

# A Comparative Study: Polythene And Eco- Friendly Packaging Bags

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## Abstract

One of the most dangerous threats to the environment is the increasing use of polythene bags. These polythene bags have become a threat to the environment. In the study a comparison has been made between polythene bags and environmentally friendly in terms of their physical, chemical and decomposition properties, their advantages and disadvantages and their price. The result shows that polythene bags have good resistance against water, acid, alkali, sunlight. They are cheaper and more durable than the environmentally friendly bags but are non-biodegradable. On the other hand, environmental friendly bags are biodegradable and reusable but show limitation for liquid material carriage.

**Key Words:** Ecofriendly, Packaging bags, Polythene, Testing, Process.

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## I. Introduction

Polythene bags have become the most common items in our day to day life. In fact, they are the most produced man-made items in the world. It is one of the most used items because of its high convenience, strength and inexpensiveness. These bags have been used for many years as a method of carrying food and other items. Polythene bags are light in weight and strong, although they take more than 1000 years to decompose in a landfill. [1, 2]

There are many disadvantages of polythene bags. They are threat to plant and animal life, pollute soil and water, and the ecosystems that support life. It causes many terminal diseases like breast cancer and reproductive problems in humans and animals. [3]

Polythene bags also choke drainage pipes causing major floods. If animals eat polythene bags their intestines are damaged. Besides if food items are preserved in a colorful polythene bag, it can damage the human health due to the presence of heavy metals like lead and cadmium. Polythene is harmful for crops as well. If any plastic bag gets mixed with the soil of an agricultural field, the crop production goes down [1].

To overcome the dangers of polythene bags, an alternative was needed. Many countries had begun to ban plastic bags. China banned the production, sale, and use of plastic shopping bags that were 0.025mm thick and plastic bags thinner than it [4].

The Indian government is also trying to take initiatives in order to remove non-biodegradable polythene bags from the country. Biodegradable bags are a good alternative to polythene bags. Biodegradable polymers can replace polythene bags in our day to day lives. Efforts need to be made in order to protect our environment from the hazardous polythene bags.

## Manufacturing Processes of Different Packaging Bags Polythene Bags

Polythene bags are made from the byproducts of petroleum and natural gas. Polythene is the main raw material used for the production of these bags. Oil used in the production of plastic is 4% of the total oil production in the world [2].

## Polypropylene (PP) Bags

The polypropylene bags are produced by the spun bond process. The spun bound process consists of polymer melting, transport and filtration of polymer melt, filament excursion, filament drawing, filament deposition, bonding, winding up, and bag making. The film roll is bound on the winding machine and is stitched

in the desired shape and size.

**Cotton Bags**

Cotton bags are produced from woven cotton fabrics. Cotton fibers are processed through the spinning process where it is converted into cotton yarn. Then a set of wrap and weft are interlaced in the weaving machine to produce a cotton fabric. This is then stitched to make biodegradable bags.

**Paper Bag**

Paper bags are made of Pulpwood that is obtained from trees, which is a renewable source [2]. The generated pulp is processed through different steps and converted into paper. This paper may also be obtained from the paper industry. The paper sheet is cut manually or automatically and converted into paper bags using adhesives. Figure 2 shows the manufacturing process of a paper bag.

The strength, Chemical properties, degradation, flammability and odor test of different packaging materials has been discussed in this section. This has been shown in table 1, 2, 3 and

4. It is observed that after burning PP bags and Polythene bags, they burn with an odor and convert into a shrink black solid. However, eco bags leave black ash after burning, as shown in table 4. The bags of Jute and Cotton are stronger than PP and Polythene bags. A paper bag has the lowest strength among all bags, as shown in table 1.

Material	Strength(kg)		Extension(Inch)		Gram/Square Meter
	Machine direction	Cross direction	Machine direction	Cross direction	
Polypropylene	10.8	9	7.6	8.5	12
Polythene	5.4	4.9	16	14	04
Cotton	40.2	33.1	7.1	8.5	18
Jute	99	98.4	7.5	7.55	21
Paper	4.0	3.0	1.0	1.2	10

**Table: 1- Strength and Elongation Test**

Material	Acid	Alkali	Sunlight	Microorganisms
Polythene	Good Resistance	Good Resistance	Strength decreases after a period of time	No affect
PP	Good Resistance	Good Resistance	Strength decreases the Fabric is weakened after a month	No affect
Cotton	Damaged, weak fibers	Resistant; No harmful effects	Prolonged exposure weakens fiber	Mildew and reproducing bacteria damage fiber
Jute	Damaged, weak fibers	Resistant; No effect	Prolonged exposure weakens fiber	Mildew and reproducing bacteria damage fiber
Paper	Color of the paper changes to black and it appears to be burnt	Colour changes to yellow	It can cause paper to yellow or darken and weaken and embrittle the cellulose fibres that make up paper	Can carry the bacteria and damage the paper

**Table: 2- Chemical testing of different packaging bags**

Material	Degradation Period
Cotton Bags	1-5 Months
Paper	2-5 Months
Polythene Bags	More than 200 years
Polypropylene Bags	50-200 years
Jute Bags	2-5 Months

**Table 3: Degradation in landfills**

Material	Tests		
	Melting	Flame	Odor
Polythene	Shrinks black solid	Orange	Smells like faulty wire
Polypropylene	Shrinks black solid	Orange	Polyethylene
Cotton	Black ash	Yellow	Paper
Jute	Greenish black	Yellow	Paper
Paper	Black ash	Red	-

**Table 4: Flame and Odor Testing**

The chemical testing of different materials shows that the PP and Polythene bags are resistant to acid, alkali, sunlight and microorganism. The degradation period of cotton, paper and jute is far less than polythene.

The advantages and disadvantages of each packaging material are shown in table 5.

Material	Advantages	Disadvantages
Polythene Bags	Recyclable, strong, durable, chemical resistance, cheap, easy to carry liquid material	Non-biodegradable. Non-renewable, harmful to the environment
Polypropylene Bags	Recyclable, strong, durable, chemical, resistance, cheap, better printing and dyeing	Non-biodegradable. Non-renewable, harmful to the environment
Jute Bags	Natural, renewable source, biodegradable, compostable, strongest natural fiber, durable	More expensive, heavier, thicker fabric not so good for printing and dyeing
Cotton Bags	Renewable source, biodegradable, easily available cheaper than jute, strong and durable	Costlier than polythene liquid cannot be carried
Paper Bags	Natural, renewable resource, biodegradable and compostable, easily and cheaply available	Not water resistant, not durable, less strength, liquid cannot be carried

**Table 5: Advantages and Disadvantages**

Material cost as per size of bag	Cost in rupees			
	6 inch X 8 inch (per piece)	9 inch X 11 inch (per piece)	10 inch X 12 inch (per piece)	10 inch X 14 inch (per piece)
Polythene	1.25	2.8	3	3.33
Polypropylene	1	1.2	1.5	2.15
Cotton	8	9.30	14.40	15
Jute	21.50	29	60	62
Paper	2.50	4	5	7

**Table 6 Cost Comparison of different packaging bags**

### Cost comparison of different packaging bags

The cost comparison of polythene and eco bags has been discussed in the above table. It is observed that Polythene and PP bags are cheaper than cotton and Jute bags of the similar size. The paper bags showed the similarity in cost with PP and Polythene bags in the lower size category. Cotton and Jute bags are very costly in 10 X 12 inch and 10 X 14 inch categories.

## II. Conclusion

The comparative study between polythene and eco-friendly packaging bags highlights the critical need for sustainable and environmentally conscious choices in the packaging industry. Polythene, while offering convenience, cheaper in cost and durability, poses severe threats to our ecosystems due to its non-biodegradable nature and contribution to pollution. On the other hand, eco-friendly packaging bags, crafted from renewable resources or biodegradable materials, emerge as a promising alternative.

The environmental impact of polythene, including its persistence in landfills and adverse effects on wildlife, underscores the urgency for a shift towards more sustainable practices. The eco-friendly options, whether made from plant-based materials or designed for easy decomposition, demonstrate a commitment to reducing the carbon footprint associated with packaging. While acknowledging the challenges of cost and scalability in transitioning to eco-friendly alternatives, it is evident that investing in sustainable packaging solutions is a crucial step towards a healthier planet. Though, Eco friendly bags have certain limitations like its cost and quality, which can be overcome by improving the quality of fibers and materials used in making these bags. Along with this cheaper blends of fabric can be taken under consideration for the manufacturing of the

ecofriendly bags.

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