

EPDLA Life Cycle Inventory of Polymer Dispersions

On behalf of several participating members of the European Polymer Dispersions and Latex Association ('EPDLA'), PricewaterhouseCoopers Advisory conducted a Life Cycle Assessment (LCA) of the production of the following different families of aqueous polymer dispersions:

- SB (Styrene Butadiene) covering “hot and cold” processes;
- SA (Styrene Acrylate);
- ACR (Pure Acrylate);
- VAM (Polyvinyl acetate), it covers also copolymers like Vinyl acetate/Veova and Vinyl acetate / Acrylic;
- VAE (Vinyl acetate ethylene);
- ALK (Alkyds); and
- PU (Polyurethane).

The 14 participating companies were Alberdingk Boley, Arkema, BASF, Bayer MaterialScience, Celanese, Dow, DSM, EOC, Organik Kimya, Styron, Synthomer, Versalis, Vinavil and Wacker Polymers.

The aim of this LCA was to provide EPDLA with state-of-the art LCIs (Life Cycle Inventories compliant with ISO 14040 series; ILCD format) representing industry-average data for the aforementioned dispersion families produced in Western Europe. The current summary provides besides the former results an update for Vinylacetate-Ethylene and for Polyurethane based polymer dispersions, due to three additional EPDLA members having joined the original study from 2013.

LCIs help producers quantify the environmental impacts of their activities.

Precise data on the current environmental impacts of the production of polymer dispersions were collected from the participating companies across production sites in 11 countries and compiled over a wide perimeter. The evaluation covers all aspects of the production, since process data collected covers raw materials and energy inputs and outputs - including water and air emissions - and side processes such as transportation and auxiliaries.

The following indicators were calculated in the study:

- climate change (global warming potential – IPCC 100 years);
- photochemical ozone creation potential (CML version 3.9);
- depletion of abiotic resources (CML version 3.9);
- air acidification and eutrophication (CML version 3.9);
- three indicators on energy flows:
 - total primary energy (MJ);
 - primary energy from renewable resources (MJ); and
 - primary energy from non renewable resources (MJ).

The production processes of all polymer dispersions included in the study were modeled individually with the latest available data.

A 99 % cut-off rule was applied, however, dangerous or toxic compounds have systematically been included even if their relative weight was below the cut-off threshold.

All average results and models have been provided to the respective companies. These were then reviewed and finalized in iterations. No confidential or otherwise legally sensitive information was passed between participants, ensuring compliance with competition laws.

The following table gives the average value of indicators (impact & flow) for each dispersion family:

Indicator [per 1 kg of wet dispersion]	unit	Polyvinyl acetate	Vinyl- acetate Ethylene	Styrene Butadiene	Styrene Acrylate	Alkyd	Pure Acrylate	Poly urethane
Global Warming Potential (GWP) over a 100 years	kg eq CO2	1,0	1,2	1,2	1,5	1,5	1,7	3,4
Photochemical oxidation	g eq C2H4	0,3	0,3	0,3	0,4	1,1	0,5	1,0
Depletion of abiotic resources	g eq Sb	13,2	15,4	16,6	16,5	13,6	15,3	25,5
Air acidification	g eq SO2	3,3	3,1	4,1	6,2	6,3	8,0	13,1
Eutrophication	g eq PO4	0,4	0,5	0,3	0,4	2,4	0,7	1,9
Total Primary Energy	MJ	30,3	35,4	38,1	37,4	47,6	36,6	60,6
Renewable Energy	MJ	0,5	0,4	0,3	0,4	15,8	0,7	1,3
Non Renewable Energy	MJ	29,8	35,0	37,8	37,0	31,8	35,9	59,3
Solids	%	51	51	50	50	50	50	44

The functional unit of the LCA is 1 kg of wet dispersion. The uncertainties of the results are in the typical range of a Life Cycle Assessment based on industry data.

The resulting LCI represents a comprehensive and up-to-date cradle-to-gate analysis (i.e. from the raw materials to the factory gate of the polymer dispersion producer) for the production sites of the participating companies. This does thus not take into account the lifespan of the downstream product (like e.g. a paint or an adhesive).

In addition, the results of the data analysis enable producers to identify key factors of environmental impact to be able to take measures to further reduce this impact where possible.

The results can be considered as representative for Western European polymer dispersions since the 14 companies involved are the major producers of polymer dispersions within the Western European market (EU-28) and Turkey. The plants covered by the data collection are located in 11 countries (Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Spain, Sweden, Turkey, United Kingdom).

Main learnings out of the LCI study:

- The main origin of impacts are the monomers and the main raw materials (in case of dispersion polymers).
- We see that at the gate of the factory several dispersion families show quite similar impacts within the margin of error typical for the methodology used.
- In order to consider the environmental impact of a polymer dispersion in across the entire life cycle, all steps (raw materials, manufacturing, application, use phase and end of life) have to be calculated.

The present industry average LCI data may thus serve as a good basis for a total life cycle (cradle to grave) calculation for any downstream product.

For further information please contact the EPDLA Secretary General

Flore Cognat
The European Chemical Industry Council - CEFIC
Avenue E. van Nieuwenhuysse 4 (box 2)
B - 1160 Brussels - Belgium
Tel: + 32.2.676.72.03
Mail: fco@cefic.be

Warnings from PwC:

The present information which is an extraction of the report supplied to some members of EPDLA (Alberdingk Boley, Arkema, BASF, Bayer MaterialScience, Celanese, Dow, DSM, EOC, Organik Kimya, Styron, Synthomer, Versalis, Vinavil and Wacker Polymers) on February 18, 2015 is not at all exhaustive. It concerns a study aiming at supplying factual data based on a methodology of life cycle assessments (LCA). This study is only based on the facts, circumstances and hypothesis that have been submitted by the EPDLA and that are described in the report. If these facts, circumstances and hypotheses differ, our conclusions are likely to change.

Should participating members of EPDLA wish to broadcast the summary to their clients, we won't accept any responsibility towards third parties. The use of the summary under the care of the participating members of EPDLA comes within their own responsibility.

One should consider the results of this study as a whole regarding the principles and methodological limits, and not analyze them separately.

In addition, it is not part of our responsibilities to update the study nor the synthesis according to a fact or event that could occur after our work.

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