

# Making Waste Work: A Toolkit

## How to prepare plastics to sell to market

A step-by-step guide



### How-to guide 7

Part of  
**Making Waste Work: A Toolkit**  
for community waste  
management in low and middle  
income countries

Zoë Lenkiewicz and Mike Webster

Illustrated by Susan Hatfield

October 2017

[wasteaid.org.uk/toolkit](http://wasteaid.org.uk/toolkit)





WasteAid UK is a charity working to make an impact on the global waste emergency by:

- Partnering with local organisations to improve the health, environment and livelihoods of people without waste services.
- Building the skills of local people to deliver practical solutions to the waste management crisis in their own communities.
- Raising awareness of the benefits of proper waste management and campaigning for greater change.

[www.wasteaid.org.uk](http://www.wasteaid.org.uk)



CIWM (Chartered Institution of Wastes Management) is the leading professional body for the resource and waste management sector, representing around 6,000 individuals in the UK, Ireland and overseas. It awards the title of Chartered Waste Manager to qualifying members.

The objectives of the CIWM are to advance the scientific, technical and practical aspects of wastes and resource management worldwide for the safeguarding of the natural environment, to promote education, training, and research in wastes and resource management, and the dissemination of knowledge of the topic; and to strive to achieve and maintain the highest standards of best practice, technical competence and conduct by all its members.

[www.ciwm.co.uk](http://www.ciwm.co.uk)

#### **Creative Commons**

Under this licence, our work may be shared freely. This provides the freedom to copy, distribute and transmit this work on to others, provided WasteAid UK and CIWM are credited as the authors, text and images are unaltered. This work must not be resold or used for commercial purposes. These conditions can be waived under certain circumstances with the written permission of WasteAid UK. For more information about this licence go to <http://creativecommons.org/licenses/by-nc-nd/3.0/>

#### **Disclaimer**

The information in this Toolkit and associated How-to guides is provided in good faith and is intended as an indicative guide to the processes and activities referred to only, based on information provided by currently active operators and practitioners. It should not be taken as a definitive guide to the activities referred to, and should not be used as a substitute for undertaking a full site-specific health and safety risk assessment. WasteAid and CIWM recommend always undertaking a full feasibility and environmental and health and safety risk assessment, based on the specific conditions applying to the community, waste, and site in question. WasteAid and CIWM do not accept any legal responsibility for any errors, omissions or misleading statements, or for any injury or loss resulting from the use of or reliance upon the processes outlined in this Toolkit and associated How-to guides. WasteAid and CIWM are not responsible for, and cannot guarantee the accuracy of, information on sites they do not manage, nor should the inclusion of a hyperlink be taken in itself to mean the endorsement of the site, the site owner or any specific content to which it points.

## 7 How to prepare plastics to sell to market

*Sometimes it is more practical and profitable to collect and sell sorted plastics than to recycle them yourself.*

**Summary:** Collect, sort, clean and bulk different plastic materials in the right way. See *How to identify common types of plastic*, How-to guide 7.1.



***It is always better to work with clean, separated materials than with mixed waste.***

***Clean, sorted and bulked plastics are much more valuable.***

**Note:** The processes of sorting, cleaning and bulking materials to sell to merchants can also be applied to paper and card, metals and glass – provided there is a local market for these materials. The value of clean materials is calculated by weight. Since plastic does not weigh much it helps to do some additional processing to maximise the value of the material, for example gathering a large quantity, shredding, compacting, and baling.

**Quality:** Good quality materials are likely to fetch higher prices. Good quality materials are:

- Clean and dry, not covered in food waste or dirt or left out in the rain
- Very well sorted, with only the type of material that your buyer wants
- Compacted and baled to reduce transport costs

**Quantity:** Your buyers will want to know that you can provide a regular supply of quality material. If you have enough, they might send a vehicle.

**Storage:** It is important to have a place large enough to store collected material, keeping it dry, away from animals and safe from possible theft.



*When you are dealing with plastics:*

- *Only use the flame test as a last resort.*
- *Be very careful that you are clear on which type of plastic you are handling and that there are no other types mixed in. This is very important when doing the flame test.*
- ***NEVER BURN PVC – IT IS EXTREMELY TOXIC.***
- *Plastic waste may be dirty and could carry disease, especially if it was used for packaging food before and is stored where rats can touch it. Always wash your hands after dealing with waste plastic.*

## How to increase the value of your plastic

### 1. Cleaning

If plastic is clean it is more valuable. You can wash it before, during or after sorting (floating in water is also a good way to sort the plastics).

- Empty any contents of containers into prepared collection barrels
- Remove other materials and the wrong plastics – remove lids and paper, plastic or metal labels
- **Manual washing:** This can be done in large drums or containers. If the plastic is covered in oil, then use hot water with soap or caustic soda (use gloves if using caustic soda)
- **Mechanical washing:** Use a water filled container with a motor with paddles at low speed. The plastic is left to soak whilst the paddles stir continuously. The dirt settles out and the plastic is removed with a drainer.

### 2. Drying

Either leave in the sun or dry with a fan and gas burner.

### 3. Sorting

You need to do this to the requirements of your customers, but this is often the way that is needed:

- Remove all materials that are not plastic (such as paper labels or metallic stickers)
- Separate films (soft plastics) from hard plastics
- Separate the plastic types (PVC should always be separated, as a minimum)
- Separate films into transparent and mixed colour
- Separate rigid PE materials into light (transparent and white) and mixed colour.

### 4. Agglomeration

You might want to do this with film plastic so it takes up less space and makes it easier to handle and sell. An agglomerator consists of a vertical drum with a set of fast moving blades at the bottom, which chops the sheets into thin film flakes. Due to the cutting and friction energy of the process the flakes become warm, and start to melt and form crumbs or agglomerate (join together). This will increase the bulk density of the material so it can be fed directly into reprocessing machines.

## 5. Reducing the size of plastic

Making plastics denser helps reduce transport costs and can be more easily fed into reprocessing machines. There are different ways to do this:

- A. Cutting: You can cut materials, like gallon containers, into smaller pieces to make it easier to transport or feed into shredders (3 labourers, each with scissors, can cut up 1 tonne of sorted plastic per day).
- B. Shredding: This will cut plastics into small enough pieces to transport or reprocess. You can use a mechanical shredder (a small one with a 5kw motor could be used to start and grow as you save more money). If you have not already washed the plastics, you can now easily rinse with water or remove any dirt or dust.

*To build your own plastic processing machines see free blueprints online<sup>1</sup>.*

- C. Flaking: If you have a hammer mill you can produce plastic flakes, which are easier to handle in industrial processes.
- D. Baling: You can use handmade or bought machines, you can get up to 15 times more plastic in the same space if you bale.

Type of material	Loose weight of material	Baled weight of material
PET (soda bottles, food packaging etc.)	18-24 kg/m <sup>3</sup>	240-350 kg/m <sup>3</sup>
HDPE (milk jugs, detergent containers)	13-14 kg/m <sup>3</sup>	240-300 kg/m <sup>3</sup>

Figure 1: It is much more efficient to transport material that has been baled<sup>2</sup>.

<sup>1</sup> Blueprints are available from Precious Plastic: <https://preciousplastic.com>

<sup>2</sup> WASTE (2011) *Solid Waste Entrepreneurship Guide*.

## How to identify common types of plastic

If you work with plastics regularly you will soon find it easy to identify the most common types of plastic simply by their look and feel.

There are three other simple ways to identify different plastics.

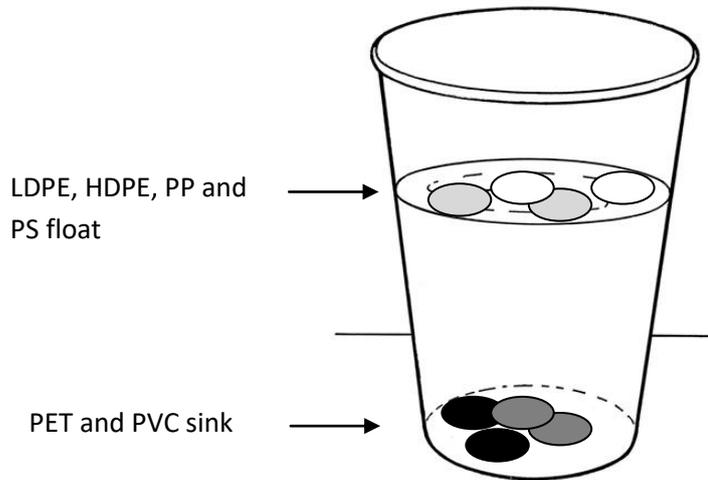
### 1. See if you can find an identification number

Recycling Number	Abbreviation	Full name
	PETE or PET	Polyethylene terephthalate
	HDPE or PE-HD	High-density polyethylene
	PVC or V	Polyvinyl chloride
	LDPE or PE-LD	Low-density polyethylene
	PP	Polypropylene
	PS	Polystyrene
	OTHER or O	Other plastics, such as acrylic, nylon, polycarbonate, and polylactic acid (a bioplastic), and multilayer combinations of different plastics

Figure 2: Plastics can be identified by their recycling number.

## 2. Float test

Cut out a flat piece of the plastic, about the size of a coin and put it in fresh (not salt) water (it doesn't have to be clean water):

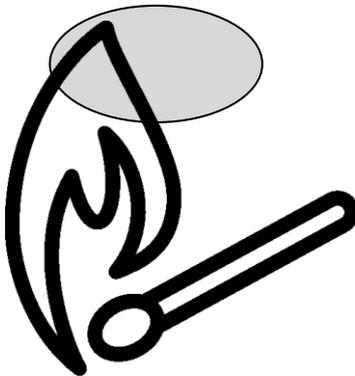


## 3. Flame test

Only do the flame test if you have tried everything else and are still unsure which plastic it is.

Take a small piece of your plastic, the size of a coin. Go outside to a well-ventilated area away from other plastics. Hold the plastic away from your body and light it using a long stick or match:

- Observe the colour of the flame. LDPE, HDPE and PP have a blue flame with a yellow tip; PET and PS have a yellow flame with dark smoke; PVC has a yellow flame with a green tip (avoid burning PVC if possible).
- See how easily it burns. HDPE and LDPE burn easily – be very careful if you are testing this type of plastic because it can melt and drip; PVC will light but not so easily and does not drip; PET also lights but not so easily and bubbles as it burns.
- Note the smell from the smoke. If you must, and this is strongly advised against, waft the smoke towards you and take a quick smell of the smoke to give you further clues as to the type of plastic you are handling. **WARNING:** if you have already identified the plastic from other methods and particularly where you suspect the plastic is PVC, do not burn it.



- PET smells similar to burnt sugar
- LDPE and HDPE smell like candle wax
- PP has a sweet smell
- PS smells like gasoline
- PVC has an acrid smell like chlorine – if you accidentally burn PVC stay away from the smoke and gas it releases, and put out the fire immediately.

## 1 PET (Polyethylene Terephthalate)

Common uses for PET are:

- Water or soft drinks bottles
- Food trays and containers
- Hair product bottles.



PET is clear and tough and stops gases or liquids entering. It becomes softer at around 80°C. Lids and labels are made from other plastics.

### What can PET be recycled into?

PET plastic is crushed and then shredded into small flakes which are then reprocessed to make new PET bottles, or spun into polyester fibre. This recycled fibre is used to make textiles such as fleece garments, carpets, stuffing for pillows and life jackets, and similar products.

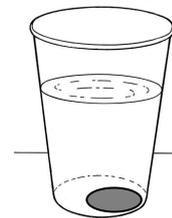
NOTE: PET is intended for single use applications; repeated use increases the risk of chemicals seeping into the liquid and bacterial growth. PET plastic is difficult to decontaminate, and proper cleaning requires harmful chemicals.

### How can I tell something is made of PET?

1. Look: PET containers are clear, sometimes have a “1” printed on them and are often used for water or drink bottles. They have a bump on the bottom of the bottle.



2. Float test: PET will sink in water.



3. Flame test:

- Yellow flame
- Plastic drips
- Burns slowly
- Smells like burnt sugar
- Light smoke with soot (floating particles).



## 2 HDPE (High-Density Polyethylene)

Common uses for HDPE include:

- Detergent and oil bottles
- Toys
- Heavy-duty plastic bags
- 'Gallon' containers for holding fuel, oil etc.



### What can HDPE be recycled into?

HDPE is the most commonly recycled plastic and is considered one of the safest forms of plastic. It is a relatively simple and cost-effective process to recycle. It is very hard-wearing and does not break down under exposure to sunlight or extremes of heating or freezing. For this reason, HDPE is used to make picnic tables, plastic lumber, waste containers, water pipes, fence posts or other products which require durability and weather-resistance.

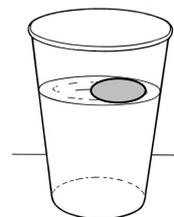
### How can I tell if something is made of HDPE?

1. Look: It often has a 2 printed on it. HDPE is hard, semi-flexible, and resistant to chemicals and moisture. It has a waxy surface, is opaque (you cannot see through it) and softens at 75°C. It has a ridge at the bottom of the container.



2. Listen and feel: Many plastic shopping bags are manufactured from HDPE and the easiest way to distinguish them from LDPE bags is from the sound they make when you crinkle them in your hands. If the sound is soft and swishing (think of green leaves blowing in the trees), then you have identified LDPE; if the sound is crisper and crinkly (think of dry leaves being crushed together), then you have HDPE. The two sounds are quite distinct.

3. Float test: HDPE will float in water.



4. Flame test:

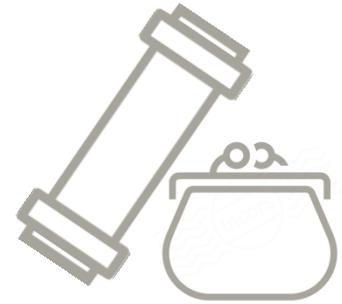
- Blue, yellow tipped flame
- Burns slowly
- Plastic drips
- Smells like candle wax (paraffin).



### 3 Polyvinyl Chloride (PVC)

PVC comes in two forms:

**Rigid:** sometimes abbreviated as RPVC, is used in construction for pipe and in profile applications such as doors and windows. It is also used for bottles, other non-food packaging, and cards (such as bank or membership cards).



**Flexible:** Plumbing, electrical cable insulation, imitation leather, signage, music records, inflatable products, and many applications where it replaces rubber.

#### What can PVC be recycled into?

It is used for flooring, shoe soles, wellington (“rubber”) boots and shoes.

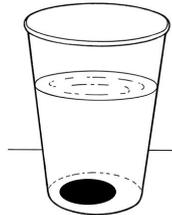
#### How can I tell if something is made of PVC?

1. Look: It often has a 3 printed on it.

- Rigid PVC is strong, tough, can be clear or opaque, and softens at 80°C.
- Flexible PVC is plasticised, clear, elastic and can be welded by solvents.



2. Float test: PVC will sink in water.



3. DO NOT perform the flame test.



*Stay safe: do not burn PVC.*

*It produces extremely toxic fumes.*

#### 4 Low Density Polyethylene (LDPE)

LDPE is used for plastic bags and film, waste bags, and bottles you can squeeze.

##### What can LDPE be recycled into?

LDPE can be recycled into building materials, as well as bags.

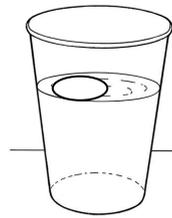
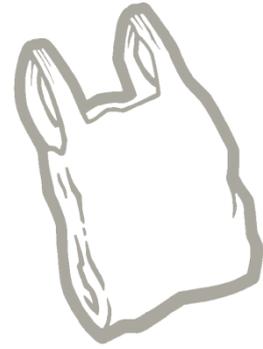
##### How can I tell if something is made of LDPE?

1. Look: LDPE is soft and flexible (it is usually used as a film). It is translucent (lets light through but is not clear), and softens at 70°C. It often has a 4 embossed on it.
2. Feel: LDPE feels soft, smooth and flexible. It can be scratched easily with a fingernail.
3. Listen: If you rub it together, it will make a soft swishing sound, as opposed to a crinkling, harsher sound.

4. Float test: LDPE floats in water.

5. Flame test:

- Blue, yellow tipped flame
- Burns slowly
- Plastic drips
- Smells like candle wax (paraffin).



## 5 Polypropylene (PP)

PP comes in many forms and has many uses:

- Bottle caps
- Food containers
- Buckets
- Appliances
- Plastic chairs
- Crystal clear plastic bags used for retail and presentation (BOPP)
- Woven rice sacks and animal feed sacks
- Plastic shopping bags with a woven appearance
- Sports clothing
- Disposable sanitary napkin linings
- Rope.



### What can PP be recycled into?

PP is commonly recycled into tubes, rigid packaging, containers, crates, disposable cutlery, pallets, hangers, and tubs.

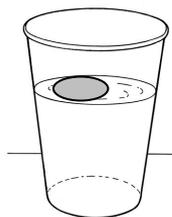
### How can I tell if something is made of PP?

1. Look: Rigid PP is usually hard, opaque and coloured using pigments. Woven PP looks like cloth and is used for sacks and bags. Specially treated, PP becomes crystal clear and is used in packaging and retail for presentation. It has a high melting point (160°C). PP often has a 5 stamped on it.



2. Feel: Woven PP feels soft, like cloth. Rigid PP feels rugged. It cannot be scratched with a fingernail.

3. Float test: PP floats in water.



4. Flame test:

- Blue, yellow tipped flame
- PP shrinks quickly but burns slowly
- Plastic drips
- Has sweet odour.



## 6 Polystyrene (PS)

Common uses for PS are:

- Disposable plastic cutlery and dinnerware
- Food containers
- CD cases and cosmetic packs
- Disposable razors.

Expanded polystyrene (EPS) is used for:

- Insulation panels
- Packing “peanuts” and packaging
- Foam cups and food containers.



### What can PS be recycled into?

PS cannot be recycled easily. EPS is especially lightweight and so transport is often uneconomical. When it is recycled, it is melted and turned into pellets to be used in the production of toys, outdoor furniture and insulation.

### How can I tell if something is made of PS?

1. Look: PS is rigid and shiny. EPS is usually white and made of pre-expanded polystyrene beads. It often has the number 6 on the base.



2. Feel: EPS is rigid and tough, but crumbles into separate grains. (This is different to the kind of foam used in furniture and car seats, called Polyurethane foam.)

3. Float test: PS and EPS float in water.

4. Flame test (PS and EPS):

- Yellow flame
- Burns quickly
- Plastic drips
- Smells like gasoline
- Dense black smoke with soot (floating particles).

