



Borregaard

LIFE CYCLE ANALYSIS FOR SOFTACID V

Borregaard has engaged an independent third party to conduct a Life Cycle Analysis (LCA) on SoftAcid® V, as well as an environmental competitive comparison with pure formic acid. When comparing the seven impact categories, SoftAcid V surfaced as the overall most sustainable choice.

SUMMARY

The study was performed in 2019 by NORSUS, one of Europe's leading research institutes for LCA and other environmental impact analyses. The analysis includes seven impact categories, and SoftAcid V has a lower impact than pure formic acid in all categories. Overall, SoftAcid V is the most sustainable choice of the two products, with lower CO₂ emissions and consumption of fossil fuels.

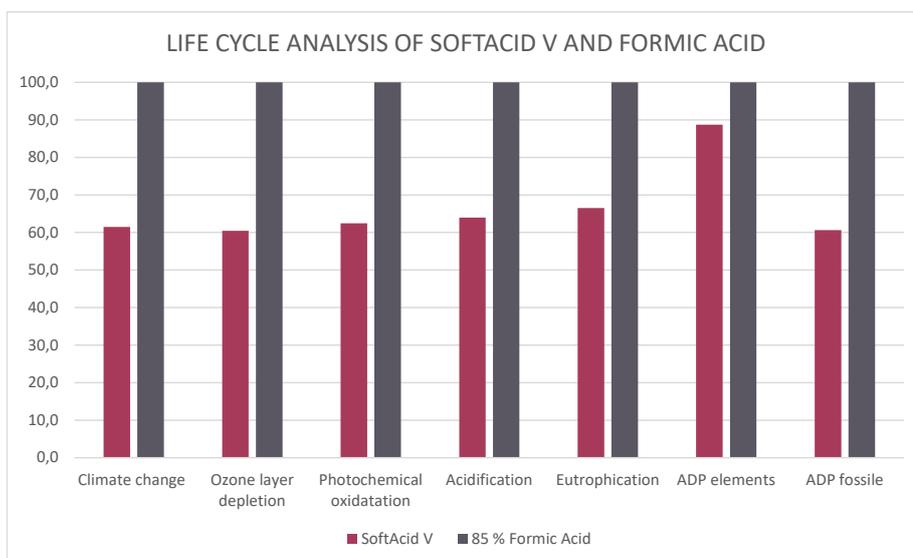


Chart 1: These data are presented on the graph to show the relative environmental performance of the products in the seven categories tested

SoftAcid®

- > SoftAcid V is an additive for commercial feed production. It can be used in feed for all animal species
- > Consists of formic acid in combination with lignosulfonic acid
- > Based on natural biopolymers derived from trees
- > Less corrosive, safer to use and easier to handle than pure organic acids
- > More sustainable compared to pure acids

ABOUT THE TESTING

The seven environmental impact categories evaluated are listed in Table 1, along with the assessment method, unit and a description of the potential value lost for each category. The results from the study, which also constitute the basis for Chart 1, are listed in Table 2.

Table 1: Environmental impact categories included in the analysis

Environmental impact category	Impact assessment method	Unit	Value lost	Comments
Climate change	IPPC 2013 GWP 100a, V1.03	kg CO ₂ -eqv.	Increased average global temperature could lead to severe impacts on human health, material resources, and ecosystems.	Assuming steady state in biogenic systems (not considering uptake of CO ₂ in biological systems, nor counting biogenic CO ₂ when burning biological matter).
Ozone Layer depletion	CML-IA baseline v3.04 (April 2013, v4.2).	kg CFC-11-eqv.	The ozone layer in the stratosphere protects humans, animals and plants from possibly damaging UV rays from the sun.	
Photochemical ozone creation	CML-IA baseline v3.04 (April 2013, v4.2).	kg C ₂ H ₄ -eqv. (ethene/ethylene-eqv.)	The creation of ozone near ground level can lead to respiratory diseases and inhibited growth for plants and other members of the ecosystem.	
Acidification	CML-IA baseline v3.04 (April 2013, v4.2).	kg SO ₂ -eqv.	Acid depositions lower pH in soil and water bodies and affect plants and animals, as well as buildings and other infrastructure.	'Sulfur oxides' has been included manually by NORSUS.
Eutrophication	CML-IA baseline v3.04 (April 2013, v4.2).	kg PO ₄ ⁻³ -eqv.	Eutrophication occurs when too many nutrients are released into the environment. This leads to some species growing fast, depleting oxygen in lakes and rivers, for example, and causing loss of biodiversity.	'Monoethanolamine' (to air/water/soil, factor 0,132 for all) were added manually by NORSUS. This factor was calculated in the report OR 15.09 ('LCA of Electricity, including CCS - A study of a Gas Power Plant Case with Post-Combustion CO ₂ Capture at Tjeldbergodden') for Statoil.
Use of resources: ADP elements	CML-IA baseline v3.04 (April 2013, v4.2).	kg Sb-eqv.	Non-renewable resources consumed (minerals).	
Use of resources: ADP fossil fuels	CML-IA baseline v3.04 (April 2013, v4.2).	MJ LHV	Non-renewable resources consumed (fossil fuels).	Extended with additional fossil fuel substances and values to make the list of fossil fuels complete.

Table 2: Potential environmental impacts from production of the chemicals included in the analysis: SoftAcid V and formic acid. The potential environmental impacts are calculated per 1000 kg product

Impact category	Climate change	Ozone layer depletion	Photochemical oxidation	Acidification	Eutrophication	Use of resources: ADP elements	Use of resources: ADP fossil
Unit	kg CO ₂ -eq	kg CFC-11 eq	kg C ₂ H ₄ -eq	kg SO ₂ -eq	kg PO ₄ ⁻³ -eq	kg Sb eq	MJ LHV
SoftAcid V	1,21E+03	2,53E-04	3,95E-01	6,09E+00	2,22E+00	2,76E-04	2,52E+04
Formic Acid (85%)	1,96E+03	4,19E-04	6,33E-01	9,52E+00	3,33E+00	3,11E-04	4,16E+04

REFERENCES

1. Modahl et al. 2019. Environmental analysis of competing products for lignin from Borregaard (Internal report).
2. Modahl, Ingunn & Soldal, Ellen. 2016. The 2019 LCA of products from Borregaard, Sarpsborg. OR 14.21. Fredrikstad, NORSUS.
3. Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230. Available at: <<http://link.springer.com/10.1007/s11367-016-1087-8>>

