

Old Plastic Bags conversion to Construction Bricks

Umeed Maalik

Abstract— One of the biggest constrains to manage solid waste is to tackle old plastic bags /shoppers. Their decomposition period ranges 10 to 10,000 years in rough statistics. To eliminate these bags from waste stream is a notorious difficulty. So to convert this problem to a product could be a fascinating approach. It is a forward step towards green behavior. It also minimizes dumping loads so it is a space safety measure as well.

Keywords— Construction materials, Old Plastic Bags, Plastic Bags, Reduce Reuse Recover, 3Rs, Single use plastic bags.

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INTRODUCTION

PLASTIC in form of single use plastic bags is most dangerous, to the planet earth. It is once used and then dropped in open landfills or other waste collection site. It is either engulfed by the animals searching food on dump sites. Or this plastic is exposed directly to the sun to convert into micro plastics.

1.1 Old plastic bags

Plastic bags are single-used polythene bags. After a single use it is considered old.

1.2 Plastic: The word 'Plastic' is derived from its Greek origin, *Plastikos*.

Plastikos lexically means: "Capable of being shaped or molded."

Technically **plastic** is a type of synthetic polymer. And a **polymer** is a complex compound produced by polymerization (ACC, 2005-10).

1.3 Polymerization: "A process of converting a mixture of monomers into a polymer" (IUPAC, 2014).

Principle: Use of 3Rs: Reduce Reuse & Recover stairs to Mange solid waste.

Objectives:

1. To avoid the nuisance of accumulated and feely flying shopping bags around a dumping site and nearby roadsides.
2. To refrain these shoppers to be engulfed by animal flocks feeding from dumping sites.
3. To circumvent the blockage caused to drainage system because of these shoppers.
4. To evade the recycling and dumping (leach ate, gases resulting) hinders.
5. To dodge time taking degradation and decay.
6. To attain freely available raw material to form blocks and tiles to industry.
7. To achieve a low cost construction material availability.
8. To gain a lesser in weight and durable construction material.
9. To get a heat insulated building structure.
10. To introduce a new trend in construction with a cheaper product.
11. To construct green building of less cost an initiative.
12. To achieve an environment friendly assertive to show ecofriendly attitude.

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Old Plastic bags (shoppers) conversion to Construction bricks, blocks and colorful tiles.

Preamble:

One of the biggest constrains to manage solid waste is to tackle old plastic bags /shoppers. Their decomposition period ranges 10 to 10,000 years in rough statistics. To eliminate these bags from waste stream is a notorious difficulty. So to convert this problem to a product could be a fascinating approach. It is a forward step towards green behavior. It also minimizes dumping loads so it is a space safety measure as well.

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1- Introduction:

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1.4 Discovery of Plastics:

- I. The idea of plastics was to be introduced as an invention about 100 years ago.
- II. This idea was captured from naturally existing polymers. Like: Tortoise shells and Animal horns.
- III. In 1862, in Great International Exhibition Landon, Alexander Parkes presented an organic material (a derivative of cellulose). It was such that melts on heating and retains its shape on cooling.
- IV. In 1907, a Chemist Leo Hendrik Baekland found a formula to form a new synthetic polymer from coal tar. This polymer was named **Bakelite** it preserve its shape as once formed. (ACC, 2005-10)

1.5 Applicability of Plastics:

- I. In 1914, First patent for Polyvinyl chloride (PVC) was registered. (ACC, 2005-10)
- II. Wood, glass and metals were gradually switched to plastics a cost effective initiative.

2- Life Cycle of Old Plastic Bags (OPGs):

Old plastic bags (OPGs) are a manmade product from naturally existing material.

Raw Material:

- A. Natural gas
- B. Coal
- C. Oil and Petroleum

2.1 Process of Polymerization:

1. **Monomer formation:** Oil and gas under goes a cracking process. It results formation of hydrocarbon monomers. Like: **Ethylene** and **Polyethylene**.
2. This processing if continues leads to form other monomers, like: styrene, vinyl chloride, ethylene glycol, etc.
3. The chemical bonding of the monomers results chains called. **Polymers** (CCT, 2014).

2.2 Structure of a Polymer Unit:

1. Various combinations of hydrocarbon monomers results forming different Polymers and then plastics, with diverse characteristics.
2. A simple polymer unit is a combination of carbon and hydrogen units.
3. The basic structural molecules of each plastic polymer backbone are also Carbon and Hydrogen.
4. Other molecules like: nitrogen, oxygen, chlorine and fluorine are also involve in formation of different plastics. Such as:
 - Poly vinyl chloride (PVC) carries chlorine.
 - Nylon carries nitrogen.
 - Teflon carries fluorine
 - Polyester carries oxygen.(ACC, 2005-10)

2.3 Structure of plastic bags/ shoppers:

- a. These are mostly made of low-density polyethylene (LDPE).
- b. LDPE is a thermoplastic (repeatedly reform able).
- c. LDPE is formed by monomer ethylene (Ethylene: C₂H₄).
- d. In 1933, ICI (Imperial Chemical Industry) produce this polyethylene. (Dennis, 2010)

2.4 Structure of Polyethylene:

Its IUPAC (International Union of Pure and Applied Chemistry), name is Polyethene or poly (ethylene) abbreviated as: PE.

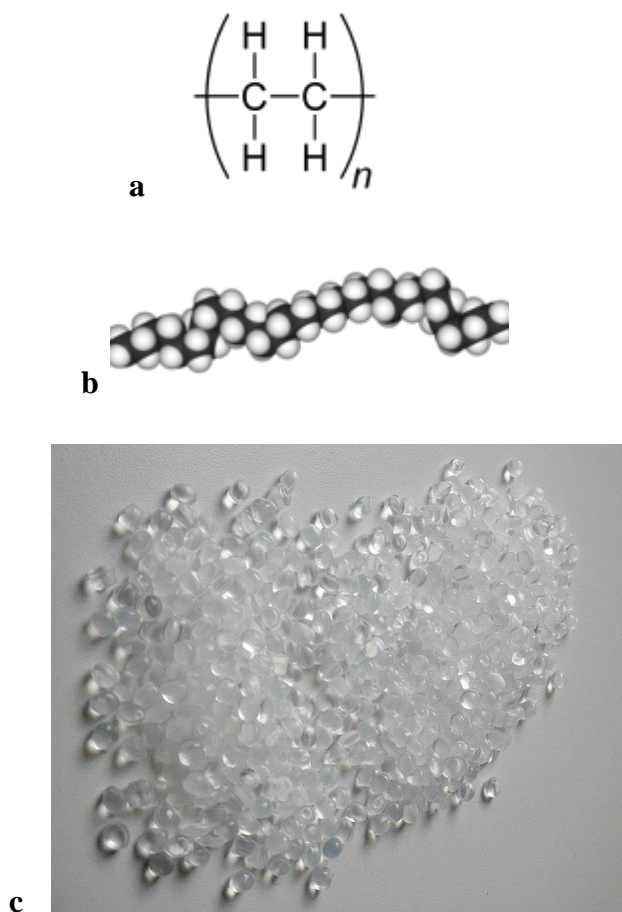


Figure 1: a: skeletal formula, b: Space filled model & c: Granulated sample of polyethylene monomer (Wikipedia, 2017).

2.5 Low-Density Polyethylene (LDPE):

The granules are blended with coloring agents or other additives and transferred to film extruding machine. Here granules are given molten heating and forced to a die (PPP 2005-10).



Figure 3: A sample Film Extruding Machine (PPP, 2005-10).

2.7.3 Design printing:

The roll of film is transferred to printing and designing press. Two types of flexographic printers are used. One is stack type while other is central impression (PPP, 2005-10).

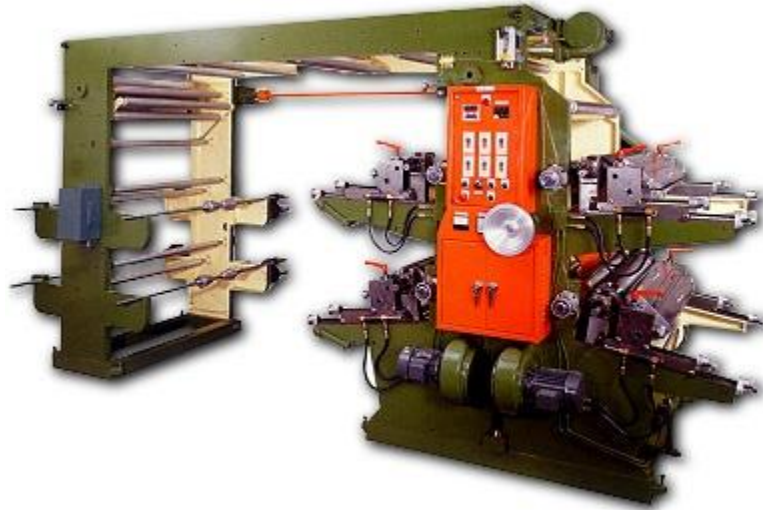


Figure 4: 2 Colors Flexographic Printer

2.7.4 Bag Production:

Side-weld bags: A machine with a hot knife is working through simultaneous cut and seal of tubular film to form bags.

Bottom-weld bags: A machine with a hot wire to make seal and a flying knife to cut films below seal to form bags.



Figure 4: Side welding Machine (PPP, 2005-10).

2.8 Usage of Plastic bags:

Mostly these bags are said to be made for a single use. Few of these are used twice or thrice as well. A clean plastic bag can be folded and saved to use again. It depends on the user behavior. Most countries are trying to use less plastic bags raising the slogans like:

“Less Plastic More Fantastic”

They are trying to switch on recyclable environment friendly bags. If a person uses 500 plastic bags per year he/she can be converted to use just 50 or less than 50 recyclable bags. But an alteration of using attitude is also needed.

2.9 After use Fate of Plastic bags:

1. Become a part of open dumps
2. Dumped into the land fills
3. Openly fired along with other waste
4. Recycled
5. Incinerated

2.9.1 As a part of open dumps:

This is the most flagrant fate of old plastic bags (OPBs).

- a. These can harm grassing animal.
- b. These can stop water passage (In 1988 & 1998 Bangladesh floods underwater two third of country. The major cause of flooding was explored the chocked drainage systems by old plastic bags, (The Christian Science Monitor, 2011).
- c. These can block soil pours wherever it reaches.
- d. These undergo photo degradation exposed to ultraviolet sun rays. Start to split and crack (Juliet, L. 2007).

2.9.2 Dumped into the land fill:

Mostly waste decomposes in the landfills generating gases and leachate etc. Old plastic bags are estimated to take about 500 years to decay in the landfills (USA TODAY, 2011).

2.9.2.1 Decaying/Decomposition of old plastic bags:

- a. A recent endeavor by TreeHugger America's Top Young Scientist of the year is Plastic bags can decompose in just 3 months. It can be achieved by naturally occurring microorganism's fermentation. He acknowledged two strains of bacteria (one from genus: *Pseudomonas* and second from genus: *Sphingomonas* (Brandon Keim, 2008), that together work achieved with a primary decomposer *Sphingomonas* with help of *Pseudomonas* (Kenny Luna, 2008).
- b. Old plastic bags can take 10-100 years to decay or decompose (Rick LeBlanc, 2017).
- c. Fungal degradation of old plastic bags is also in use. A strain *Penicillium simplicissimum* experienced to biodegrade polyethylene. This degradation was monitored with chromatography (high temperature gel-permeation chromatography). Polyethylene was UV irradiated or is incubated at 80°C with nitric acid for about a week then it is liquid cultivated with fungus. In 3 months polyethylene can be degraded to lower weight (Keiko, 2001).

2.9.2.2 Suggested Difficulty in decomposition of OPBs:

Researcher explored the gradual conversion of old plastic bags into smaller pieces. It is suggested that these petroleum derived polymers are unable to undergo biodegradation because microorganisms don't recognize them. It is a fear felt that small pieces of plastic or their photo degraded synthetic granules are continuously entering in the terrestrial and marine ecosystems. It leads to a dark future of food chains infiltrated with plastic particles (EarthTalk, 2010).

2.9.3 Openly Fired: It is highly drastic towards air pollution. It evolves dioxins and other high level chemical directly into the atmosphere.

2.9.4 Recycled:

Recycling of old plastic bags can save barrels of oil annually (Earth 911, 2017).

- a. Recycling occur through chipping old plastic bags into pallets. Those are then reprocessed to form new bags or plastic lumber.
- b. Old plastic bags can be converted liquid fuels through high heat process, called Pyrolysis (Rencee Cho, 2012).

2.9.5 Incinerated:

- a. German and Irish studies show old plastic bags are better towards energy sustainability when incinerated.
- b. Cradle to grave analysis of a plastic bag as compared to paper bag is less fuel consuming.
- c. Old plastic bags if incinerated energy will be captured as heat which is used to boil water to generate steam which further can run turbines to produce electricity (Andy Ho, 2003).

3- Significance of conversion of old plastic bags into construction material (Bricks, blocks and Tiles):

1. It is a incredible to deal with a problem to get a product
2. It is ecologically feasible approach to manage old plastic bags from waste stream.
3. It is a foot-step towards eliminating discarded plastic bag danger because of which plastic bags are banned.
4. This construction material will be produced with less/minimum manufacture cost.
5. This construction material is itself plastic in nature so reduces other uses of polythene in construction material.

4- Plan:

Old plastic bags conversion to construction brick involves following steps:

1. Segregation and collection of old plastic bags.
2. Transport to brick conversion industry

3. Operation and Manufacturing of blocks/bricks/tiles
4. Sale as construction material
5. Utility as construction blocks, bricks or tiles.

5- Material availability OPBs as Raw Material:

5.1 Segregation and Collection of OPBs:

OPBs available in the selected area are collected by:

- a. Hiring paper pickers to collect OPBs (from commercial area)
- b. Street garbage collectors are briefed to collect OPBs (from residential area)
- c. A Shop (in any mini market of area in the vicinity of both commercial and residential areas) will be hired as collection site where pickers and collectors deposit their collections of OPBs on daily bases
- d. Material will reach on collection site on decided times like: in the morning from commercial area. (Because garbage full of OPBs is dropped outside shops on daily basis as a common practice). So pickers can collect OPBs from outside garbage collection in early morning.
- e. In the evening from residential site. (Because street garbage collectors work from morning to evening so at end they can deposit their collections of OPBs.
- f. The collection shop will be given under the supervision of a person who can read, write and can make records of daily collection from each collector. He has to weight OPBs and give their decided payments to collectors. Although someone can adopt this job as a part-time duty by fixing collection times one hour in morning and evening.

5.2 Transport to brick conversion industry:

The collected OPBs in the shop have to be transferred to the brick conversion industry on daily basis by hired loaders.

5.2.1 Bick Conversion Industry:

The collected OPBs are here converted with special techniques.

6- Operation and Manufacturing of blocks, bricks and Tiles:

In the ceramic industry old plastic bags and shoppers are placed into heat molding and forced together. Further these are framed to form blocks, bricks and tiles. In form of tiles these can be differently colored and designed.

6.1 Method of Construction Material Manufacture:

It involves different steps:

- a. Segregation of various types of OPBs according to their quality to be best suitable firstly to manufacture colored and designed tiles, secondly to bricks and thirdly to building blocks.
- b. Each type of OPBs is then conveyed to their specific manufacture plant.
- c. Here the OPBs are heat molded and then converted to their specific die to form design and shape.
- d. Manufactured tiles, bricks and blocks are then collected as ready products to be available for use.
- e. These light weight bricks and tiles are valid for outdoor, indoor decor and wall construction

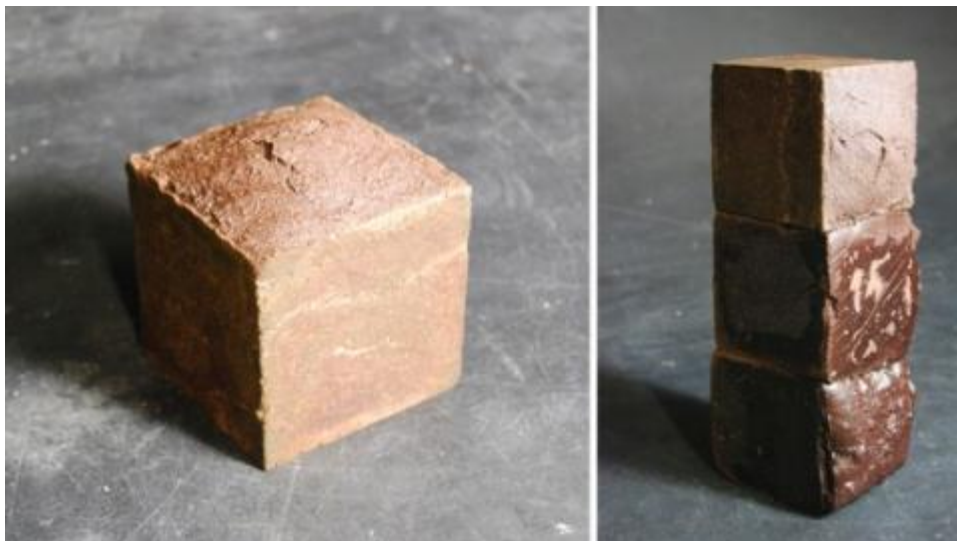


Figure 5: Construction blocks from OPBs (CityMetric, 2017)



Figure 5: Color ful tiles from PPBs (CityMetric 2017)

7- Project Planned Cost:

Working Detail	Approximate Cost
Old Plastic bags segregation & collection	10,000/month
Transport to industry	20, 000/month
Brick manufacturing	50,000/month
Sale as construction material	30,000/month

7.1 Utility of Construction bricks, blocks and tiles:



Figure : Tiles made by shopper & other plastics use as roof tiles

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Conclusion

Plastic accumulation problem can be tackled in many ways. Different efforts are in experimentation from past few years. The most important step is to protect animals and food chains. Once the plastic bags are used immediately they must be gathered to reuse. To convert into construction bricks these single use plastic bags after once used is a meaning way to reuse, reduce and recover.

Once these engulfed by land animals in complete or in pieces with food. No longer, these can be recovered. The adverse effects of these single use plastic bags (most commonly referred as shoppers in Pakistan) are not limited to land. If these are not properly handled after use, their exposure to sunlight results to change into microplastics that are quite hazardous. Microplastics due to this negligence are now part of every ecosystem vulnerable but out of control. To convert old plastic bags into construction materials or other useable forms can avoid being more a part any bionetwork.

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