20 years of
Life Cycle Assessments

EDANA Environmental Evaluation Committee

Overview of Life Cycle Assessments - January 2013

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Foreword

Since 1992, when the first EDANA LCA project was undertaken, our industry has come a long way, and covers many different product categories. This report summarises the main findings of the numerous LCA activities EDANA has engaged in over the years.

EDANA is the leading international trade association serving the nonwovens and related industries. As an industry, we have a longstanding tradition of using life cycle assessments as the tool of choice to evaluate the environmental impact of our products.

EDANA's unique vertical structure, encompassing companies from all stages of the value chain from raw materials to finished products, makes EDANA particularly well-suited to act as a platform to coordinate industry-level LCAs as companies with direct access to data for all parts of the life cycle are present under one roof and used to working together.

In the early 1990s, the sustainability vision of EDANA led to the creation of a platform enabling its member companies to be the pioneers in developing LCA information across a value chain. Many industries seek to implement today what EDANA was able to achieve then: the creation of a platform to collect and analyse LCA data from the raw material to finished product.

This was made possible thanks to EDANA's unique integration of companies from all parts of an elaborate value chain, its long tradition of promoting best practices in relation to the environment, and an ambitious sustainability vision.

Building on the vast amount of data collected over the years, EDANA established an industry sector LCA database, with comprehensive documentation of the datasets. This has enabled member companies from all stages of production to best utilise the data thanks to information about the scope, quality and age of the data, (amongst others) available for the materials they use, and the products they manufacture.

Another key aspect of the wealth of LCA data available within EDANA was crystallised in the trend analysis on baby diapers and incontinence products, where data was available to cover more than 20 years of product development.

For an industry sector, average LCA data is crucial for sustainability reporting and interaction with key stakeholders, as industry average LCA data also enables individual member companies to benchmark their products and processes, understand the source of their main environmental impacts, and how they can effectively reduce them.

1

Life Cycle Assessments

A life cycle assessment (LCA) is a method for assessing the potential environmental burden and impacts associated with a product system from the acquisition of raw materials through production, use, end-of-life treatment, possible recycling and final disposal. Life cycle based sustainability models and metrics play a key role in guiding the transformation of technology, consumption patterns, and corporate and governmental policies for achieving a more sustainable society.

Life cycle modelling represents a unique sustainability assessment framework for at least four reasons:

1) The life cycle of a product system encompasses all processes for addressing societal needs including materials production through to end-of-life management;

2) The life cycle links production and consumption activities;

3) The system boundary of a product's life cycle enables a comprehensive account of sustainability performance including environmental, social and economic metrics;

4) Metrics can be used by key stakeholders that manage and control the life cycle supply chains to guide their improvement.

The LCA methodology has been developed extensively during the last decades. The Society of Toxicology and Chemistry was the first organisation to structure the method in a Code of Conduct. As from 1992, the international organisation of standards, ISO, started to work with standards for LCA. They were revised in 2006, and principles, framework, requirements and guidelines are now in the two standards ISO 14040:2006 and ISO 14044:2006.

LCAs consider the potential environmental impacts throughout a product's life cycle (i.e. cradle-to-grave) from raw material acquisition through production, use and disposal.

Examples of environmental impact categories of an LCA, includes potential effects in the area of resources, human health and ecosystem health. Potential environmental impacts are global warming (greenhouse gases), acidification, smog, ozone layer depletion, eutrophication, eco-toxicological and human-toxicological effect, land use as well as depletion of resources. Since LCAs can also include human and environmental toxicity indicators, this may be easily misinterpreted as safety indicators by non-experts. Safety evaluation of chemicals is an absolute requirement within a sustainability framework for which reason assessment tools should be used designed for this purpose.

In this example, risk assessment is a more appropriate tool to evaluate chemicals than LCA. In such a way, sustainability needs to be assessed by a complementary set of assessment techniques.

LCAs can be used to make an informed decision on selecting a specific product. They can also be used by the producer to identify processes in the life cycle where environmental improvements can be implemented.

The term 'life cycle' refers to the notion that a fair, holistic assessment requires the assessment of raw material production, manufacture, distribution, use and disposal including all intervening transportation steps necessary or caused by the product's existence. The sum of all those steps - or stages - is the life cycle of the product. The concept also can be used to optimise the environmental performance of a single product (ecodesign) or to optimize the environmental performance of a company.

The LCA study can assist in:

- Selection of relevant environmental performance indicators;
- Identification of improvement opportunities for the studied product or service throughout its whole life;
- Decision-making in industry, governmental and non-governmental organizations;
- Marketing opportunities for products, e.g. to use LCA data for eco-labelling, environmental product declaration (EPD), etc.

An LCA commissioned by EDANA for any of its product categories can be used to provide a baseline for a product category's environmental performance in order to show improvements during its development.

The outcome of an LCA will also show which are the important environmental aspects of a product category, hence providing arguments in policy discussions with retailers, NGOs or authorities.

LCAs can therefore be used with the following objectives:

- Provide input for product or process development;
- Generate data to support decisions or comparisons between raw materials, products, product categories or processes;
- Support arguments for a product or process in sustainability policy debates.

2

Overview: EDANA LCA Initiatives - Publications

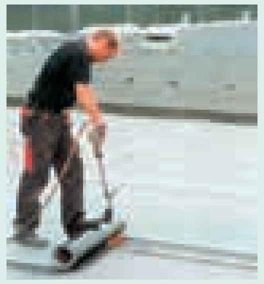
1992-1997: The EDANA LCA Project

1992 Life Cycle Assessment Workshop (Brussels)
Scope: Identification of an outline for the EDANA LCA project

Guidance on LCA methodology, dos and don'ts, interpretation of LCAs, pressures from regulatory bodies and NGOs towards LCAs. Case studies on polypropylene fibres, baby diapers, medical gowns and drapes and packaging.

1994 Workshop – The EDANA LCA Project (Vienna)
Scope: LCA methodology for an EDANA LCA

Information on process tree, data structure of modules, impact assessment and valuation, use and misuse of LCA data, the Econet tool/ UMBERTO



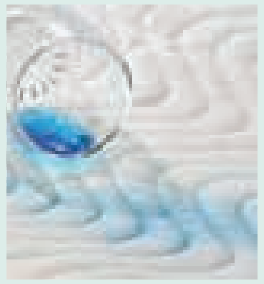
2001: Ecoprofile of Polyester Nonwovens for Roofing membranes

Scope: Cradle to gate LCI

The five main manufacturers of polyester nonwovens for roofing membranes undertook a joint ecoprofile to determine the environmental impact of their products.

1997 The Edana LCA Project: a case study
Scope: review of first EDANA LCA on baby diapers

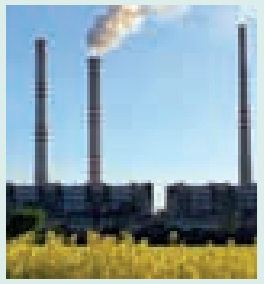
The EDANA LCA project has enabled many members to gain knowledge of LCAs/LCIs as a tool. Companies were provided with a database allowing them to make calculations specific to their products, on the basis of the data collected.



2004: Life cycle data for Incontinence Products

Scope: Cradle to grave LCA

To update the processes and systems from the prior LCA of 1997, and apply this to obtain life cycle data for incontinence products.



2005: Assessment of Waste Management Alternatives for Diapers

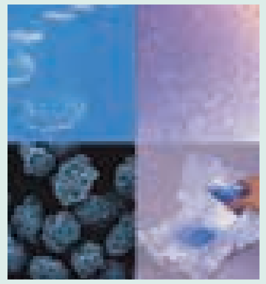
Scope: Gate to grave LCA

Case study of different waste management systems; landfill, incineration and four different mechanical, biological pre-treatment plants (MBT). Also includes the benefits of replacing electricity, steam, and heat generated by conventional power plants with electricity, steam, and heat generated by incineration of waste from MBT plants.

2007: Trend analysis of the Environmental Performance of Baby Diapers and Incontinence Products

Scope: Cradle to grave LCA for diapers and incontinence products

Comparison of LCA data for baby diapers and incontinence products between 1995 and 2005.



2009: Life Cycle Inventory of Superabsorbent Polyacrylate (SAP)

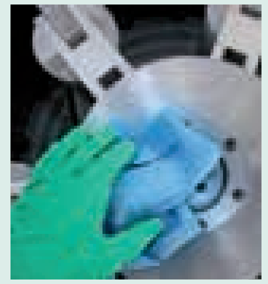
Scope: Cradle to gate LCI for SAP produced in Europe

The producers of Superabsorbent Polyacrylate (SAP) in Europe conducted a Life Cycle Inventory (LCI) to model the environmental impact of their activities. The study is based on primary data from all European SAP manufactures, constituting five manufacturing sites.

2010: Baby wipes LCA

Scope: Cradle to grave LCA

Comparative LCA of an average baby wipe (European industry average) with alternative products, i.e. cotton wool balls and washable cotton cloths (wash cloths).



2011: Industrial wipes LCA

Scope: Cradle to grave LCA

Comparative LCA with an average industrial single-use wipe (European industry average), and with alternative products, namely washable rental cloths.

3

EDANA LCA Initiatives

1992 - 1995

2001

1992-1995 : The EDANA LCA Project

Background

On 25th November 1992, EDANA held its first LCA workshop. Over 100 delegates from more than 60 EDANA member companies attended this meeting. This workshop, the first of its kind in the nonwovens and related industries, aimed to introduce the LCA methodology to companies and demonstrate how it could be used. After years of working on environmental management, the interest in LCA stemmed both from external demands by authorities and national interest groups and from the opportunity to identify environmental improvements that would lead to savings within companies.

EDANA Guidelines for the environmentally-sound manufacture of nonwovens, and of absorbent hygiene products, were published in 1992. This provided a basis for member companies to pursue environmentally safe and cost-effective manufacturing of their materials and products. EDANA members agreed on the need to take environmental responsibility, and felt that in order to do so they should accurately know the impact of the products and processes used.

Goal

The first EDANA LCA project started in June 1993, with 66 member companies participating. The single-use diaper was chosen as reference for the project given it is the product involving the most EDANA members at the various stages of the value chain. IFEU, the German-based Institut für Energie und Umweltforschung was selected to support data collection and analysis. The deliverables from this project were as follows:

- A common approach to LCA methodology;
- LCA software for calculation (UMBERTO);
- A database relevant to each company;
- A baseline for each company to measure future product and process improvements;
- Better understanding of LCA methodology and its applications.

After three years, the project delivered on the ambitious objectives set: through several workshops participating companies became acquainted with the LCA methodology, its opportunities and limitations.

The EDANA LCA project consisted of two sub-projects:

- A 'learning project' to ensure that member companies become familiar with the benefits and limitations of LCA methodology;
- A case study focused on the life cycle of a single-use diaper. The execution of a case study was intended as a practical example to generate reference data which could be of use to all participating companies, and to develop life cycle inventory (LCI) software with detailed process trees which could be easily used or amended by individual companies, facilitating their future application of the LCI tool. The data also provided a valuable basis to illustrate how LCI data could be analysed and interpreted, and to explain the state of discussion in the developmental stage of life cycle impact assessment.

2001 : Eco Profile of Polyester Nonwovens for Roofing Membranes

Background

Nonwovens and especially polyester nonwovens are used in a wide variety of applications for consumer and industrial markets. This study concerns polyester nonwovens manufactured in Europe for the industrial roofing market.

One of the main applications in the roofing market is membranes used for waterproofing where the most important function of the polyester carrier in a waterproofing membrane is the enhancement of mechanical properties and lifespan.

The waterproofing membrane applied for example on flat roofs should resist heavy influences caused by the weather such as temperature fluctuations, rain, storm and hail. Also damage caused by footsteps, apparatus mounted on the roof and animals should not lead to a failure in the waterproofing system. Polyester reinforcement is the key to a very high level of tear and puncture resistance.
A professionally built roof made by high quality membranes should lead to a minimum of repair work, replacement of materials and the longest possible lifetime.

Goal

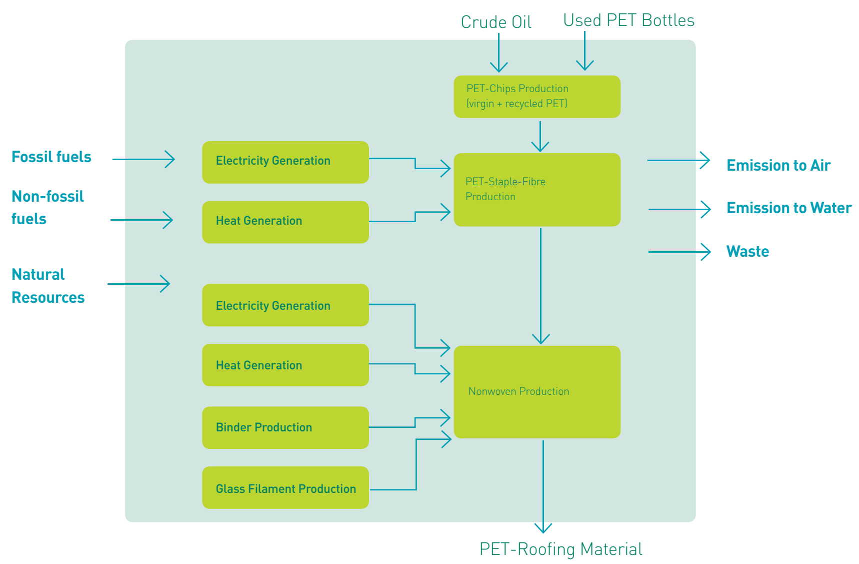
The five main manufacturers of polyester nonwovens for roofing membranes undertook a joint ecoprofile to determine the environmental impact of their products.

In the construction industry, authorities, trade, branch organisations and producers work together to assess and minimise the possible effects of their activities towards the environment.

The five main producers in Europe of polyester nonwovens for the roofing industry have cooperated within EDANA and carried out an eco-profile project. The purpose of the project was to generate environmental product information on polyester nonwovens for roofing membranes.

The companies participating and delivering data to the project were:

Boundaries of LCI-Data Set for PET-Roofing Material (1)



- Colbond, The Netherlands;
- Freudenberg Politex, Italy;
- Johns Manville Europe, Germany;
- ORV, Italy;
- WATTEX, Belgium.

Scope

Cradle to gate LCI

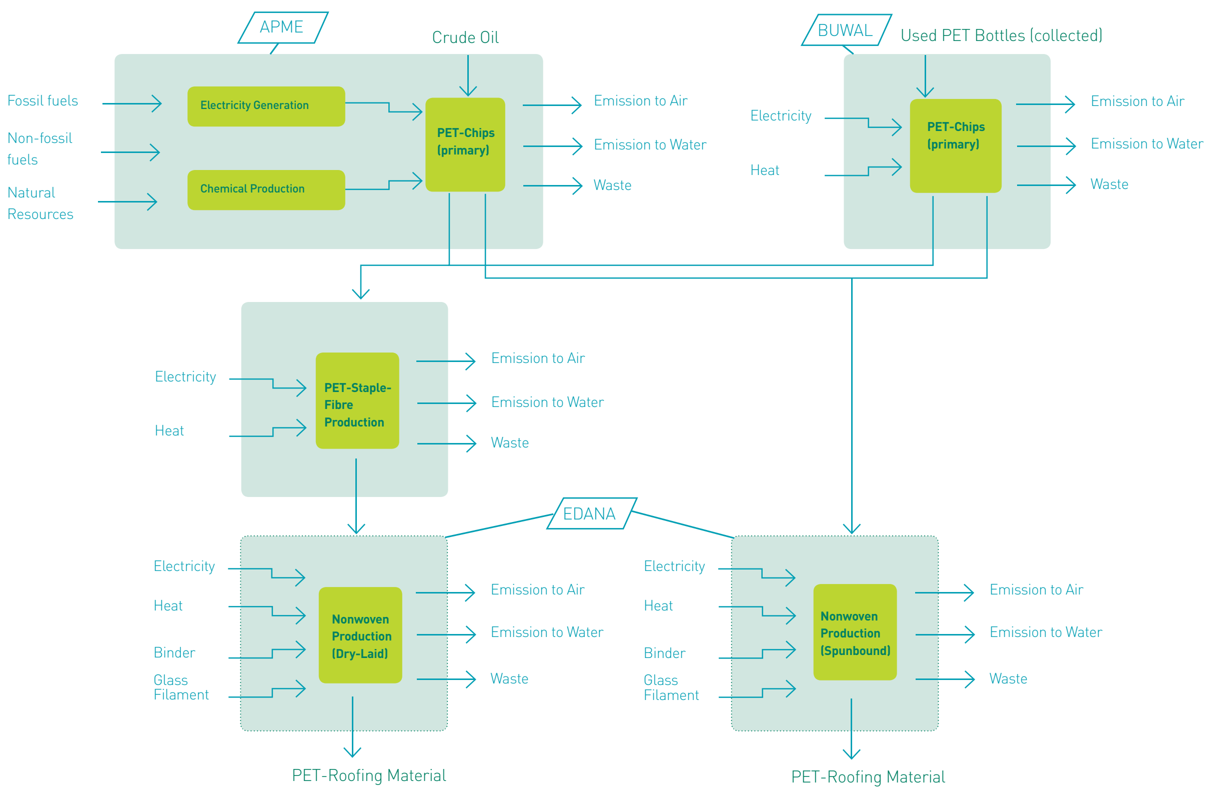
The "cradle-to-gate" data comprises all process steps of polyester nonwoven production from crude oil extraction to the factory gates of nonwoven producers. The eco-profile has been calculated as an average weighted by the European production volume in 1999 of the participating companies, in order to achieve the best representation possible.

One of the main materials for the production of nonwovens for the reinforcement of waterproofing membranes is polyester (PET). It enters the nonwoven production process either as PET chips or PET staple fibers. Both inputs can be based on virgin PET or a mixture of virgin and recycled PET. Therefore, a representative share of recycled PET has been accounted for.

The PET nonwovens are produced by spunlaid and dry-laid techniques, both of which are comprised in the present eco-profile.

According to LCA methodology, the processes required to deliver material and energy input into the PET nonwoven system have been traced back and included into the system model. For each process, resource consumption, air and water emissions, and wastes generated have been aggregated into the inventory data set.

Boundaries of LCI-Data Set for PET-Roofing Material (2)



2004 : Life Cycle Data for Incontinence Products

Background

EDANA conducted a new effort to collect input and output data for the production and use of adult incontinence products including the production of raw materials (upstream processes), the production of the product itself, its use and the (downstream) waste management systems.

Goal

The main objective of the project was to upgrade the processes and systems from a prior LCA study (1995). As it is a cradle to grave study, waste management is included. The data on natural resources and raw materials are data from the suppliers and IFEU. Product data, production of diapers as well as waste management data are from EDANA/IFEU database. The report has a European perspective.

The functional unit is the use of incontinence products for one person in one year. In total 1,700 pieces (197.2 kg of product) are needed, with an average weight of 116 g.

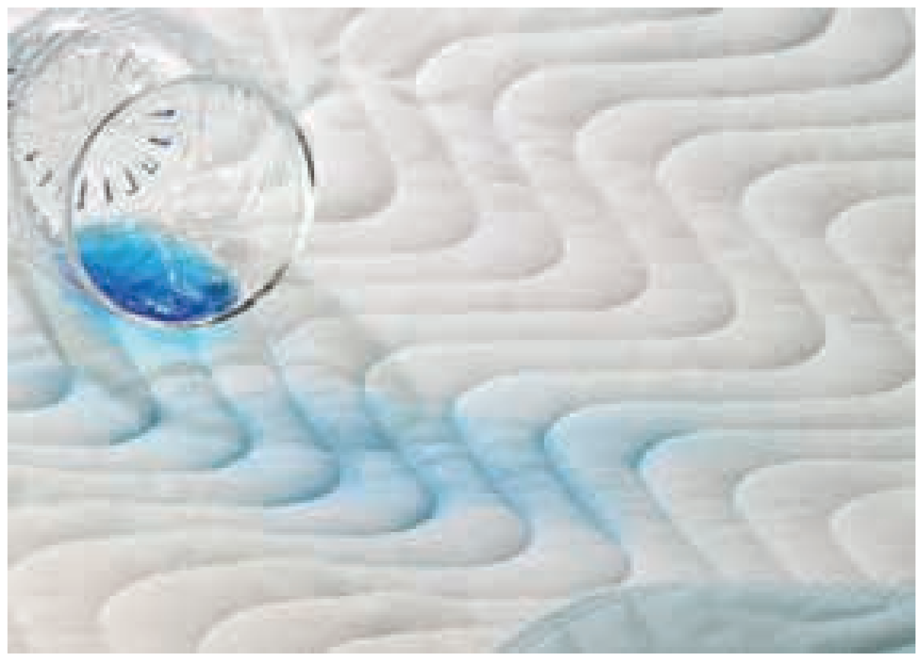
Scope

Cradle to gate LCI

The data collection comprises the upstream processes of the production of:

- Fluff pulp;
- Superabsorbent polyacrylate (SAP);
- PP nonwovens;
- Polyethylene and polypropylene film;
- Adhesives;
- Adhesive tape;
- Elastic materials;
- Packaging materials and the production of the incontinence product itself.

In addition, the data of processes such as transportation, incineration and disposal of used incontinence products in landfill were collected, modelled and documented.



2005 :
Assessment of Waste Management Alternatives for Diapers

Background

Mechanical – biological treatment (MBT) is regarded as a major alternative to direct landfill and direct incineration, and which may also contribute to the objectives of the EU landfill Directive for residual waste. The roles of waste reduction and recycling were not considered in this report. Nevertheless, incineration and co-incineration of parts of the waste flow will always play a role in MBT concepts.

Goal

Since EDANA had an up-to-date data set for the production of incontinence products and the components of baby diapers, this data was used to learn about the environmental impact of the different waste management options concerning the used products.

Different aspects like the CO2 balance, resource savings, and emission of gases or effluents could be calculated using the different characteristics of the waste management alternatives.

Scope

Cradle to gate LCI

This project is a case study of different waste management systems; landfill, incineration and four different MBT plants (gate to grave). Also included was the equivalent benefit system (cradle to grave), e.g. the benefits of replacing electricity, steam, and heat generated by conventional power plants with electricity, steam, and heat generated by the incineration of waste from MBT plants.

The study was concentrated on waste treatment options in Germany because of the already existing experiences but these options are discussed across Europe. The focus is mainly on MBT and the material flows which they generate.

The characterisation of the waste stream does not start with a hypothetical used diaper but is based on a real field analysis of the fraction of "hygiene products" in Germany which is mainly composed of used baby diapers.

Then the different waste management options are explained which consist of four MBT options, direct landfilling and direct incineration.

The MBT options are not identified in this exercise but they all represent operating plants or plants which were being optimised at the time of the study. For most of the plants, information and real operating data, provided by the plant operators, were used and partially adopted for this study.

Key conclusions

Most of the impact results show that the benefits of waste management are larger than the impacts caused by the waste management operations mainly due to energy substitution. Fossil resources, global warming and emission of carcinogenic pollutants are especially reduced by a properly performed treatment.

The MBT options tend to be advantageous. The more diaper material fed to coal power plants as a refuse derived fuel (RDF), the better the results are. This rule can be stated for all impact categories. Therefore, the best option is total conversion into RDF and co-incineration.

In other respects no clear ranking has been obtained because of ambiguities (landfill is most disadvantageous but better than Municipal Solid Waste Incinerator (MSWI) in terms of nutrification).

Further analysis shows that the waste treatment of used diapers (including all up- and downstream processes) has less environmental impact than the processes substituted by waste management. This can be stated for all considered alternatives apart from landfilling.

Waste management of used diapers does not necessarily cause adverse environmental impacts if treated the right way. The results show that the benefits of the waste management options (mainly by energy substitution) compensate the impacts they cause.

About two thirds of the material of a diaper is based on organic materials (pulp, faeces) and the content of harmful substances like heavy metals is low compared to average municipal solid waste.

Combustion of diapers in MSWI or as a RDF in industrial combustion plants causes low emissions of CO2 (fossil) and other pollutants, while the substituted energy processes (electricity from general grid, district heating or coal firing) usually creates higher or about the same level of emissions.

The use of fossil resources and the emission of carcinogenic pollutants can be reduced by a properly performed treatment of the waste. The use of MBT or MSWI with high energy efficiency reduces the global warming potential of products at the end of life stage.

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:182:0001:0019:EN:PDF

2007 :
Trend Analysis of the Environmental Performance of Baby Diapers and Incontinence Products

Background
A trend analysis is an exercise to understand more about the developments of a product and its use over the years. It is an application of life cycle thinking in the context of production and consumption, and should be used to better understand the environmental performance of a product and its service.

The understanding of the developments of the past in a quantitative and qualitative way could be an important guide for future developments of the product and the setting of priorities. It also can be used to influence consumer behaviour and communicate with legislators about important framework conditions (e.g. for energy production, waste treatment, etc.).

Goal
The influence factors for the changes of a product and its use patterns are manifold and complex. Therefore a main task of this trend analysis was to understand the different influencing aspects and break them down in a transparent manner.

Scope
Cradle to grave LCA for diapers and incontinence products.

Key conclusions
The combination of improvement of processes, the reduction of weight, the change in diaper composition and the development of waste treatment has the effect that an environmental improvement for all impact categories can be stated for baby diapers and incontinence products from 1995 to 2005. For some impact categories the shift from landfilling to incineration is significant to ensure the environmental improvement.

Production processes:

- In general a tendency can be observed for an improvement of less impacting production conditions. Nevertheless, it is difficult to distinguish between the real improvement and the effect of a different sample of production sites used as reference;
- A more careful approach will be needed to better monitor the developments of environmental performance of a whole industry sector. Single plants could be observed quite easily, however this is different for a whole industry sector with all production sites and changing framework conditions;
- Data gaps and inconsistencies are most influential on this basic step of the trend analysis and some examples had been found to assign a change in the time line only to different knowledge of data or different modeling approaches.

Waste management:

- The most important trend aspect in waste management is the change of waste treatment as final disposal. According to the European waste policy this is a shift from landfilling to incineration. A ratio of 78% to 22% (landfill – incineration) in 1995 changed to a ratio of 68% to 32% in 2005;
- Technical improvements are driven by European legislation. For both treatment options technical improvements have been achieved. For incineration better flue gas scrubbing systems are applied and for landfilling better landfill gas collection systems and liners for leachate collection are installed. The positive consequences for diapers can be noted for the reduction of the emission of the greenhouse gas methane and most other pollutants.

Composition and weight of baby diapers:

- The total weight of a baby diaper decreased by more than 30% from around 65g in 1987 to 40g to 2005. This material reduction resulted in a reduction in the majority of environmental impacts caused by the production, use and disposal of an average baby diaper;
- The reduction of weight is combined with a significant change to the material composition. The increase share of SAP and PP nonwovens is contrasted by a decrease of fluff pulp. Even if the specific figure of an environmental parameter (per kg of material) is higher for SAP or PP the overall weight reduction overrode the specific increase. Only the demand for fossil energy is higher in 2005 than it would have been in 1987;
- For global warming and summer smog formation, the change of diaper composition would have resulted in higher figures for 2005. But the lower landfill gas generation in waste management due to the lower content of fluff pulp compensated for the increase and continued to show a still positive development caused by the composition;
- Acidification, terrestrial and aquatic nutrification were positively influenced by the change in baby diaper composition.

Composition and weight of incontinence products:

- The time span from 1995 to 2005 resulted only in a minor reduction of weight by 6% with corresponding consequences for the environment;
- The tendency of less fluff pulp (minus 11%) and a 60% increase of SAP from 1995 to 2005 are an important steering aspect for the environmental results. All environmental impacts decreased or were at least constant thanks to the changes of composition, weight and production rejects for incontinence products. The effect was a reduction in weight of approximately 10%);
- With only small changes in composition and weight, and a link to environmental changes, parameters previously considered as unimportant have gained more significance. The influence of production rejects, transportation routes and other minor assumptions can be significant, and even dominate single impact categories.

Conclusions for the whole life cycle of baby diapers:

- The combination of improvement of processes, the reduction of weight, the change in diaper composition and the development of waste treatment has the effect that an environmental improvement for all impact categories can be stated for the baby diaper from 1995 to 2005;
- For some impact categories the shift from landfilling to incineration was significant in the delivery of environmental improvement;
- Based on normalised results, the environmental impact

caused by the total sale of baby diapers in Europe was equivalent to the impact caused by 50,000 (summer smog) to 300,000 inhabitants (based on the fossil energy demand) of Europe.

Conclusions for the whole life cycle of incontinence products:

- The combination of improvement of processes, reduction of weight, change in diaper composition, and the development of waste treatment has meant environmental improvement for all impact categories for incontinence products from 1995 to 2005;
- The environmental improvement of processes between 1995 and 2005 is highly important for the overall performance since the change in composition and weight was not decisive;
- Based on normalised results, the environmental impact caused by the total sales of incontinence products in Europe was equivalent to the impact caused by 30,000 (summer smog) to 130,000 inhabitants (based on the fossil energy demand) of Europe.

2009 : Life Cycle Inventory of Superabsorbent Polyacrylate (SAP)

Background

The producers of Superabsorbent Polyacrylate (SAP) in Europe decided to conduct a Life Cycle Inventory (LCI) to accurately measure the environmental impact of their activities.

The study was based on primary data from all European SAP manufactures, constituting five manufacturing sites and is thus considered representative of the European average. The study showed a significant improvement as a result of continuous efforts to reduce the environmental footprint of their products.

Goal

Precise data on the actual environmental impact of SAP production enabled producers to identify key environmental impact factors and, where possible, take measures to further reduce this impact.

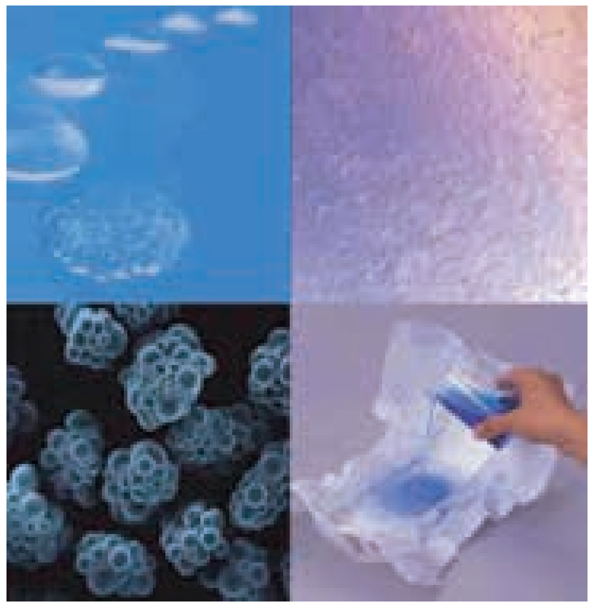
This data will also enable a more accurate evaluation of the environmental profile of finished goods that incorporate SAP and hopefully lead to a more balanced view of the added value of SAP.

Scope: Cradle to gate LCI for SAP produced in Europe

The degree of detail of the upstream processes of SAP and of the modelled inputs into the SAP technologies that have been applied in this study is high. All data has been modelled up to the resource and no relevant cut offs in the unit process data has been undertaken.

Key conclusions

Considering the environmental impacts of the SAP production the process chain seems to be already optimized. As the environmental impact of the GAA is the most important in the complete SAP process chain (depending on impact between 42% - 69%) from cradle-to-gate, the GAA LCA data is essential for the sustainability of SAP.



2010 : Baby Wipes LCA

Background

The significant growth of the market for baby wipes, together with an increased demand from producers, retailers and consumers for information on the environmental impact of these products, prompted EDANA to coordinate a study on behalf of the main producers of baby wipes.

Goal

The overall goal of this study was 1) to provide the nonwovens industry an understanding of the environmental impacts associated with baby wipe products, and 2) to provide a relative comparison of these products with alternatives in the marketplace.

Scope

Cradle to gate LCI

Comparative LCA of an average baby wipe (European industry average) with alternative products, i.e. cotton wool balls and washable cotton cloths (wash cloths).

For the task of comparing alternative products a common function had to be chosen. Cleaning the baby along 1000 ordinary nappy changes was selected as this common function. The reference flows of material and energy needed to fulfil the function was defined with the help of a separately commissioned "habits and practice" study.

The LCA study is based on primary data collected for baby wipes and best available knowledge of the alternative systems. A highly representative data set for Europe was created for the production of baby wipes.

Production data for cotton fibres and wash cloths was taken from a database (figures are partly based on 2002 data). Environmental burdens by wash cloth production may therefore be slightly overestimated, however, the 3,000 assumed use cycles will downscale this effect. Production of cotton wool balls from cotton fibres was based on current information provided by manufacturers, whereas cotton fibre production is of older origin.

Key conclusions

Looking at the results, resource use and environmental impact were generally higher for cotton wool balls compared to baby wipes and wash cloths.

However, the comparison between cleaning babies with wipes or with wash cloths is less clear:

- Baby wipes perform better on resource used for water consumption and fossil energy demand, while they perform worse in the land use categories;
- The environmental impacts in favour of wash cloths are acidification, summer smog, ozone depletion, terrestrial eutrophication, aquatic eutrophication and carcinogenic risk potential. The AOX (Adsorbable Organic Halogen) parameter, which relates to the impact on water bodies, is also lower for wash cloths;
- The environmental impact in favour of baby wipes is global warming potential.

These relative assertions are also supported by normalised figures, derived by scaling the use of baby wipes in Europe to the alternative systems and applying the equivalent function.

The normalised results provide quantitative information of the environmental impact of cleaning a baby to the respective total impacts in Europe expressed in person equivalents.

For significant impact categories (environmental burdens caused by an equivalent of 10,000 people or more), the normalised results can be interpreted as follows:

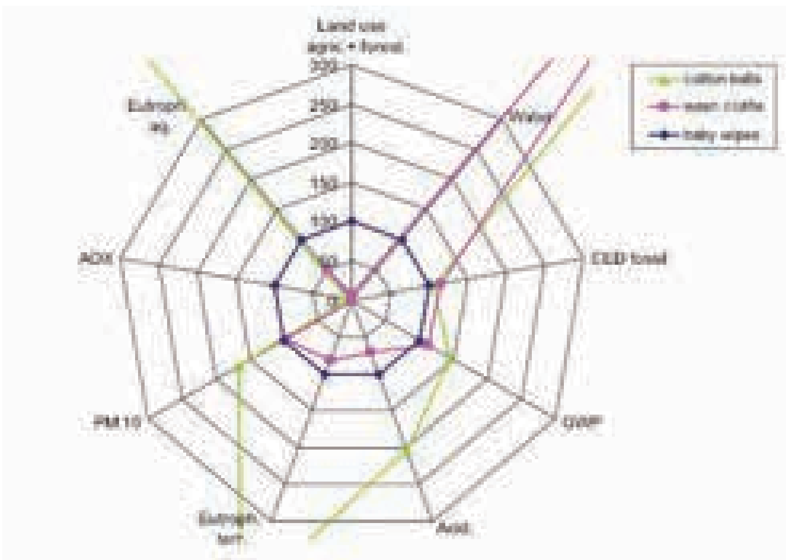
- Cotton wool balls generally perform worse compared to the other products;
- Baby wipes perform better for the freshwater consumption and the energy-related indicators cumulative energy demand and global warming potential;
- Wash cloths are better for land use, acidification, aquatic and terrestrial eutrophication.

From the normalisation step, all relevant indicators and some key inventory indicators are presented in the below spiderweb chart, showing results relative to baby wipes. AOX additionally represents emissions to water.

Key contributing stages for the majority of life cycle indicators are the production of the basic raw materials for baby wipes and cotton wool balls, and the use of warm water for wash cloths and cotton wool balls.

In general, the use phase of the wash cloth greatly influences the outcome of the environmental comparison. Lower use of warm water for baby cleaning and efficient washing processes can change the whole picture.

Figure: Results relative to baby wipes on the most relevant indicators following normalisation vs. an average EU-27 person (ref year 2008)

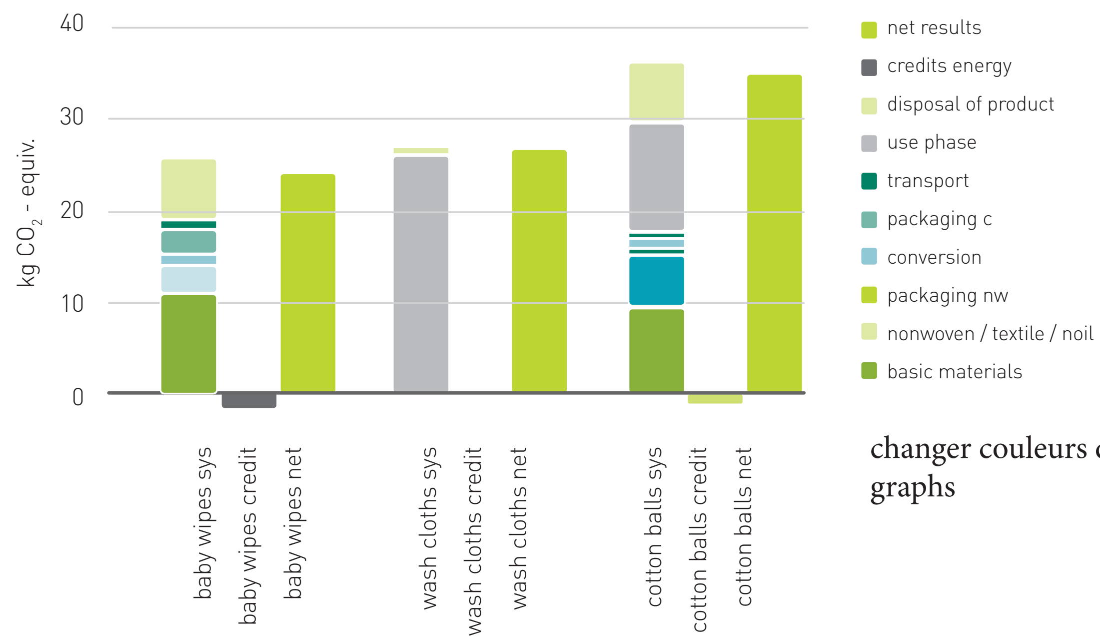


Consumer research studies on washing habits and practices using wash cloths show that the amount of warm water used differs considerably between families. Additionally, the respective domestic hot water boilers and the corresponding energy sources are different, leading to differences in energy use and associated environmental impacts.

The weight of the cotton wool balls varied but this had no consequences for the final conclusions. The same held true for choosing other allocation methods for the production of cotton wool balls.

Since the sector with the greatest influence on the environmental performance of the life cycle of baby wipes is the production of basic materials, careful selection and production of these materials will contribute to the reduction in resources used, and environmental impacts.

Figure: Key contributing life cycle stages for baby wipes, wash cloths and cotton wool balls (example given for global warming potential).



changer couleurs des graphs

2011 : Industrial Wipes LCA

Background
The increased demand from producers and their customers for information on the environmental impact of industrial wipes prompted EDANA to coordinate a study on behalf of the main producers of industrial wipes.

Goal
Life cycle assessment (LCA) is used to provide the nonwovens industry with an understanding of the environmental impacts associated with an average European industrial wipe product, and to provide a relative comparison of these products with alternatives in the marketplace, i.e. rental cloths.

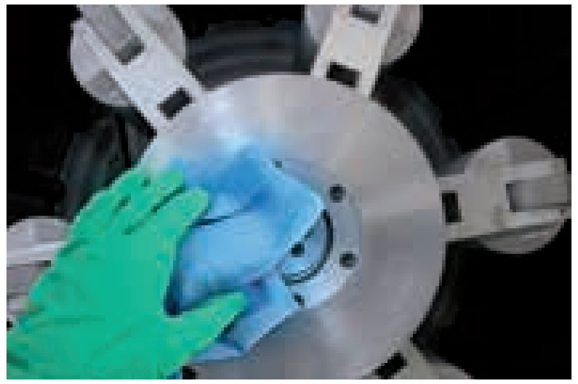
Scope: Cradle to grave LCA
Comparative LCA of an average industrial single-use wipe (European industry average), with alternative products, namely washable rental cloths.

For the task of comparing alternative products a common function had to be chosen. Cleaning up 100kg of used oil from stained machines was selected as this common function.

The reference flows of material and energy needed to fulfil the function was defined according to half the sorptivity of a certain mass of single-use industrial wipes and rental cloths.
The LCA study is based on primary data collected for single-use industrial wipes, and the best available knowledge of the alternative system. A highly representative data set for Europe was created for the production of single-use industrial wipes.

For the use stage, statistical data was missing for the laundry of oil stained rental cloths. Therefore two standard scenarios were shown for the rental cloth system: "rental cloth optimised" using the oil to produce energy in the laundry, and "rental cloth conservative" just disposing of the oil in waste incinerators.

Key conclusions
Looking at the results resource use and environmental impacts are generally higher for single-use industrial wipes compared to rental cloths.



Exceptions are:
- Resource use: single-use industrial wipes perform better in water consumption and sealed land use;
- The environmental impact in favour of single-use industrial wipes is aquatic eutrophication arising from water emissions during the production processes.

These relative assertions were also supported by normalised figures, derived by scaling the use of single-use industrial wipes in Europe to the alternative system applying the equivalent function. The normalised results provide quantitative information of the environmental impact of cleaning oil with single-use industrial wipes and rental cloths to the respective total impact in Europe expressed in person equivalents.

For significant impact categories (environmental burdens caused by an equivalent of 10,000 people or more), the normalised results can be interpreted as follows:

- Rental cloths generally perform better compared to single-use industrial wipes;
- Single-use industrial wipes perform better for the freshwater consumption and the aquatic eutrophication potential.

For freshwater consumption, fossil cumulative energy demand, greenhouse warming potential, land use agriculture and forest, acidification potential and fine particulate matter, the differences in person equivalents amongst the rental cloths and single-use industrial wipes were considerable, namely more than 20,000 people equivalents. The single-use industrial wipes perform better in freshwater consumption and lower in the remainder.

Key contributing life cycle stages for the majority of life cycle indicators are the production of the basic raw materials for single-use industrial wipes and the laundering process and the textile production for rental cloths.

The kind of usage of the cleaned oil is substantial. The oil separated from the laundering of the rental cloths goes to a much more efficient incineration compared to waste incineration with energy recovery for the industrial wipes.

Sensitivity analyses have been carried out to check the influence of assumptions on the rental cloth system. The following sensitivity analyses did not change the outcome substantially:
- Variation of the production data set for rental cloths;
- Reduction of the use cycles of rental cloths from 30 to 15 times;
- Energy recovery from waste oil recovered from rental cloths in laundries vs. in cement industries;
- 60% to 90% cotton in rental cloths, the rest consisting of polyester (PET);
- Higher amount of specific energy consumed by laundering process by up to a factor of three.

Since the production of raw materials is the stage with the largest influence on the environmental performance of the life cycle of single-use industrial wipes, careful selection and production of these materials will contribute to reducing resource use and environmental impacts. Furthermore, the waste management for oil stained single-use industrial wipes has a considerable impact.

This issue might be addressed by introducing collection systems for oil-stained single-use industrial wipes in order to direct this waste to more efficient energy recovery systems.

4

Conclusions

In over 20 years of use by EDANA and its member companies, life cycle assessment methodology has become a tool effectively used not only to model the environmental impact of products and processes, but also to deliver significant improvements of environmental performance thanks to better product design and process efficiencies.

In a materials-based industry, LCA is a major asset and a way to regularly challenge the nature and quantity of the materials used and the design of the products and production processes. LCA data has become the main scientific building block for the substantiation of environmental claims and sustainability-related communication. Each LCA is an occasion to quantify the extent of improvements enabled by efforts across the value chain and a first step in identifying areas for further improvement.

Going forward, we aim to continue the high level of LCA activity, extend the scope of products covered and increase the depth of analysis by covering more parts of the value chain i.e. product components and ingredients.

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