Life Cycle Assessment of biobased polyamides VESTAMID® *Terra*

Evonik has expanded its VESTAMID® family with a group of polyamides (PA) named VESTAMID® *Terra* that are based entirely or partly on renewable raw materials.

- VESTAMID® *Terra* DS and
- VESTAMID® *Terra* HS

VESTAMID® *Terra* DS, 100 percent natural

VESTAMID® *Terra* DS is based on polyamide 1010 and is the polycondensation product of 1,10-decamethylene diamine (D) and 1,10-decanedioic acid (sebacic acid—S). Because both monomers are extracted from castor oil, VESTAMID® *Terra* DS is a material that is based 100 percent on natural resources.

VESTAMID® *Terra* HS

VESTAMID® *Terra* HS is based on polyamide 610. PA 610 is the polycondensation product of 1,6-hexamethylene diamine (H) and 1,10-decanedioic acid (sebacic acid—S). Because sebacic acid is extracted from castor oil, VESTAMID® *Terra* HS is a material that is about 63% based on renewable resources.

Framework of the LCA

Goal: Comparison of the environmental performance of the production of

- VESTAMID® *Terra* DS
- VESTAMID® *Terra* DS
- VESTAMID® *Terra* HS
- VESTAMID® *Terra* HSGF30

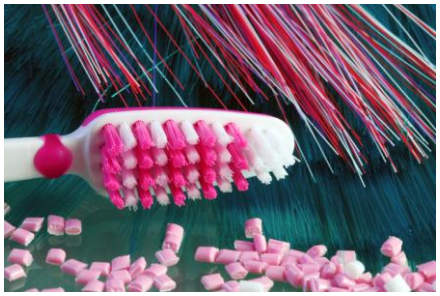
System boundary: Cradle-to-Gate

Functional unit: 1 kg of product

Data sources: Primary data were used for the production of VESTAMID® *Terra* (average Evonik process data in the year 2008) and secondary data were used for the remaining parts (mainly GaBi Database (PE International, Stuttgart, Germany). The software GaBi (PE International, Stuttgart, Germany) was used for the LCA modelling.

Cut-off rules for the inventory: Below 1% for single inputs and below 5% for the sum. No environmentally relevant flows were neglected.

Impact Assessment: The established method of the Dutch Environmental Science Research Centre Leiden (CML) with characterization factors from 2007 was used.



Results of the Life Cycle Assessment (Cradle-to-Gate)

Evaluation variables	Unit/ kg product	VESTAMID® *Terra* DS	VESTAMID® *Terra* DS GF30	VESTAMID® *Terra* HS	VESTAMID® *Terra* HS GF30
Primary energy demand (net cal. value)	MJ	231	182	175	143
Abiotic Depletion	kg Sb Equiv.	0.0639	0.0531	0.0566	0.0481
Global Warming Potential	kg CO_2 Equiv.	4,0	4,5	4,1	4,6
Ozone Layer Depletion Potential	kg R11 Equiv.	2.58×10^{-7}	2.55×10^{-7}	3.58×10^{-7}	3.25×10^{-7}
Acidification Potential	kg SO_2 Equiv.	0.0748	0.0584	0.0422	0.0356
Eutrophication Potential	kg Phosphate Equiv.	0.00848	0.00663	0.00518	0.00434
Freshwater Aquatic Ecotoxicity Potential	kg DCB Equiv.	0.0342	0.0255	0.0285	0.0215
Marine Aquatic Ecotoxicity Potential	kg DCB Equiv.	4030	2900	1710	1280
Terrestric Ecotoxicity Potential	kg DCB Equiv.	0.0132	0.0102	0.00887	0.00715
Photochem. Ozone Creation Potential	kg Ethene Equiv.	0.00546	0.00559	0.00356	0.00426
Human Toxicity Potential	kg DCB Equiv.	1.12	0.936	0.549	0.534

This LCA was performed by the LCA group of the Science-to-Business Center Eco² of Evonik.

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