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## Life Cycle Assessment of multilayer polymer film used on food packaging field

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### Abstract

The environmental impact of a multilayer polymer film, Low Density Poly Ethylene/Polyamide system (LDPE/PA), generally used on food packaging field, was estimated using life cycle assessment (LCA). The aim of the work was to understand how to reduce the environmental pressure from plastic packages for its lower recovery and reuse, which can be improved by developing material recovery or other appropriate recycling technology to improve the cyclic materials flows and recycling ratio. LCA is a tool specifically developed for assessing the overall environmental burden of a product, including the system used for manufacturing it and its end-of-life treatment. This work provides a cradle-to-grave LCA study of a food packaging envelope made with a multilayer polymer film, with two different depth of 70 and 90 micron, and a study of the possibility to utilize a 50% of recycled LDPE and PA polymer pellets in order to reduce the environmental impact. A one square meter envelope is used as functional unit.

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### 1. Introduction

The realization of a product, from a firm, implicates the definition and the careful planning of all of his/her cycle of life phases, in how much the adopted technologies and the materials used in phase of production can negatively influence the environmental quality of the following phases (use and end life): the methodology LCA represents the "perfect tool" for working on such procedure. And is in this context that the concept of the "to think about the cycle of life" (LCT - Life Cycle Thinking) it assumes importance and concreteness: the planning doesn't concern only the product but all of its cycle of life. The

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LCT becomes therefore a behavior that the various Firms should assume, not only to be able to contribute in an important way to the reduction of the global pollution, but also to mostly affirm him on the market, becoming more competitive and earning prestige to the customer eyes. Thus is important to understand that individualize the environmental impact and the sustainable development are the two concepts key for LCA methodology. The first one, because the application of the methodology involves, for definition, the quantification of the environmental impacts of every characterizing phase the cycle of life of a produced datum or trial. The second in how much, once you effect the final analyses and gotten the results, the possible improvements are appraised with the purpose to guarantee the environmental sustainability of the product in everything of its cycle of life; in other words, it is tried to reach that equilibrium, between technological innovation and guardianship of the environment, that really the sustainable development so much pursues. In a context as that as soon as above described, in which the concept of environmental sustainability assumes importance and concreteness more and more, arousing the interest of many producers in the various sectors of the industry is inserted our research, that aim to investigate, really from an environmental point of view, the packing field and, in particularly, that of the multilayer thin films used on the food packaging field [1-3].

The LCA is performed in accordance to the international standards ISO 14040 and ISO 14044. The inventory is based on data obtained from the envelopes producer, data from the scientific literature and from the Simapro database.

## 2. Materials and Methods

Two kind of film, with different thickness of 70 and 90 micron, were taken into consideration and, in order to compare the results, the same functional unit was identified, corresponding to a one square meter envelope. The study was conducted following the procedure indicated by the European standards series ISO 14040 and articulated in the following four basic steps:

1. definition of the objective and scope of the study; functional unit and system boundaries identification;
2. inventory analysis of lifecycle (Life Cycle Inventory Analysis), that clearly affects the main phase of the study, namely data collection;
3. evaluation of life cycle impact (LCIA-Life Cycle Impact Assessment);
4. interpreting the lifecycle data(LCI-Life Cycle Interpretation).

The data collected were elaborated with a dedicated calculation software (Simapro 7.0) and analysed by the Swiss IMPACT 2002+ methodology.

In order to evaluate and planning the data and information collection, the system boundary was build up, as shown in the following figure:

Further, with the aim to study the maximum echo-efficiency associated to the life-cycle of the examined products, having observed that the more impactant phase of the life-cycle associated to the envelopes concerns LDPE and PA film production, the possibility to use recycled granule, in quantity equal to the 50%, was take into consideration. Such option has been verified in terms of environmental compatibility and compared with the results first obtained.

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