HPLC · SMB · Osmometry

The Life of an HPLC System – An Environmental Perspective

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Summary

Life cycle assessment is a method that assesses all potentially environmentally relevant impacts resulting from products or processes. All phases of the product life cycle, from resource extraction through to manufacturing, utilization, up to and including disposal, are taken into account. The environmental impacts are then considered within an impact assessment. Here, the connection between material flows and the resulting environmental impacts is described with the help of existing models. Based on different impact categories, e.g. global warming or acidification, potential environmental impacts can be illustrated.

Introduction

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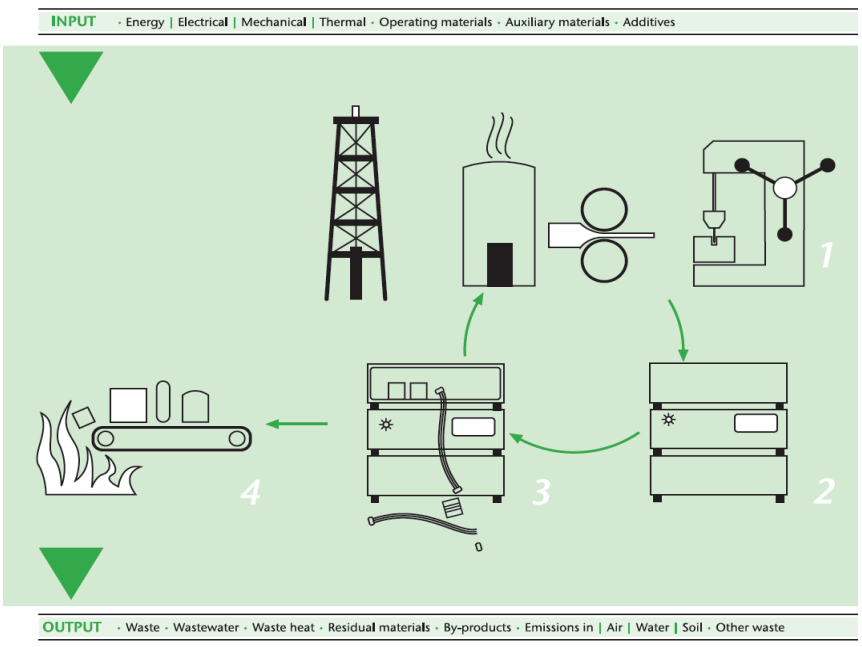

***Fig. 1**: Life cycle assessment – from cradle to grave*

Materials and methods

For the calculation, KNAUER computed a six-year useful life of the PLATINblue UHPLC system for the original purchaser with a service time of 4,260 hours per year. At this moment, KNAUER does not receive the products back as items for recycling – since the lifespan is substantially longer, thanks to the quality workmanship and quality components used. Thus recycling and disposal are not considered in this study. For the calculation of the solvents required for operation, KNAUER chose a 50:50 mixture of methanol and water, as this combination can be used without hesitation in nine out of ten cases of chromatographic analysis.

Within the GaBi-Software tool, the production of the components, solvents and energy consumption is modeled and the associated environmental impacts are displayed.

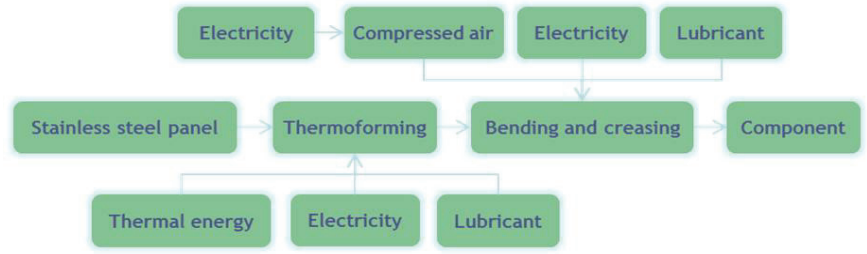

***Fig. 2**: Evaluation component-by- component: Exemplary illustration*

Results

The global warming potential (GWP) is the generally accepted equivalent of greenhouse gas accumulation (CO_2e), and describes the relevance of emissions for the global warming effect. The acidification potential is calculated in correspondence to the global warming potential and is stated as sulfur dioxide equivalents (SO_2e). These describe the capability of certain substances to form and release H+ ions. The conversion of airborne pollutants, such as sulfur dioxide and nitrogen oxides, into acids (e.g. H_2SO_4 and HNO_3) causes the acidification of soil and water. Of course there are other relevant categories which were taken into account - these are however not further elaborated here.

In Figure 3 and 4 the global warming potential and acidification potential of the production and use of the PLATINblue UHPLC system are displayed. Hereby the contribution of electricity consumption to the overall environmental impacts is significant. Furthermore the production of the components is environmentally relevant. Surprisingly solvent production has not a very high impact.

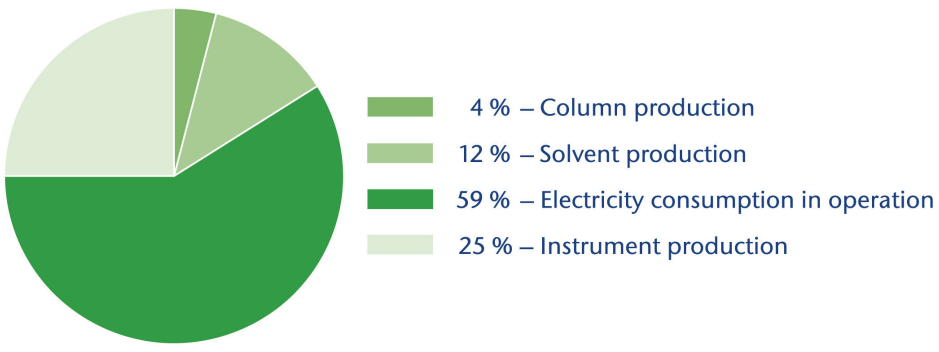

***Fig. 3**: Global warming potential production and use of a PLATINblue UHPLC system*

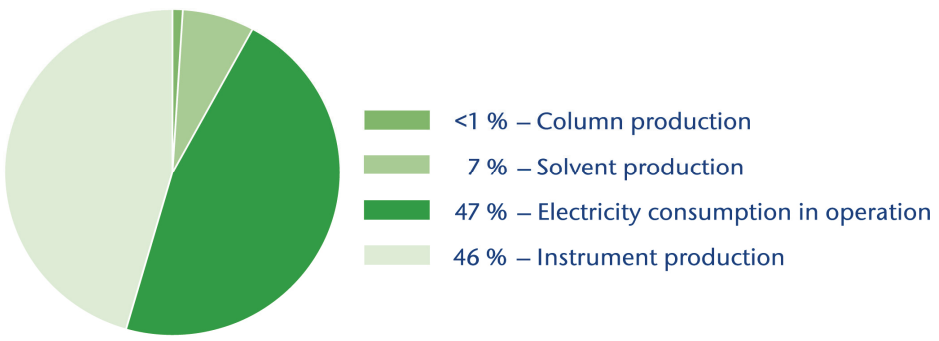

***Fig. 4**: Acidification potential production and use of a PLATINblue UHPLC system*

Conclusion

With the help of the life cycle assessment environmental relevant areas of production and use of a HPLC could be identified. Surprisingly not the solvents but electricity consumption during the use of the HPLC systems is a major driver for environmental impacts. Other solvents besides methanol might of course have more severe environmental impacts, also with regard to the use and disposal phase and when including eco- and human-toxicity. However, a future focus should be on the installation of electricity-saving components. As electricity consumption of KNAUER systems is already lower than that of most competitors' products, less environmental impacts are associated with the use of KNAUER systems.

References U.S. Environmental Protection Agency; ISO 14040:2006; ISO 14044:2006; PE- International 2010; Ecoinvent 2010