metal frame on which pp-sack is hung for waste collection. The frame has an upper portion and a lower portion both of which are square (can be circular) in shape and are joined together by two bars as shown in figure 2 (left).



**Fig. 2. Metal frame for hanging pp-sack (left), frame holding pp-sack covered with black polyethylene (middle); a full assembly of the new bin (right)**

There is a pin at each of the four corners of the upper portion on which the sack is hanged. The lower portion of the bin frame serves as platform for the sack. The bin is assembled by hanging pp-sack on the pins and the sack is covered by black polyethylene as shown in figure 2 (middle). A full assembly of the bin has a cover (figure 2, right). The sack is reusable and can last up to 1 year before it may be discarded. Importantly, it can be replaced when it is full to prevent wastes overflow. The bin has a volume of about 400 litres or more depending on the size of the sack used.

## 2.1 Costs

On commercial production, the new bin is expected to cost about GH¢ 20.00 (US\$10.00) per bin compared with GH¢ 200.00 for the common plastic bins which rather are of a lower volume; 250 litres. According to Ghana Statistical Service, there are about 5 million households in the country. Currently most households have only one of the common plastic bins for waste collection (personal observation). In order to shift to waste segregation, each household would need 1-4 extra waste bins depending on the extent of segregation (separate bins for organic, plastics, paper, glass, metals and others).

Table 1 shows the budget needed to purchase the two types of bins depending on the quantity (assumed) that may be adequate to effectively collect wastes in Ghana. If 4 extra bins are to be provided for each household to segregate wastes, 20 million bins will be needed. This would cost GH¢ 4 billion and GH¢ 400 million if the common plastic and the new bins are used, respectively. In this case, the new bin would save the nation GH¢ 3.6 billion. If 5 million bins were needed, GH¢ 900 million will be saved by using the new bin instead of the common plastic bins. This does not include bins for waste collection in public places.

**Table 1. Quantity (assumed) and costs of bins needed to effectively collect wastes in Ghana**

Quantity of bins required (millions)	----- Total costs of bins (million GH¢) -----		Cost difference (million GH¢)
	Common bin @ GH¢ 200 per bin	New bin @ GH¢ 20 per bin	
20	4000	400	3600
10	2000	200	1800
5	1000	100	900

## 2.2 TESTING THE NEW BIN

The new bin has been used to collect inorganic wastes in my house at Kwamo, a suburb of Kumasi in Ghana from 1997 to date. The house is a fully detached apartment with six residents. Two of the residents are employed by the public sector and the rest are students of High School. Before the bin was introduced, all the household wastes were collected in the same bin as generally done in the country. With the introduction of waste segregation, two small bins were placed at the kitchen for inorganic and organic wastes (figure 3 left). The inorganic wastes were emptied into the new bin, and the wastes were dumped at the refuse site whenever the sack was full; because there is no recycling company around to absorb the wastes. Organic wastes on the other hand (mainly from the kitchen) were dumped in a temporary composting bin, installed at the home garden. The temporary bin is a plastic barrel with a volume of 250 litres; the top and bottom is open (figure 3 right). When the temporary composting bin was full, the wastes were heaped on the ground, composted, and the compost used for growing vegetables in the garden.



**Fig. 3. Inorganic and organic wastes in separate bins at the kitchen (left), organic wastes harvested from the temporary composting bin (right) ready to be composted.**

### 3 OBSERVATIONS

1. Initially pp-sack was hanged on the metal frame for waste collection but the sack biodegraded when exposed to sunlight for about 4 weeks. This problem was solved by covering the sack with black polyethylene. With this arrangement, the sack could be used for about 1 year before it got spoilt. It must be added that black polyethylene bag alone was not strong to accommodate more wastes.
2. Initially members of the house misplaced wastes in the different bins (e.g. organic wastes in inorganic bin) but this mistake ceased about 2 weeks after practicing waste segregation.
3. On the average, it took about 1 month for the sack to be filled with inorganic wastes.
4. On the other hand, it took about 5 months for the temporary composting bin to fill up. It took so long for the bin to fill up because the old wastes partially decomposed with time thereby creating more space.
5. Housefly (*Musca domestica L*) maggots grew in the organic wastes in the temporary composting bin. This was minimized by providing a cover for the bin.
6. Virtually no smell emanated from the organic wastes in the temporary composting bin, if the bin was closed.
7. Large quantities of edible mushroom sometimes grew on the compost heap during rainy seasons.

### 4 DISCUSSION

My experience on the bulk method of waste collection and waste segregation showed that waste segregation is far more advantageous. Waste segregation accumulates 'pure' organic wastes that can be composted for crop production. Even if the organic wastes were simply dumped at a refuse dump and unattended to, they would decompose naturally, and the resultant compost could be harvested and used to grow crops. In Ghana, this compost is called 'black soil', and it is in great demand for horticultural purposes. In general, domestic wastes in developing countries consist of over 50% organic material [4]. Studies done in Indonesia and Colombia found residential wastes composed of 78% and 90% compostable material, and market wastes 89% and 90% compostable respectively [5]. In India, about 45% by weight of municipal solid wastes in the cities is compostable [6]. Similarly, compostable material in municipal wastes from seven cities in Nigeria ranged from 30%-76% [7]. Thus collecting organic wastes in separate bins and composting for crop production could reduce the waste burden by 50% or more.

There is a scheme in India, which residents collect wastes in two categories-organic and inorganic [8]. The organic wastes are fed into composting pits and processed into compost for crop production, whilst trained rag pickers sort the inorganic wastes further for recycling. The benefits of this scheme include

- Accumulation of valuable recyclable materials
- Compost for crop production
- Reduced burden on landfill sites
- Reduced cost of waste management on government.

In Ghana waste collection companies often do not collect waste promptly from residential areas. This results in waste bins overflowing with wastes, which emanate strong stench and breed houseflies. If only organic wastes were collected in the common plastic bin, it would take a long time to fill up. This means that the bin can remain closed for a long time, and this will virtually eliminate stench and flies. The inorganic wastes that do not smell can be collected in sacks and kept for a long time without any nuisance. Thus waste segregation can reduce the inconveniences that people go through when domestic wastes are not collected promptly. It is therefore, important to adopt waste segregation even if there are no facilities to recycle the accumulated wastes. Indeed it will be difficult for a major recycling program to succeed in a country like Ghana where the chunk of wastes is littered on the environment and the rest is collected in bulk. The program will not have enough wastes to recycle. Waste segregation generates recyclable materials, which can encourage investors to establish recycling factories. However, the best strategy would be to promote waste segregation alongside recycling.

It could take considerable time and effort for many developing countries to successfully adopt waste segregation. This is because the citizens generally have the habits of littering or putting all the components of waste in the same bin; and habits are often difficult to change. With strict supervision, it took about 2 weeks for members of my household to be accustomed to waste segregation. However, if any country fails to promote waste segregation now, the habit of littering and collecting

wastes in bulk will be passed on to future generations and create more serious problems in future. It is therefore a disservice to future generations if any country fails to stop the habit of littering and collecting wastes in bulk.

It should be easier for a country to begin waste segregation at homes and schools where family and school heads could supervise. If the citizens do not know how to use separate bins in homes and schools, waste segregation is not likely to succeed in public places.

For the past 16 years all the organic wastes in my house have been used as compost for vegetable production. If this is done in most homes, it would drastically reduce the wastes that end up in landfills and rather increase food production. It is therefore prudent for every country to promote home composting for gardening. It must be noted that home composting for gardening is a well developed industry in many countries. And there are firms that specialize in production of inputs for this industry such as home composting bins and worms to aid decomposition of the wastes. Countries that want to promote this industry must design a policy to ensure that new buildings have space for composting and gardening. It is however not feasible to compost wastes in every home; for example, compound houses or flats. Wastes from such homes may be composted at communal waste dumps, which exist in many settlements. Currently, city authorities in Ghana and other countries charge fees for collecting household wastes. In order to encourage waste segregation, households that segregate should pay less than those that do not. Charging waste segregators less is sustainable because the resultant wastes could be recycled to generate extra revenue.

The perception is that home composting produce strong stench. Indeed members of my house held that view before the system was introduced, but this turned out to be false. Home composting produces no more stench than toilet septic tanks, which most homes have. Another perception is that waste segregation involves extra work and time compared with the bulk method of waste collection. It sounds as if people have to separate wastes that are mixed together. This is not the case; rather anyone with waste simply puts it in the allotted bin.

One major problem that frequently occurs in Ghana is waste bins overflowing with wastes due to delays in collecting wastes. If this happens, people are compelled to drop wastes on the ground, causing unsightly situations. If the new bin is used to collect wastes, sacks that are full can be replaced by street sweepers.

Dumping wastes at landfills, gutters and communal dumping sites profusely breed house flies that spread diseases. As indicated above, there are specially designed bins with covers that are used in many countries to compost organic wastes at the household level. Home composting using these bins drastically minimizes the incidence of houseflies. Notwithstanding their nuisance, housefly maggots could be used to produce a meal (Magleal) which is rich in protein and suitable for livestock production [9]. In this regard, a company in South Africa, AgriProtein Technologies, has begun a magmeal program to produce sustainable protein feed for livestock like pigs and chickens [10]. Waste segregation requires substantial investment for acquisition of waste bins. At each point of waste collection, separate bins are needed to collect plastics, paper, glass, organic, and metallic wastes. Many developing countries have serious budgetary constraints, and may not be able to purchase multiple quantities of expensive bins. This problem could be addressed by using the new bin to collect inorganic wastes. The frame could be fabricated by local artisans or manufactured industrially using plastic.

## 5 CONCLUSION

The serious domestic waste management challenges confronting many developing countries could be ameliorated through productive use of the wastes. The first important step that must be taken in many countries to encourage productive use of wastes is the use of separate bins for collecting the various components of wastes. This method of waste collection requires substantial investment for the acquisition of waste bins. The initial investment could be minimized by using the new bin. Studies should be conducted to determine the potential of organic wastes from waste segregation as substrate for mushroom and magmeal production.

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