How can the sustainability of pharmaceutical packaging be measured?

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Today, sustainability for many businesses is no longer just an ecological factor but also an important economic factor. This article indicates how sustainability in the production and transportation of packaging for pharmaceutical products has a positive impact on costs.

Environmental life cycle assessment

Concepts such as the ecological footprint are doubtless very interesting, but they do not help us to assess the environmental impact which is generated by a single product throughout its life cycle. To do this we must go one step further and apply what is known as the ecological life cycle assessment (LCA) method. LCA is the model for the complex interaction between a particular product and its environment 'from cradle to grave'.

Step 1 – Inventory (LCI - life cycle inventory): describes the emissions which occur and the raw materials which are used during the life cycle of a product. To make the comparison as objective and scientific as possible, commercially available software was used.[1]

Step 2 – Assessment: A listing of the impact of these emissions and of the depletion of raw materials.

Using the widely recognised Eco-indicator 99 method[2], the damage caused by all the emissions calculated in step 1 to our ecosystems is measured. Finally, individual categories, such as CO_2 emissions, can be compared.

Case study – NeoTOP packaging compared to a plastic tray for a six-syringe pack

In this case study we examine the environmental impact caused by two different packs which serve precisely the same purpose in their life cycle – the delivery of six syringes to a hospital. The NeoTOP solution consists of two flat cardboard blanks which are erected automatically by the Dividella packaging machine. The other, more traditional packaging consists of a cardboard box and a plastic tray. The plastic tray is usually deep-drawn on a thermoforming machine and then placed in the cardboard box in the cartoner. For purposes of illustration, we have looked at plastic trays made from PVC and PP, in order to better clarify the differences between different plastics. In this case, the aluminium tray serves only as a theoretical example, but can easily be applied to tablets, which are packaged in an aluminum blister.

In the scenario, the following aspects were considered:

- Production of raw materials such as PVC, PP, PET and cardboard fibres
- Manufacturing processes such as the production of cardboard and plastic film
- Energy consumption per pack by secondary packaging machines
- Transport of cardboard and plastic over a distance of 100 kilometres to the pharmaceutical plant
- End of life (landfill scenario)

The following aspects were not considered:

- LCA of syringes and patient information, as these are the same for both solutions.
- Transport from the pharmaceutical plant to end users. This subject is covered separately in the section on financial implications.

The life cycles were modeled in the SimaPro software and assessed according to the above-mentioned steps. Figure 1 illustrates the inventory stage and indicates the influence of any form of packaging on different environmental categories, such as "organic emissions" or "climate change". The latter includes, for example, emissions such as carbon dioxide or methane gas. The results from the database show that the CO_2 footprint of the NeoTOP solution over its entire life cycle amounts to about 18 grams of carbon dioxide, whilst the plastic solutions are at about 80 grams and aluminum is at the top of the scale at 155 grams. In short, even if we assume an error bar of 20 % in the modelling, the factor for Toploading is 4 to 5 times better with regard to the carbon dioxide environmental indicator.

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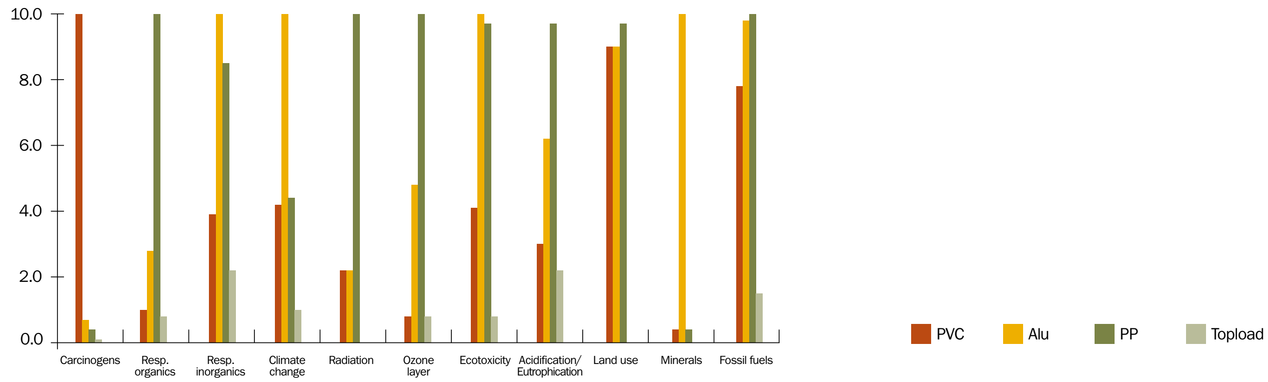

Figure 1: Comparison of different packaging materials and solutions in a wide range of environmental categories according to Step 1 of the LCA.

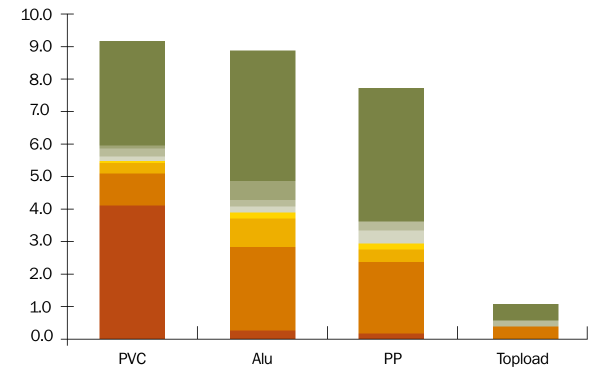

Figure 2: Comparison of overall environmental impact caused by the two different packaging solutions and different materials, measured in Eco-indicator 99 points.

The next stage examines how the different solutions look from the viewpoint of their overall impact. In Figure 2 all emissions of all categories are evaluated against each other and summated to give a total score for each packaging solution. The total environmental impact is measured using Eco-indicator points in accordance with the Eco-indicator method.

It is clear that the NeoTOP solution causes by far the least environmental damage. All other packaging solutions generate an environmental impact approximately 5 times higher. Of course, in the overall result many emissions are included; carbon dioxide is only a small factor, but an important one in the overall picture.

Financial implications of sustainable solutions

It is not particularly surprising that, as a general rule, more sustainable packaging also saves pharmaceutical companies money. On the one hand there is the cost of the packaging material. The less material used, e.g. an optimised size, the better the solution. Naturally, optimisation of size is not the only parameter in the development of pharmaceutical packaging. For each pack, there is always the challenge of weighing up different interests, some of which are in conflict, as shown below.

Smaller packs	versus	More advertising space
Lighter materials	versus	Better product protection
High pack density	versus	Single doses of medication
Higher OEE	versus	Smaller lot sizes
Size optimisation	versus	More patient information

However, Dividella has proved on numerous occasions that cost savings of 10 to 40 % are possible on packaging materials when switching from combination packs to NeoTOP solutions which consist entirely of cardboard. Savings of 10 to 20 % are possible if the size of the two solutions is similar, and 40 to 50% if the size can be optimised. Depending on the number of packs produced in a year, these recurring cost savings can be considerable.

Of course, the smaller size of the densely packed NeoTOP solution (thanks to the cardboard flutes preventing contact between the glass components) has a major effect on the transport costs of refrigerated goods. As an example, we have calculated the annual savings for a four-syringe pack (NeoTOP compared to a plastic tray in a side-loading box) which is currently on the market. If one assumes a volume of 2.5 million packs per year and an average shipment distance of approximately 2 600 km per vessel, the savings amount to about one million US dollars a year. For air transport of the same volume, these savings amount to about 10 million US dollars.

It goes without saying that the precise savings depend on the logistics, such as the type of transportation, distribution channel and network, and the number of packs. The above examples clearly show that material and transportation costs for solutions which are also environmentally sustainable can be considerably lower. For secondary packaging of pharmaceutical products, there has not so far been a single case in which the ecological and economic aspects contradict each other.

This article presents a method for analytical measurement the impact of different products and services on the environment. The LCA method allows customers to evaluate packaging solutions and to select those which reduce their own ecological footprint. In general, this environmental ranking goes hand in hand with the economic ranking. In other words: sustainable packaging solutions also bring significant cost savings.

1 SimaPro by PréConusultants (www.pre.nl)
2 Eco-indicator 99 impact assessment method – report available at www.pre.nl