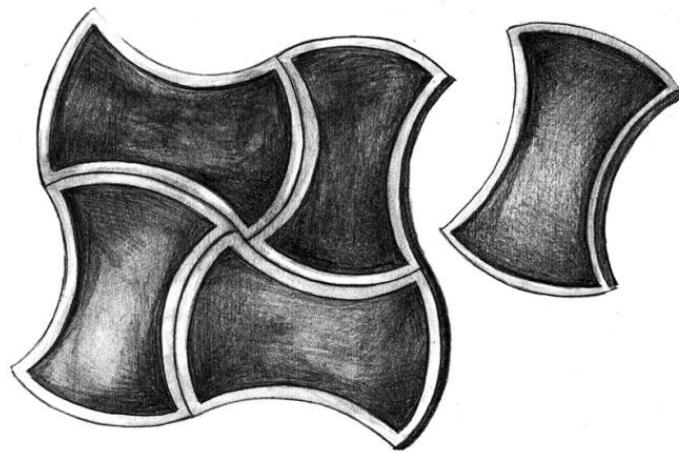


Making Waste Work: A Toolkit

How to transform plastic waste into paving tiles

A step-by-step guide



How-to guide 8

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

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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.

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8 How to transform plastic waste into paving tiles

You can convert waste plastic into useful and valuable building materials.

Summary: Melt LDPE plastic film in a barrel over a wood fire. When the plastic has melted, mix in sand. Transfer the mixture to an oiled mould. Remove the mould and leave to cool.

Waste materials: Plastic bags, water bags, plastic film, containers – the correct type is Low Density Polyethylene (LDPE). See *How to identify common types of plastic*, How-to guide 7.1 to identify the correct plastic type.

Product: Paving slabs, sanitation slabs, floor gutters and bricks.

Benefits: You can make a variety of building materials that are cheaper than the concrete version. They set quickly and are very strong. Depending on the mould, you can make floor or paving tiles or even bricks for walls. They also make good rainwater harvesters: being non-water absorbent, the risk of dew, algae and fungus is almost eliminated, and this ensures clean water. You can add colourants such as iron to make red tiles. Bricks made with this technique make good insulation, keeping you warm in winter and cool in summer.

The sand in the tiles acts as a fire retardant. If there is a fire, the outer layer of plastic melts, leaving a face of sand. Sand is not flammable, so it slows the spread of the fire through the brick. Never light a fire directly on top of plastic floor tiles. Plastic tiles are not advisable for roofing in case of fire.



Always make sure you have clean, separated material and you know what it is. If in doubt, leave it out!

Hint: Use fine, dry sand. The best type is 'sharp sand' or 'construction sand' used for making concrete. Sieve the sand to remove small and large particles that can lead to pockets of air, or pores, in the finished tile.



*It is VERY IMPORTANT to only use the correct types of plastic and that you know what is in your mix. You should ensure there is **no PVC**. Fumes from other types of plastic can be very dangerous.*

Always use a well-ventilated area.

You will be using heat and fire. Make sure you have fireproof gloves (fabric, NOT rubber), heatproof boots (NOT rubber), and cover your arms and legs with overalls or heavy trousers.

You will need:

- Overalls, gloves, masks, covered shoes or boots
- 1 melting barrel (an oil drum cut in half, 80cm wide and 50cm high). If possible use a shield to keep the fire concentrated under the barrel
- Stirring equipment (a spade with a metal shaft, or metal reinforcing rods with a metal paddle welded to the end)
- Firewood or other solid fuel
- Clean, dry, sieved sharp sand
- Tile mould (no more than 4cm deep)
- Used engine oil
- Metal table
- Trowel.

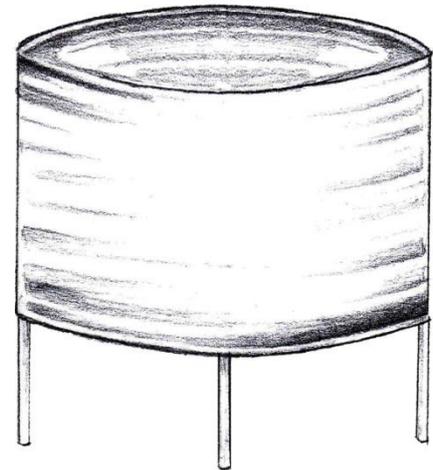


Figure 1: Prepare a melting barrel 50cm tall and with three rebar legs.

How to make the melting barrel

To make the melting barrel, cut a simple oil drum in half and attach three legs made of rebar. With the legs attached, the ideal height of the barrel is 50cm, and 80cm wide. Try to make the burner big enough that you can hold a good amount of liquid plastic but not so tall that it is tricky to mix. If you can sink the legs into the ground it will make the barrel more stable for mixing.

How to make the mould

The moulds can be whatever shape you wish – they are constructed in the same way as moulds for concrete floor tiles. If the walls of the mould are more than 4cm deep however, the material will stick to the sides and not come out properly.

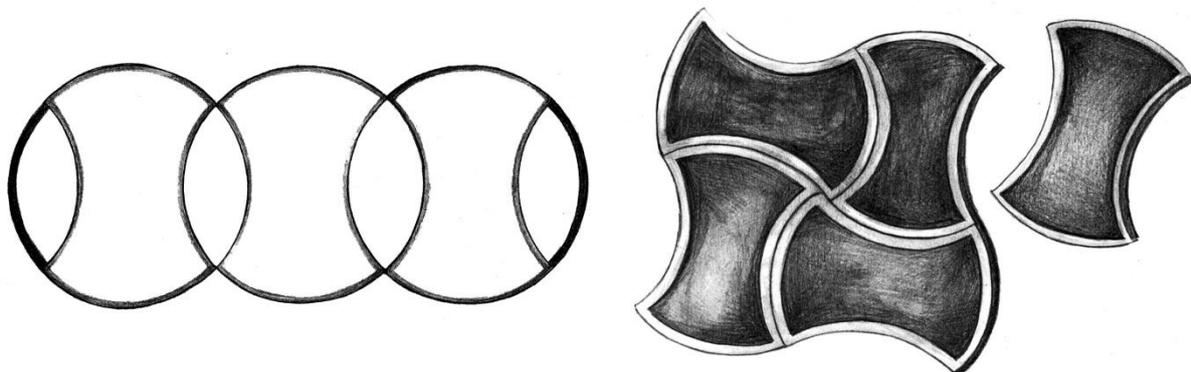


Figure 2: Example tile moulds. Tile moulds can be many different shapes, provided the tiles fit together with no gaps. This mould (left, above) produces 3 tiles with the shape illustrated on the right. It is made by cutting and welding three rings.

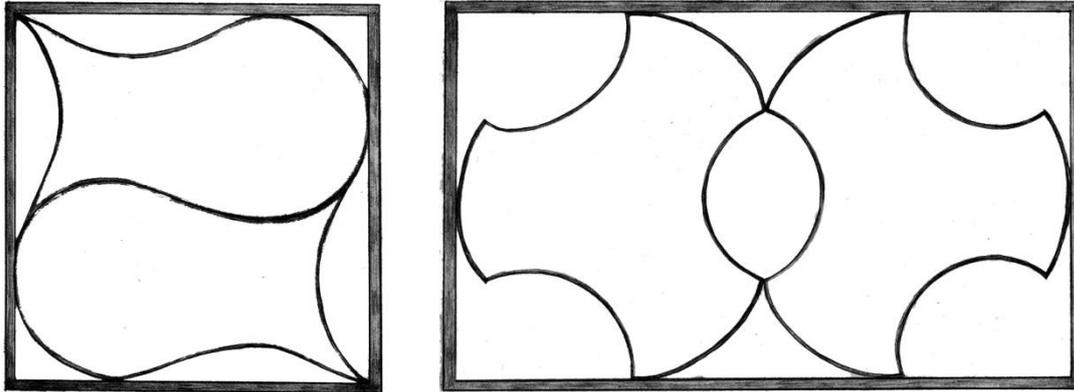


Figure 3: Alternative tile mould suggestions.

How to know how much sand you will need

The strength of the floor tile depends on the mix with sand. Laboratory tests indicate that the optimum mixture is 3 parts sand to 1 part LDPE (3:1 sand:plastic), however it is strongly recommended that you try different mixes for yourself. Try starting with 50:50 sand:plastic and then increasing the proportion of sand to 60:40 and 70:30 to see what works best for you. A mix of 75:25 works well for floor paving tiles to be used in a home compound. Usually, the tiles contain more sand than plastic, because the plastic serves as a bonding agent to hold the sand together.

As a rough guide, one standard rice sack of plastic with around 200 plastic bags (weighing around 2.5 kg) makes one paving slab.

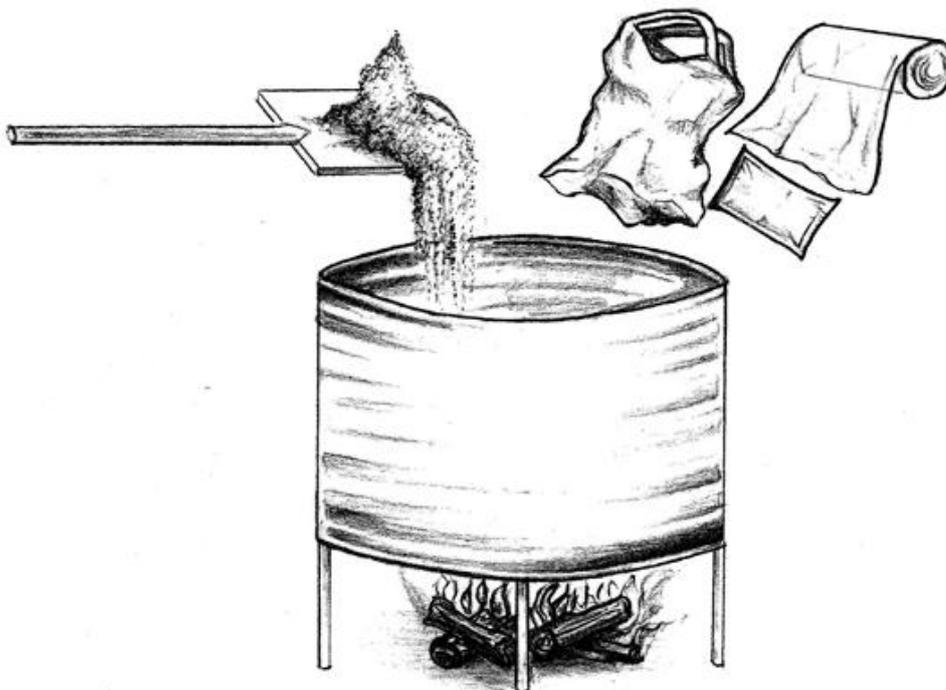


Figure 4: Experiment with different quantities of LDPE, HDPE and sand.

1. Select the right plastic

It is important to only select the correct type of plastic. This is because different types of plastic melt and burn at different temperatures and have different physical qualities. The process described here works well with LDPE¹.

Water bags, non-woven plastic shopping bags and plastic film are usually made of LDPE. It is important that you do not use other types of plastic – it could be harmful to your health. How-to guide 7.1 discusses how to identify the different types of plastic.

Make sure your plastic waste is mainly clean. Remove all materials that are not LDPE (including other plastics). If you're not sure if something is LDPE, leave it out.

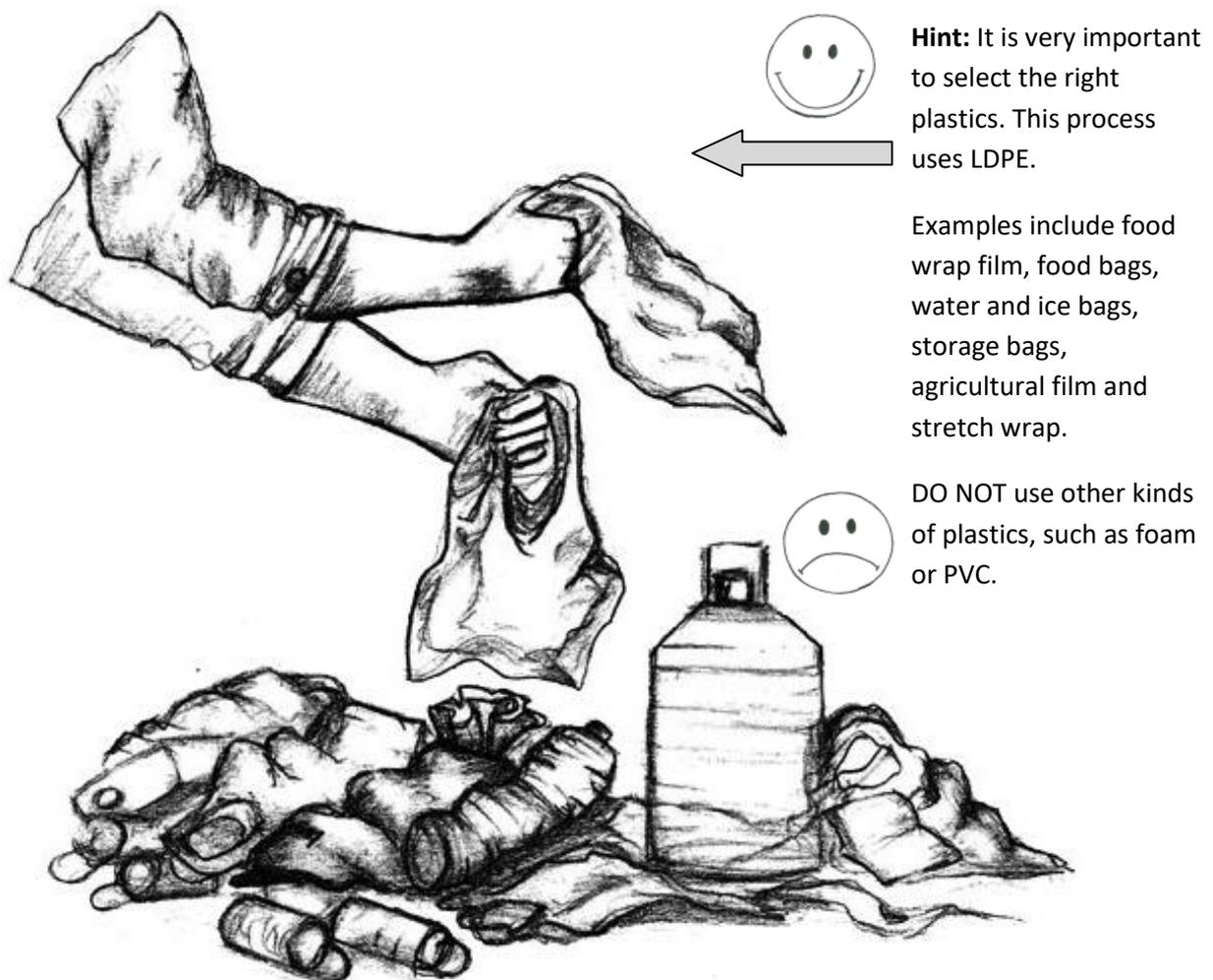


Figure 5: Sort your plastics carefully.

¹ Process design from the Living Earth Waste to Wealth programme; and Pierre Kamsouloum, entrepreneur, teacher and WasteAid Associate, Cameroon.



Figure 6: Keep mixing the melting plastic until it is a black liquid with no lumps.

2. Melt

Light a small fire under the metal drum and **gently** heat it. Add the plastic waste. As it warms up it will reduce in size. Light the plastic at the top using a small flame to help it melt down.

Make sure the fire does not get too hot. Keep adding plastic gently at the side of the melted plastic until it melts down to a black liquid. Keep adding plastic until you have around a 20cm depth of melted plastic.

Do not stand directly over the melting barrel; try to avoid breathing any gases from the fire; and take care as tools can get hot!

3. Mix

Keep mixing thoroughly until all the plastic has melted and there is a consistent black liquid. Sometimes LDPE lumps can remain even at very high temperatures. Stirring and heating must continue until all lumps are removed and a homogenous paste is obtained, since they affect the strength of the material. This can take up to 20 minutes. Do not let the liquid get so hot that it burns strongly – it will not work as a building material if this happens. A few flames from the

liquid is acceptable. Add sand until you have the required mixture and keep mixing so that the plastic, which acts as a binder, is very well mixed in and looks like grey cement.

4. Mould

Prepare the mould by making sure it is very clean, with no pieces of plastic on it from previous mouldings, and well oiled.

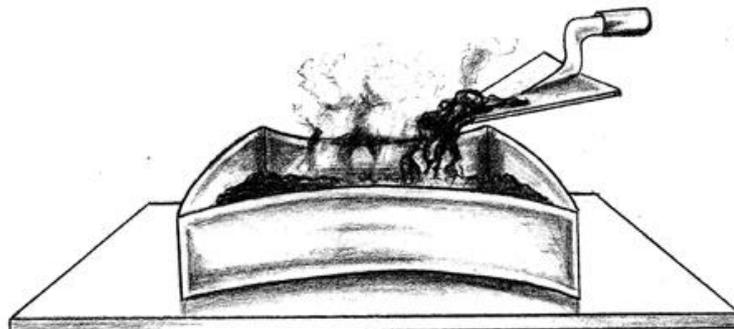


Figure 7: Make sure your tile moulds are clean and oiled before you start work.

Quickly remove the mixture using the spade with the metal shaft and put it into the mould with the trowel. The mixture is very hot so be careful and wear gloves.



Figure 8: Take care when you transfer the mix from the barrel to the table.

Press and work the mixture into the mould so there are no air gaps.

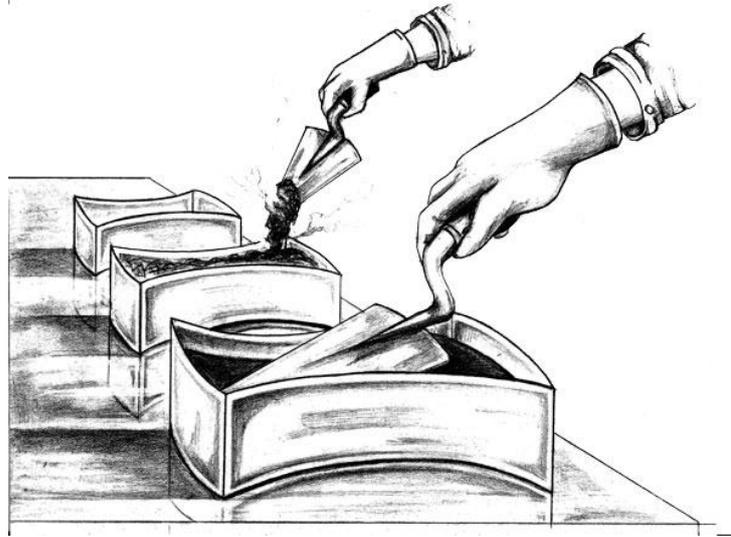


Figure 9: Press the mix tightly into the moulds. Air gaps will reduce the quality of your finished tile.

5. Set

Allow the hot mixture in the mould to set for a few minutes, repeatedly shaking the mould to loosen the edges (a rocking motion works well). Keep trying to lift the mould. When the mixture has hardened enough that the slab will not collapse, remove the mould and leave. It should harden in around 2 hours. Experiment with different amounts of sand and LDPE – the different amounts can be used for different purposes – slabs, tiles or bricks.

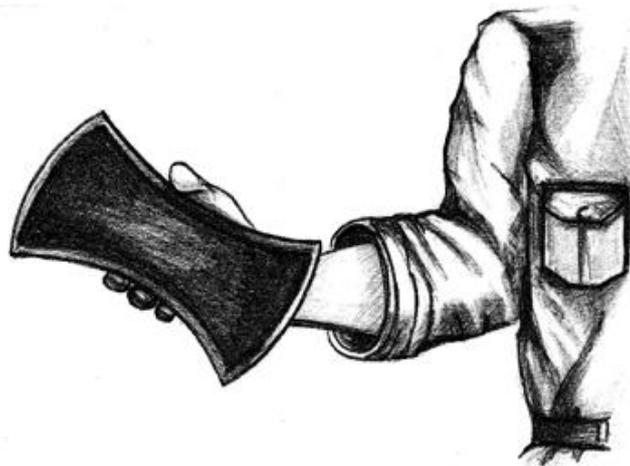


Figure 10: With practice you will be able to make a consistently high quality product.

6. Market

Tiles made in this way are as strong as concrete paving tiles. If you can have your product tested and certified as an approved construction product, you will be able to market it to local building companies as well as directly to customers.