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COMPARISON OF ENVIRONMETAL FOOTPRINT FOR PLASTIC AND GLASS CONTAINER PACKAGES USING THE LIFE CYCLE ANALYSIS METHOD

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Abstract

Modern waste management policies in the European Union, seek to reduce the environmental and health impacts of waste, as well as to improve the efficiency of Europe's natural resources.

Through the analysis of a product's life cycle, it can be identified in advance, all stages of its life and intervene by reducing to the extent possible, the negative impacts on the natural environment and humans.

The scope of the study is to analyse the life cycle of a bottle container made of two different materials, based on the method of multicriteria analysis. One material refers to plastic and the other is glass.

Introduction

The concept of life cycle (LCT) of a product or a service goes beyond the traditional evaluation on the production area-production processes and includes environmental, social and economic impacts of a product throughout its life cycle.

The main objectives of life cycle analysis are to reduce product's resources utilization and impacts, e.g. gas emissions into the environment, as well as improving its socio-economic performance through its life cycle.

Life Cycle of a product (Source: EU,2010)

Materials - Methods

To evaluate the life cycle of both materials (inputs - outputs) the method was adopted includes the stage of birth of both materials until their recycling final stage.

The methodology followed for the multi-criteria analysis is the hierarchical analysis of decisions.

The innovation of the present study is that the life cycle analysis included recycling rates which were adopted as the five alternatives (10, 20, 30, 40 and 50% recycling rate). The criteria selected in this analysis, are from one hand to achieve the lowest possible carbon dioxide emissions, and secondly the amount of energy consumption needed, over the life cycle of both materials examined.

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Results - Discussion

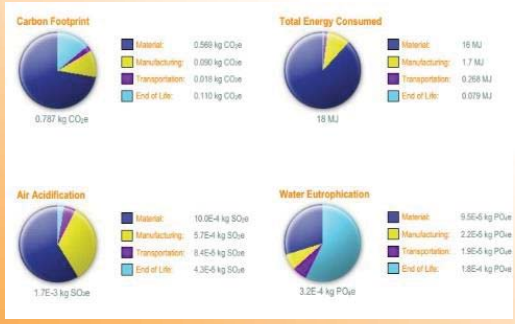
In both cases of materials, the optimum solution for lower CO_2 emissions with lower energy consumption was found to be between the 20% and 30% recycling rates.

Additionally, increasing the recycling rate has a direct effect mainly on the carbon footprint and on water eutrophication.

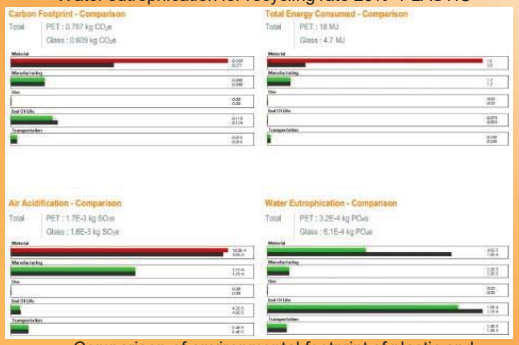
Moreover, comparing the two materials, glass with only 20% recycling rate is always a better choice than plastic in terms of reducing carbon footprint, energy consumption and sulphur dioxide emissions. Increasing the recycling rate of plastic reduces the environmental impact, but still has a more negative environmental impact than glass.

Below indicatively are given results for both materials for the recycling scenario of 20%.

Carbon footprint, Energy consumed, Air acidification and Water eutrophication for recycling rate 20%- GLASS



Carbon footprint, Energy consumed, Air acidification and Water eutrophication for recycling rate 20%- PLASTIC



Comparison of environmental footprint of plastic and glass bottle for 20% recycling.

Conclusions

We observe that the plastic container has a greater impact on the environment based on the emission of carbon dioxide than the glass container.

The higher the recycling rate, the more feasible solution can be achieved. **However, we conclude that the best solution based on optimization is in both cases between recycling rates of 20-30%.**