

Thickness of Plastic Carry Bags – An Overview

P. Haritha, Department of Chemistry, Gudlavalleru Engineering College, Gudlavalleru, India.
haritha.potluri@gmail.com

B. Sreenivasa Rao, Department of Chemistry, GITAM University, Visakhapatnam, India.
srbattula@gmail.com

P. Vasavi, Department of Chemistry, KTR Women's college, Gudivada, India.
vasavi.potluri@gmail.com

Abstract - In the present article, the effects of plastic carry bags basing on its thickness and the measures taken by the government of India was discussed. Plastic carry bags are in general made from polythene and are often used for the purpose of carrying or supplying commodities. The option of plastic carry bags is attributed to its outstanding barrier properties and water-proof properties, safety in handling due to their non-breakability nature and also very light in weight. The main problem with carry bags lies with difficulty in degradation. In addition, it clogs drains and thus cause great problem to urban sewage systems. Choked carry bags in drains increases breeding areas for mosquitoes, besides causing floods during the monsoon. The use of plastic carry bags with less than 20 microns may be mistaken as food by animals and by the consumption of plastic carry bags by animals causes lot of health problems. The central Government of India has notified the Plastic Waste Management Rules, 2016 according to which the minimum thickness of plastic carry bags has been increased from 40 microns to 50 microns. This will help in achieving facilitate collection and recycle of plastic waste. Also an emphasis has been laid by the government to promote use of plastic waste in construction of roads in accordance with the Indian Road Congress guidelines, or it may be used in energy recovery, or to convert plastic waste to oil etc. that finally result in profitable utilization of waste.

Key words: *manufacture, properties, recycling, thickness of carry bag.*

I. INTRODUCTION

Plastic bags, also termed "poly bags," are considered as one of those modern inventions that have brought many comforts to human life. But this was not the situation 70 years ago. By then no one ever considered plastic bag. In those times, people also managed to get without carry bag. Plastic bags are made from polyethylene. Polyethylene was first prepared accidentally by Hans von Pechmann [1], a German chemist in 1898, while he was heating diazomethane. The structure of polyethylene is as shown in figure1.

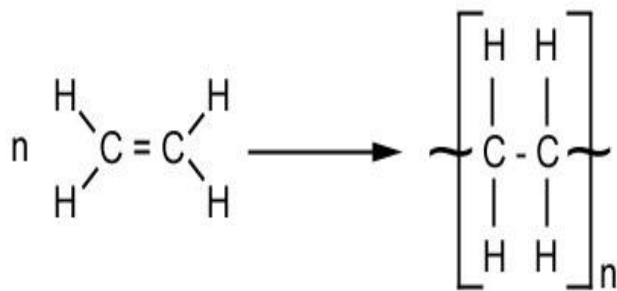


Figure 1: structure of polyethylene

Polyethylene [2] is produced from monomer ethylene (IUPAC name ethene). Its formula is C_2H_4 . Ethylene is mainly produced from petroleum or natural gas [3].

Polyethylene can be synthesized by a variety of methods like radical polymerization, cationic addition polymerization, or coordination polymerization etc. Each method gives different varieties of polyethylene.

Manufacturing process of polyethylene carry bag:

The polyethylene in the pellet form is used for plastic bag manufacturing. The machine that is used to manufacture the plastic bags constitutes of an extruder and die assembly.

Blown film extrusion is carried out vertically upwards. A schematic diagram for blown film extrusion moulding is represented in figure 2. The procedure is constituted of four important steps:

1. The polymeric material taken in the form of a pellet is compacted and then melted to form a continuous, viscous liquid. This molten plastic is then extruded through an annular die.
2. The injection of air is then made through a hole that is present at the centre of the die. And because of the pressure, the extruded melt expands in the form of a bubble. The air entering the bubble replaces the air leaving it, and hence an even and constant pressure is maintained that helps to maintain a constant thickness of the film.

3. The bubble is pulled constantly upwards from the die and with the help of a cooling ring, air is blown onto the film. With the aid of internal bubble cooling, the film may also be cooled from the interior. This eventually decreases the temperature inside the bubble and the bubble diameter is still maintained.
4. After the solidification process, the film is made to move into a set of nip rollers that results in the collapse of bubble and flattening it into two flat film layers. Finally, pulling of the film onto wind up rollers is done by puller rolls.

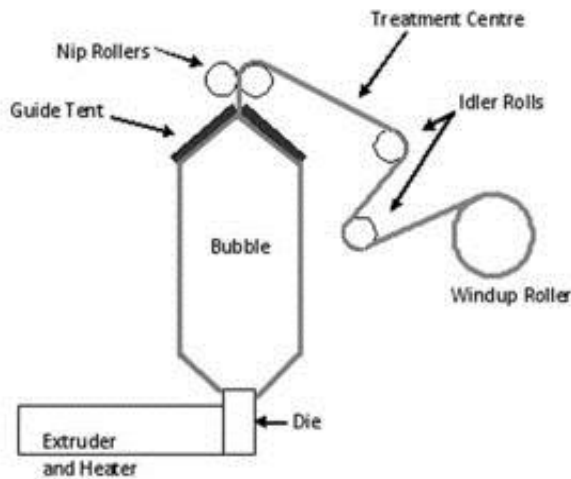


Figure 2: Blown film moulder

During processing, the polyethylene may be treated with additives, like Anti-block agents that help in prevention of the plastic layers from sticking together, Ultraviolet inhibitor that protects the plastic from ultraviolet radiation.

Properties of polyethylene:

The properties of polyethylene may be classified into mechanical, chemical, electrical, optical, and thermal properties.

Thermal properties

The melting point of polyethylene vary with the type of polyethylene. The medium and high-density polyethylene commercial grades possess the melting point in the range of 120 to 180 °C and in the case of average, low-density polyethylene, the melting point lies in the range of 105 to 115 °C.

Mechanical properties:

Polyethylene possesses very low strength, hardness and rigidity, and a high ductility and high impact strength. Polyethylene shows strong creep under constant force that can be decreased by adding of short fibers. Polyethylene is waxy to touch.

Chemical properties

Polyethylene is constituted of saturated, non polar, high molecular weight hydrocarbons and its chemical behaviour is analogous to paraffin. In highly crystalline polyethylene,

density, chemical stability and mechanical strength also increases.

LDPE, MDPE, and HDPE grades possess good chemical resistance. Crystalline samples are not soluble at room temperature. Polyethylene is soluble at high temperatures in non polar solvents like toluene or in xylene, or in chlorinated solvents. Polyethylene does not absorb water. The gas and water vapour permeability is very low when compared to other plastics. PE becomes brittle when exposed to sunlight.

Electrical properties

Polyethylene is a good electrical insulator.

Optical properties

Basing on film thickness and its thermal history, PE may be clear (transparent) or milky-opaque (translucent) or opaque.

Applications of carry bags

Polythene carry bags are generally used for the purpose of carrying or supplying commodities. The main features that evolved the use of plastics widespread in packaging materials, and especially in carry bags, are: Chemical resistance and inertness, superb barrier properties and waterproof characteristics, Safe in handling because of non-breakable property and very light in weight, Transparency for visibility of content being packed. If needed, it may also be made opaque for the protection of content from exposure to sunlight. It shows greater resistance to bacterial as well as to other kinds of microbial growth.

II. PLASTIC AND ENVIRONMENT

The Current Scenario of plastic products has developed into an integral part of our daily life, ranging its production to cross over 150 million tonnes per year globally. With its origin in 1957, the Indian plastics industry has also shown a prominent growth. Around 30,000 processing units are being operated that include small and medium enterprises. The use of plastics are in many ways like toys, aircrafts, hosepipes, soft drink bottles, refrigerators, television sets etc.

The very fabulous properties that have made plastic such a requisite for modern living also pose several problems when once its useful life is over. Plastic find application in paints, window frames and cable coverings to prevent rotting, but this makes degradation enormously difficult. Plastic food packaging enhances the shelf life of foods, and provides a hygienic, cheap and flexible range of wrappings. Even though it has got several benefits for the food firms, the vast increase in plastic packaging has very much amplified plastic waste and, as a result, serious environmental problem.

Effects of carry bags:

Plastic bags generally block drains and thus majorly disturb urban drainage systems. Choked drains create breeding

atmosphere for mosquitoes, also causing floods during the monsoon. Because of indiscriminate dumping of plastic bags on land, toxic metals such as lead and cadmium pigments could leach into underground water [4, 5]. The use of plastic carry bags may be mistaken as food by animals and by the consumption of plastic carry bags by animals causes lot of health problems [6, 7]. Garbage mixed with plastic bags disturbs the waste processing facilities and could lead to trouble in landfill operations. As plastic bags cannot be subjected to bacterial decomposition, land filling with plastic bags would mean retaining the poison forever. Buried plastics take hundreds of years for degradation. Incineration may result in the emission of harmful gases.

Measures taken by Government of India to reduce plastic waste:

For the restriction the sale of some products in plastic carry bags, a ruling under the provisions of the Environment Protection Act 1986 has been passed by the central government of India. A ban on the manufacture and use of plastic carry bags that are below 8 inches x 12 inches in size and 40 microns in width was imposed by the Ministry of Environment, Forests and Climate Change. The ministry has also ordered state governments to register all plastic manufacturing units, in order to regulate them. Rules/Notices based on Plastic Bag Usage and Ban Plastic (Management and Handling) Rules, 2011, Recycled Plastics Manufacture and Usage Rules were given by Government of India in the 1999 [8] and are amended in the year 2003 to manage the manufacture, sale and use of virgin and recycled plastic carry bags as well as recycled plastic containers. These rules prohibit the manufacture, stocking, distribution and selling of carry bags that are made of either virgin or recycled plastic having size lesser than 20 x 30 cm and lesser than 20 microns in thickness. This rule prohibits the use of recycled plastic bags and containers for carrying, storing, packaging or supplying of food items. Under these rules, prior to the commencement of production, industries manufacturing plastic bags should necessarily register with their respective State Pollution Control Boards or Pollution Control Committees.

For enhancing better management of plastic waste, the earlier Recycled Plastics Manufacture and Usage Rules, 2003 are replaced with the government had given the Plastic Waste (Management and Handling) Rules, 2011. As per the new rules, the minimum thickness of plastic bags has been increased to 40 microns and recycled carry bags made from compostable plastics need to comply with Bureau of Indian Standards (BIS) norms.

Recently, the Government has notified the Plastic Waste Management Rules, 2016 [9], in place of the earlier Plastic Waste (Management and Handling) Rules, 2011. According to these rules, the minimum thickness of plastic carry bags has been raised from 40 microns to 50 microns. Almost, of the 15000 tonnes of plastic waste generated every day, about 9000 tonnes is collected and

processed. The rules, which were admissible upto municipal areas, have now been extended to all villages.

The Plastic Waste Management Rules, 2016 intend at:

Increasing minimum thickness of plastic carry bags from 40 to 50 microns and specify minimum thickness of 50 micron for plastic sheets for facilitating collection and recycling of plastic waste. It also include:

1. Expansion of the jurisdiction of applicability from the municipal areas to rural areas, as plastic is prevalent in rural areas too.
2. To assign the responsibilities to producers and generators, both in plastic waste management system and to establish collect back system of plastic waste by the producers/brand owners, as per extended producer's responsibility.
3. To initiate collection of plastic waste management fee by pre-registration of the producers, importers of plastic carry bags and vendors selling the same for setting up the waste management system.
4. To encourage use of plastic waste in road construction as per Indian Road Congress guidelines or energy recovery, or waste to oil etc. for profitable utilization of waste and also address the waste disposal issue; to assign more responsibility on waste generators, like payment of user charge as given by local authority, collection and handing over of waste by the institutional generator, event organizers.

Apart from this, the supposed outcome from the new rules comprises:

(i) Increase in the thickness of carry bags and plastic sheets

By increasing the thickness of plastic carry bags from 40 to 50 micron and specification of 50 micron thickness for plastic sheets may raise the cost by about 20 %. This will cut down tendency to provide free carry bags. Also, collection by the waste-pickers increases.

ii) Collect back system

The establishment of the collect back system of waste generated from different products by the producers or brand owners of those products will enhance the collection of plastic waste, its reuse or its recycle.

(iii) Decline of manufacture and use of non- recyclable multilayered plastic

Production and use of non-recyclable multilayered plastic if any must be phased out in two years' time.

(iv) Responsibility of waste generator

All institutional generators of plastic waste, should separate and store the waste generated by them as per the Solid Waste Management Rules, and the segregated wastes should be handed over to authorized waste processing or disposal facilities either on its own or through the authorized waste collection agency.

All waste generators should pay the prescribed user fee, or charge, as may be notified in the bye-laws of the local bodies for plastic waste management.

Every individual that hold responsibility for organising an event in open space involving service of food stuff in plastic, or multilayered packaging, has to segregate and manage the waste produced in such events, as per the Solid Waste Management Rules.

(v) Responsibility of local bodies and Gram Panchayat

The local bodies shall be responsible for setting up, operationalisation and co-ordination of the waste management system and for executing associated functions.

(vi) Responsibility of retailers and street vendors

Retailers or street vendors shall not sell, or provide commodities to consumers in carry bags, or plastic sheet, or multilayered packaging, that are not manufactured and labelled or marked, as given under these rules.

Every retailer, or street vendor, selling or providing commodities in, plastic carry bags or multilayered packaging or plastic sheets, or like, or covers, made of plastic sheets that are not manufactured, or labelled, or marked, in accordance with these rules shall be penalised, as given under the bye-laws of the local bodies.

III. CONCLUSION

Plastic sheets with 50 micron thickness only should be produced. Apart from government initiatives, alternatives to plastic bag can also be considered like reusable bags made of canvas, woven plastic fibre, cotton or leather can be reused many times for shopping. Biodegradable plastics derived from renewable organic sources, such as vegetable oil, corn starch and pea starch that are capable of getting decomposed by bacteria or other living organisms can be preferred.

REFERENCES

- [1] <https://en.wikipedia.org/wiki/Polyethylene>
- [2] Dennis Malpass (2010). Introduction to Industrial Polyethylene: Properties, Catalysts, and Processes. John Wiley and Sons. pp. 1-9.
- [3] Seymour RB. Polymer science before and after 1899: notable developments during the lifetime of Maurtis Dekker. J Macromol Sci Chem, vol. 26, pp.1023–32, 1989.
- [4] Barnes DKA, Galgani F, Thompson RC, et al. Accumulation and fragmentation of plastic debris in global environments. Philos Trans R Soc London Ser B 364:1985– 98, 2009.
- [5] Halden RU. Plastics and Health Risks. Annual Review of Public Health, Vol. 31, pp.179– 194, 2010.
- [6] Velappagoundar Ramaswamy and Hardeep Rai Sharma. Plastic Bags – Threat To Environment And Cattle

Health: A Retrospective Study From Gondar City Of Ethiopia, IIOAB journal, vol 2, issue1, pp 7-12, 2011.

- [7] Singh B. [2005] Harmful effect of plastic in animals. The Indian Cow, pp 10–17, 2005.
- [8] www.envfor.nic.in/legis/hsm/plastic.html.
- [9] pib.nic.in/newsite/PrintRelease.aspx?relid=138144.