

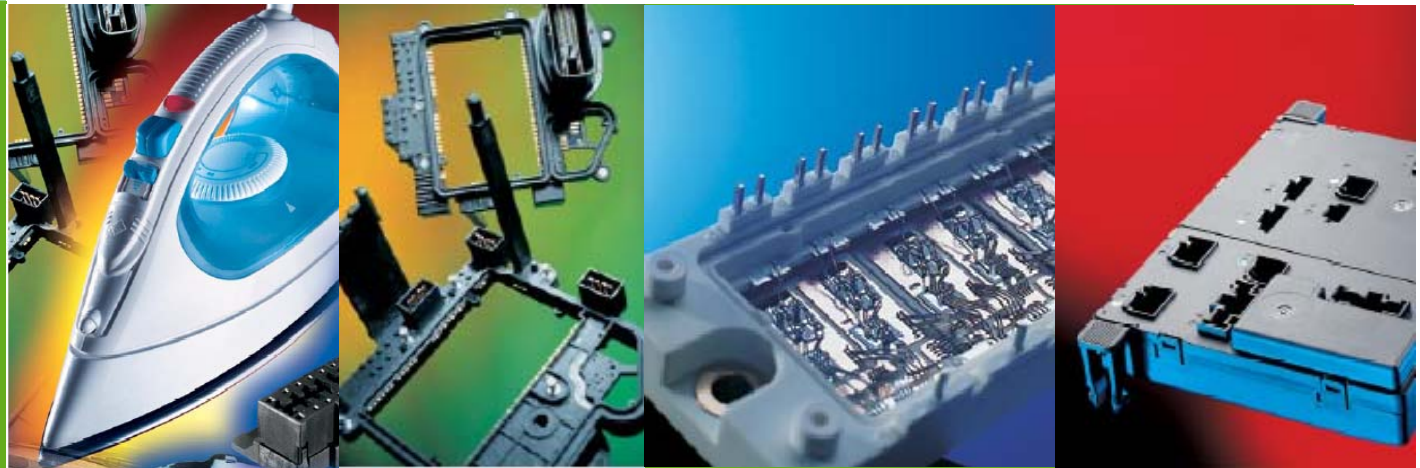
Label Eco-Efficiency Analysis



Ultradur® High Speed

BASF Aktiengesellschaft
Ludwigshafen, Dezember, 2005

 **BASF**
The Chemical Company



Summary (I)



- This eco-efficiency analysis compares the production of injection molding components using standard *Ultradur*[®] and the new BASF product *Ultradur*[®] *High Speed*
- In all cases the use of *Ultradur*[®] *High Speed* leads to an **increase in the overall eco-efficiency**.
- Both the costs over the entire life cycle and the environmental impact are more favorable when substituting standard *Ultradur*[®] with *Ultradur*[®] *High Speed*.

continued

Summary (II)

- The environmental and economic advantages of the *Ultradur® High Speed* relative to the standard *Ultradur®* are due to its modified rheological properties. The addition of specially developed organic nano particles reduces the melt viscosity. As a result, the molding temperature and the injection and holding pressure decrease, leading to:
 - Approx. 20% **energy savings**
 - **simplified** mold design and construction
 - significant **material savings** when designing thin wall parts
 - better surface properties and **less pieces out of specification**
 - up to 10-30% **shorter cycle times**

The Eco-Efficiency Label



Requirements

1. Accomplished Eco-Efficiency Analysis according to the methodology certified by TÜV Rhineland/ Berlin-Brandenburg, Germany.
2. Verification of the investigated product to be more eco-efficient for the defined customer benefit than other alternatives as result of the analysis.
3. Presentation of a third party evaluation (so-called Critical Review according ISO 14040 ff.).
4. Publication of the results via internet on website www.oeea.de, which is referred to on the label.
5. Payment of the license fee for the duration of three years (s. price list).

Certificate

CERTIFICATE



Eco-Efficiency Analysis "Injection Molding Ultradur® High Speed"

The evaluation of environmental and economic effects of "Injection Molding with Ultradur® High Speed" by using an eco-efficiency analysis according to the validated method is certified.

*BASF Aktiengesellschaft,
E-KTE/MD Engineering Plastics*

is granted the right to use the Eco-Efficiency Label in the presented form for

Ultradur® High Speed

for a duration of three years.

The main results are published under
www.oeea.de.

Ludwigshafen, 19.12.2005

Dr. M. Kayser
Senior Vice President Product Safety

Dr. A. Kicherer
Group Leader Eco-Efficiency



Final result

- The Eco-Efficiency label can be awarded to the *Ultradur® High Speed*. It was shown that it is much more favourable and eco-efficient than the alternative system.



Expert opinion: Critical Review (I)

by Prof. Hungerbühler, Swiss Federal Institute of
Technology (ETH Zürich), CH-8093 Zürich-Switzerland



General impression

The report of the eco-efficiency analysis has been drawn up as a presentation for target groups within the company. So the report focuses on the illustration of results and not on specifications of the method. Therefore many assumptions are described in the appendices.

Methodology and Data

The methodology and the assumptions made along the project are logical and scientifically valid and have been performed according to all main requirements of ISO 14040. They are consistent with the goal and scope of the project.

The allocation rules have been clearly described.

Goal and Scope

In the eco-efficiency analysis two processes for the production of injection molding components have been compared: the standard Ultradur® process and the new Ultradur® High Speed process.

Goal and scope of the project are clearly displayed in the report. It is stated that this study could be used to show the advantages of the alternative product.

Target groups of the study are identified as potential customers of the BASF.

The limitations and restrictions are also clearly stated. The study is limited to the special Ultradur® process and cannot be transferred to other regions or extraction processes.

The geographical scope of the study is Western Europe; the time-related coverage is about 2000 – 2005, depending on the data available.

The system boundaries are correctly described in the report. The use and the recycling of disposal of the products are identical for the two processes and have therefore been neglected. Because of the lower material use (10%) this doesn't seem to be consequential in this study, but if these steps would be included, the advantages for the High Speed product would be even bigger, so this neglect does not change something in the total conclusions.

Expert opinion: Critical Review (II)

by Prof. Hungerbühler, Swiss Federal Institute of
Technology (ETH Zürich), CH-8093 Zürich-Switzerland



Inventory analysis

The inventory analysis has been done in accordance with the requirements of ISO 14041, and in line with the goal and scope.

The basic data were listed in a separate database, which is not open to the public. As the reviewers have not been involved in the data collection and data processing phases the validation of the calculation has been done only in a sample survey.

The basic data and the assumptions for the inventory are valid and in line with the goal and the scope.

A remarkable point is the high quality of the basic data, because most of them are directly measured (a) at the plant for production of the product and (b) in experiments at the BASF-Technikum for the application.

Impact assessment

The impact assessment has been done in accordance to the requirements of ISO 14042.

Interpretation

The interpretation has been done in accordance with the requirements of ISO 14043, and in line with the goal and scope framework. A formal completeness check according to ISO 14043 has not been performed and documented. A consistency check has been made for the relevant data sources.

As sensitivity analysis 7 scenarios have been calculated. The relevant input and weighting factors have been analysed in the sensitivity analysis. The results show that the eco-efficiency of the two processes is hardly affected by the relevant sensitivities. The outcome of this is that the results of the eco-efficiency analysis are very stable. The conclusions are drawn in line with the goal and scope.

Eco-efficiency Study

The calculations for building the eco-efficiency portfolio are consistent and in line with the eco-efficiency method, which is described in the literature (P. Saling, A. Kicherer et al., Int. J. LCA 7 (4), 203-218 (2002)).

Expert opinion: Critical Review (III)

by Prof. Hungerbühler, Swiss Federal Institute of
Technology (ETH Zürich), CH-8093 Zürich-Switzerland



Overall Conclusion

The LCA part of the project was in general conducted in compliance with the recommendations of the ISO 14040ff standards. The study is consistent and scientifically valid. A restricting point is that the report is not always clearly arranged, as it is a presentation for the target groups like customers. It would be clearer to write two reports: a report on the eco-efficiency study with a clear methodological description and another report as a presentation.

The critical review process was very constructive, and significant efforts for improvements were successfully dedicated along this validation process.

Contact



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Objectives of the Eco-Efficiency Study



The study aims to quantify the economical and ecological advantages of BASF innovation *Ultradur® High Speed* compared to its standard product *Ultradur®*

The study used the methodology of the eco-efficiency analysis, developed by BASF as a life cycle tool to show and assess different parts of the life cycle of the raw material production and the processing of the plastic via injection moulding. Use and disposal phase have been left out of the balance since they are identical to both alternatives.

The ecological calculations belonging to the ISO-rules 14040 ff.

The methodology has been approved by the German TUV. It is used by the Eco-Institute in Freiburg Germany, TNO in the Netherlands. The Wuppertal Institute accepts the method. It was developed by BASF and Roland Berger Consulting, Munich.

Another aim was to show the customer the relative advantages of using the most eco-efficient alternative.

Limits and Restriction for the Use of the Results



The LCA-calculations were set up according to the rules and principles of the DIN EN ISO 14040 to 14043. The eco-efficiency analysis goes beyond the ISO rules, for example with the consideration of life cycle costs and use of the eco-efficiency portfolio for presentation of aggregated results.

The results are valid for the defined products and customer benefit (CB) only.