An Exploratory Comparative Study on Eco-Impact of Paper and Plastic Bags

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Abstract: Today there are varieties of comments prevailing among people who use Plastic and Paper bags for their shopping needs. A few people support Plastic bags with their own justifications and others support Paper bags. This is a hot topic of today and arguments are going up and down to deduce which one is better in terms of environmental impact, but some people abstain from this issue by choosing the other option of going with reusable bags. This exploratory study is attempted to infer the environmental concerns made by these bags. The two common grocery bags of today – Paper & Plastic bags are compared in this study. Two imperative measures – total amount of energy used by a bag to get it manufactured and the amount of pollutants emitted during the manufacturing phase of a bag - are chosen as data for Life Cycle Inventory (LCI). To arrive at a clear state of conclusion with respect to environmental impact made by these two bags, life cycle impact assessment (LCIA) study was accomplished. Evolvement of Life Cycle Assessment (LCA) study from the data available on this context is the crux of this study. The Eco-indicator 99, damage oriented method for LCIA in SIMAPRO 7.1 tool is used to assess the environmental impact made by these two grocery bags. The single score values calculated by the Eco-indicator 99 is considered as a directive to compare the environmental impact made by these and a detailed explanation of results is also dealt with in this paper. As far as the Life cycle energy analysis and amount of pollutants produced from these two bags are concerned, a plastic bag simply scores out a paper bag. The impact assessment results are also in line to support the plastic bags over paper bags. However, this conclusion has been drawn on the basis of the secondary data chosen for LCI and the results provided by the software which also has certain hypotheses and assumptions.

Keywords: plastic bags, paper bags, life cycle impact assessment, SIMAPRO, eco-indicator 99

1. Introduction

There are many types of bags available today to cater the shopping needs of people. An endless variety of raw materials and technologies are employed to manufacture them. Out of them the most popular ones are Plastic and Paper bags, since many years. Also one should accept that they are the ones which are being subjected to a lot of constructive criticisms as well. Due to the highly demanding environmental needs, many alternatives are found to be superior to them in many platforms, especially in terms of environmental friendliness have come to the market now and become familiar among common people. Even then it is worthwhile to infer the Eco-Impact made by them. Numerous perplexing arguments [1-19] can be seen in many discussions from different web pages on which bag is better amongst Paper and Plastic ones? Notwithstanding these references present different sorts of justification for the arguments, a scientific evaluation to quantify the environmental impacts is very much needed. This paper serves as an exploratory study on the quantification of environmental impacts of these bags to facilitate the investigation on the piled up issues associated with these bags. This present study sheds light on the eco-impact made by plastic and paper bags by using Life Cycle Analysis study.

2. Production Processes of Paper and Plastic Bags

Plastic bags are made from non-renewable resources, where the key ingredients are petroleum and natural

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gas. Polyethylene - High Density, Low Density, linear low-density polyethylene [LLDPE] are the raw materials widely used for the manufacture of plastic bags [20]. The shopping bags used by super markets would be ideally produced out of LLDPE to get the desired thickness and glossy look. And if one needs very thin and filmy bags then LDPE would be an ideal choice [21]. The oil used for manufacturing plastic bags figures out to 4% of the world's total oil production [12, 13]. The production outline of plastic bags in general is depicted in Figure 1, which shows the generalised picture of manufacture of plastic products and plastic shopping bags [22]. People feel plastic bags are light and easy to carry. Their shape and structure aid people to have such a feeling about them. Also they are found to be cheaper in cost when compared to paper bags. Also they have the capability to be reused and recycled. Such recycling activities can be found in a number of supermarkets and one can see many slogans in this perspective in supermarkets in most of the countries. Their rate of decomposition is much slower which can even last up to 1000 years [23] and most of the plastic bags, say up to 96% are being thrown into landfills [24].

Switching over the discussion track to Paper bags, they are made out of Pulpwood from trees, which is a renewable source. However, we get paper bags by cutting of trees which on the other way blemishes both plants and animals. It is also produced by energy created by coal or natural gas. Thus created pulp will be converted into a paper bag by different processes and machines after consuming tremendous amounts of energy from fossil fuels, electricity, various chemicals, etc. [13]. An outline of manufacturing process of paper shopping bags is given in Figure 2. And also they are biodegradable and can be recycled to create corrugated cardboards majorly.

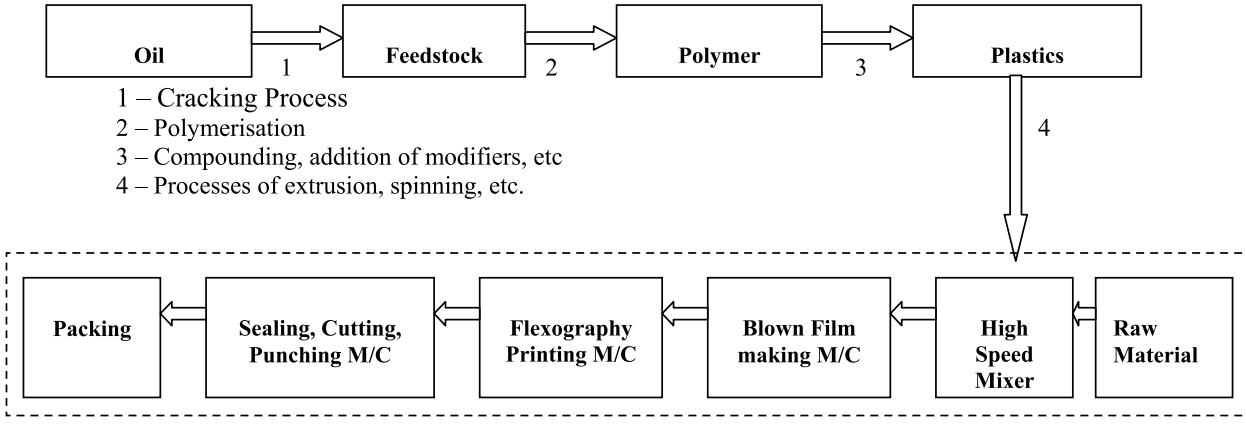

Figure1 General outline of plastic bags manufacturing process.

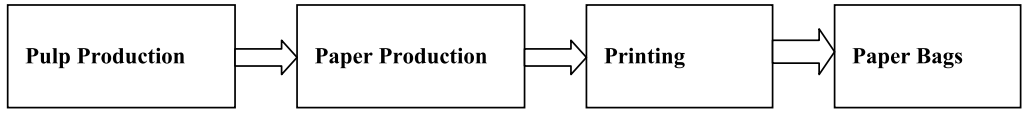

Figure2 Process outline for paper shopping bags manufacture.

3. Technology of Life Cycle Assessment

A life-cycle assessment [LCA] is an analytical tool which can help in understanding the environmental impacts from the state of acquisition of raw materials to final disposal [25]. In accordance to the definition given by The Society of Environmental Toxicology and Chemistry [SETAC], LCA is an iterative process to evaluate the environmental burdens associated with a product, process or activity by identifying and quantifying energy and materials used and wastes released to the environment; to assess the impact of those energy and material uses and releases to the environment; and to identify and evaluate opportunities to effect environmental improvement. The assessment includes the entire life cycle of the product, process or activity, encompassing extracting