epd-norway
Global Program Operator

Environmental Product Declaration

In accordance with 14025 and EN15804 +A2

Sodium lignin biopolymer C powder

Borregaard

Owner of the declaration:
Borregaard AS

Product name:
Sodium lignin biopolymer C powder

Declared unit:
1 kg dry matter

Product category /PCR:
PCR Basic Chemicals 2021:03 v.1.1

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-3740-2686-EN

Registration Number:
NEPD-3740-2686-EN

Issue date: 27.09.2022

Valid to: 27.09.2027

The Norwegian
EPD Foundation

General information

Product:
Sodium lignin biopolymer C powder

Program Operator:
The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo, Norway
Phone: +47 23 08 80 00
Email: post@epd-norge.no

Declaration Number:
NEPD-3740-2686-EN

This declaration is based on Product Category Rules:
Basic Chemicals 2021:03 v.1.1

Statements:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

Declared unit:
1 kg dry matter of lignosulfonate

Declared unit with option:
1 kg dry matter of lignosulfonate transport to customer

Functional unit:
-

Verification:
Independent verification of the declaration and data, according to ISO14025:2010

internal ☐ external X

Mie Vold, LCA.no AS
Independent verifier approved by EPD Norway

Owner of the declaration:
Borregaard AS
Contact person: Anne-Grethe Strømnes
Phone: +47 99505818
Email: anne-grethe.stromnes@borregaard.com

Manufacturer:
Borregaard AS
PO Box 162, 1701 Sarpsborg, Norway
Phone: 69118000
Email: borregaard@borregaard.com

Place of production:
Fernandina Beach, Florida, USA

Management system:
ISO 9001 (Quality management

Organization no:
895623032

Issue date:
27.09.2022

Valid to:
27.09.2027

Year of study:
2022

Comparability:
EPDs from other programs than The Norwegian EPD Foundation may not be comparable.

The EPD has been worked out by:
Ellen Soldal

Approved

Manager of EPD Norway

Product

Product description:

Borregaard's Sodium lignin biopolymer C powder is typically used as dispersing agent or binding agent for industrial applications. It is based on pine softwood, a natural and renewable material. The product is safe to handle and store, thus, no classification is required with respect to categories of danger, symbol letters or risk phrases.

Product specification:

Sodium lignin biopolymer C powder has a dry matter content of 95 % when sold to customers. The product consists of lignosulfonate and water.

Materials	kg	%
Lignosulfonate	0.95	95
Water	0.05	5
Total	1	100
PE packaging	0.008	<1

Technical data:

Dry matter (DM) content: 95%

CAS number: 8061-51-6

Market:

Global

Reference service life:

Not relevant

LCA: Calculation rules

Declared unit:

1 kg DM including 8 000 km of transport to customer by typical means of transportation. Transport to customer has been corrected in order to account for the burden of also transporting water.

Data quality:

For the upstream and downstream processes generic data may be used unless specific data are available. If specific data are available, this shall be used. Generic data are selected data from the commonly available LCA database ecoinvent, *Allocation, cut-off by classification* version 3.8 (Wernet et al., 2016).

Specific data has been supplied by Borregaard for the production year 2020.

Allocation:

The allocation is made in accordance with the provisions of ISO 14025 and Basic Chemicals 2021:03 v.1.1 (Environdec, 2021). Allocation has as far as possible, been avoided by modelling the processes at Borregaard on a detailed level. When allocation has been necessary, allocation based on mass (DM) has been used.

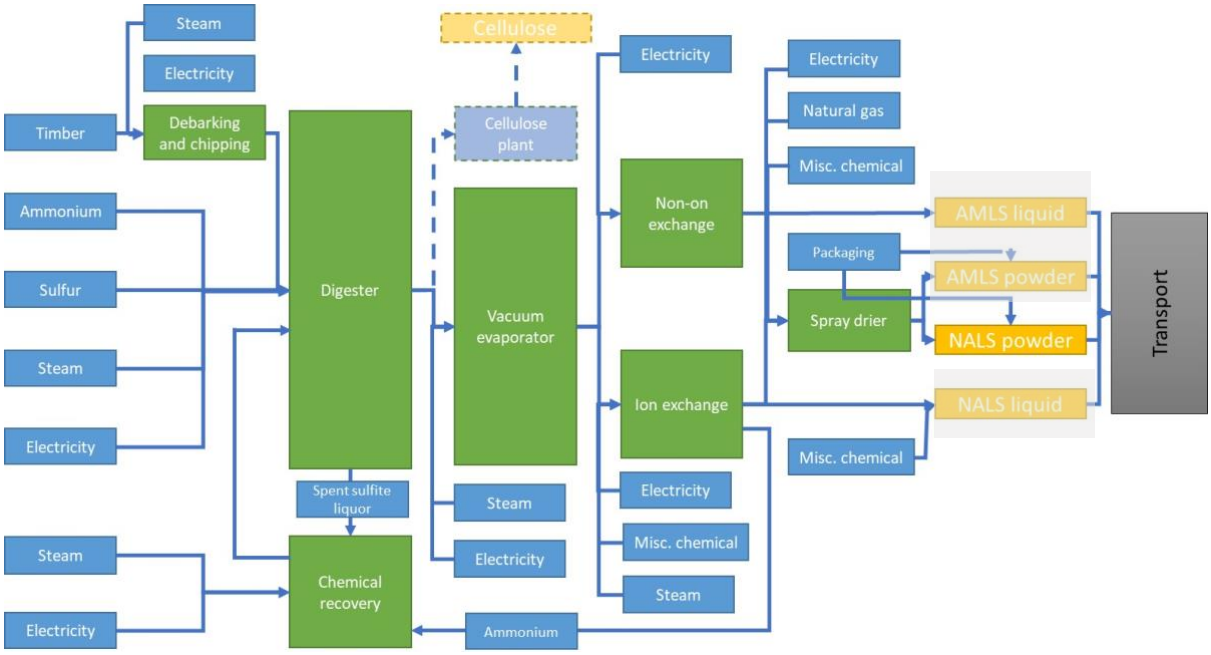

Figure 1 Technical flowchart for the production at LignoTech Florida. The blue boxes indicate input of material and energy, including production and transport (A1-A2). The green boxes illustrate processes taking place at the LignoTech Florida site (A3), producing the products (yellow boxes). The dark grey box illustrates transport to customer. Cellulose is included in the flowchart to show that the digester is a multi-output process, where burdens are allocated between the cellulose and lignosulfonate products.

System boundary:

The system boundary includes the modules A1-A4, illustrated by the flowchart. A1-A4 includes extraction, transportation and processing of natural resources, manufacturing of the product, production of packaging, and transportation of the product 8 000 km by typical transportation modes. The modules A1-A2 corresponds to the upstream module, A3 core module, A4 and beyond corresponds to downstream module. Disposal of product is included through content of biogenic carbon in product.

Cut-off criteria:

All major raw materials and all the essential energy is included. The production processes for raw materials and energy flows with very small amounts (less than 1%) are not included. These cut-off criteria do not apply for hazardous materials and substances.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

The production takes place in Fernandina Beach, Florida, USA, and transport to customers is included. Transport from production site to customer is based on information from Borregaard regarding typical transport distances and transport modes.

Ammonium lignin biopolymer powder is transported 8 000 km. The transport is distributed between rail (25%), sea (63%) and road (13%). Transport distances have been corrected in order to account for transport of water.

No scenario after A4 is included. The biogenic content of the product at factory gate has been used to calculate the emissions of CO_2 from end-of-life.

Transport from production place to assembly/user (A4)

Type	Capacity utilization (incl. return) %	Type of vehicle	Distance KM	Fuel/Energy consumption	value (l/t)
Truck	55%	Transport, freight, lorry 16-32 metric ton, euro5 {RoW}| market for transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U	1040	0.037 kg/tkm	38.5
Railway	50%	Transport, freight train {US}| diesel | Cut-off, U	2000	0.011 kg/tkm	22
Boat	54%	Transport, freight, sea, tanker for liquid goods other than petroleum and liquefied natural gas {GLO}| market for transport, freight, sea, tanker for liquid goods other than petroleum and liquefied natural gas | Cut-off, U	5040	2.00E-3 kg/tkm	10.8

For the transport processes, average data from ecoinvent 3.8 is used and it is assumed the same average capacity load here.

The transport correction factor to account for transport of water for Sodium lignin biopolymer C powder is 1.053.

Additional technical information

Calculation of the climate change impact in end of life is based on carbon content of product. 1 kg biogenic carbon corresponds to 44/12 kg biogenic CO_2. Carbon content of product is 45.5%. Thus, 1.67 kg CO_2 is added in C4 Disposal.

All timber purchased is harvested according to the country-of-origin regulations of harvest, forest management and biological diversity and is PEFC certified (PEFC Chain of custody certificate TP-PEFCCOC-0037).

LCA: Results

Energy carriers used in the production (natural gas and electricity) give the highest contribution to climate change – fossil. For the climate change – total, that includes also biogenic CO_2, the uptake of CO_2 in growing biomass and the subsequent emission of CO_2 from incineration of spent sulfite liquor dominates the impact. In the other impact categories, the chemical sodium hydroxide is an important contributor in addition to natural gas and electricity.

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Benefits & loads beyond system boundary
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	x	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	MNR

Core environmental impact indicators

Indicator	Unit	A1-A3	A4	C4
GWP-total	kg CO2 eq.	-3,71E-01	2,71E-01	1,67E+00
GWP-fossil	kg CO2 eq.	1,29E+00	2,71E-01	0,00E+00
GWP-biogenic	kg CO2 eq.	-1,66E+00	7,30E-05	1,67E+00
GWP-LULUC	kg CO2 eq.	1,82E-03	3,31E-06	INA
ODP	kg CFC11 eq.	1,44E-07	1,92E-09	INA
AP	mol H^+ eq.	1,21E-02	2,66E-03	INA
EP-freshwater	kg P eq.	1,67E-05	4,23E-07	INA
EP-marine	kg N eq.	5,16E-03	9,12E-04	INA
EP-terrestrial	mol N eq.	5,51E-02	1,01E-02	INA
POCP	kg NMVOC eq.	1,40E-02	2,65E-03	INA
ADP-M&M	kg Sb eq.	8,10E-07	1,67E-08	INA
ADP-fossil	MJ	1,34E+01	3,74E+00	INA
WDP	m^3	-1,90E-02	5,20E-04	INA

GWP-total: *Global Warming Potential;* ***GWP-fossil:*** *Global Warming Potential fossil fuels;* ***GWP-biogenic:*** *Global Warming Potential biogenic;* ***GWP-LULUC:*** *Global Warming Potential land use and land use change;* ***ODP:*** *Depletion potential of the stratospheric ozone layer;* ***AP:*** *Acidification potential, Accumulated Exceedance;* ***EP-freshwater:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestrial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water consumption*

Additional environmental impact indicators

Indicator	Unit	A1-A3	A4	C4
PM	Disease incidence	3,08E-08	2,28E-08	INA
IRP	kBq U235 eq.	4,12E-02	1,60E-02	INA
ETP-fw	CTUe	1,01E+01	1,52E+00	INA
HTP-c	CTUh	6,28E-10	2,11E-11	INA
HTP-nc	CTUh	1,18E-08	2,08E-09	INA
SQP	Dimensionless	2,89E+02	1,57E-02	INA

PM: *Particulate matter emissions;* ***IRP:*** *Ionizing radiation, human health;* ***ETP-fw:*** *Ecotoxicity (freshwater);* ***ETP-c:*** *Human toxicity, cancer effects;* ***HTP-nc:*** *Human toxicity, non-cancer effects;* ***SQP:*** *Land use related impacts / soil quality*

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD type / level 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Resource use

Parameter	Unit	A1-A3	A4	C4
RPEE	MJ	2,15E+01	4,82E-03	INA
RPEM	MJ	2,04E+01	0,00E+00	INA
TPE	MJ	4,19E+01	4,82E-03	INA
NRPE	MJ	1,34E+01	3,74E+00	INA
NRPM	MJ	0,00E+00	0,00E+00	INA
TRPE	MJ	1,34E+01	3,74E+00	INA
SM	kg	0,00E+00	0,00E+00	INA
RSF	MJ	0,00E+00	0,00E+00	INA
NRSF	MJ	0,00E+00	0,00E+00	INA
W	m^3	-1,48E-04	4,27E-05	INA

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE Total use of non renewable primary energy resources; SM Use of secondary materials; RSF Use of renewable secondary fuels; NRSF Use of non renewable secondary fuels; W Use of net fresh water

End of life - Waste

Parameter	Unit	A1-A3	A4	C4
HW	KG	5,42E-06	2,80E-07	INA
NHW	KG	1,54E-01	1,10E-04	INA
RW	KG	3,13E-05	8,23E-07	INA

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life – output flow

Parameter	Unit	A1-A3	A4	C4
CR	kg	0,00E+00	0,00E+00	INA
MR	kg	0,00E+00	0,00E+00	INA
MER	kg	0,00E+00	0,00E+00	INA
EEE	MJ	0,00E+00	0,00E+00	INA
ETE	MJ	0,00E+00	0,00E+00	INA

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	0.45
Biogenic carbon content in the accompanying packaging	kg C	0.04

1 kg biogenic carbon corresponds to 44/12 kg biogenic CO_2.

Additional Norwegian requirements

Greenhous gas emission from the use of electricity in the manufacturing phase

National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process (A3).

Electricity mix	Data source	Value	Unit
Medium voltage, SERC, USA	ecoinvent 3.8	553	g CO2-eq/kWh

Additional environmental impact indicators required in NPCR Part A for construction products

In order to increase the transparency of biogenic carbon contribution to climate impact, the indicator GWP-IOBC is required as it declares climate impacts calculated according to the principle of instantaneous oxidation. GWP-IOBC is also referred to as GWP-GHG in context to Swedish public procurement legislation.

Indicator	Unit	A1-A3	A4	C4
GWP-IOBC	kg CO2 eq.	1,29E+00	2,71E-01	0,00E+00

GWP-IOBC *Global warming potential calculated according to the principle of instantaneous oxidation.*

Hazardous substances

The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Documentation available upon request to EPD owner.

- X The product contains no substances given by the REACH Candidate list or the Norwegian priority list.
- ☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- ☐ The product contains dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- ☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Indoor environment

No tests have been carried out on the product concerning indoor environment.

Bibliography

Environdec: 2021	PCR 2021:03. Version 1.1 Basic chemicals. Product category classification: UN CPC 341, 342, 343, 345 (except subclass 3451). , Environdec. PCR 2021:03.
ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products
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Wernet, G. et al.: 2016	"The ecoinvent database version 3 (part I): overview and methodology." The International Journal of Life Cycle Assessment 21(9): 1218-1230.

epd-norway Global Program Operator	**Program Operator**	Phone:	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	Email:	post@epd-norge.no
	Norway	Web	www.epd-norge.no
epd-norway Global Program Operator	**Publisher**	Phone:	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	Email:	post@epd-norge.no
	Norway	Web	www.epd-norge.no
Borregaard	**Owner of the declaration**	Phone:	+47 69 11 80 00
	Borregaard AS	Fax	+47 69 11 87 70
	Hjalmar Wessels vei 10, 1701 Sarpsborg	Email:	borregaard@borregaard.no
	Norway	Web	www.borregaard.no
NORSUS Norsk institutt for bærekraftsforskning	**Author of the life cycle assessment**	Phone:	+47 69 35 11 00
	NORSUS AS		
	Stadion 4, 1671 Kråkerøy	Email:	post@norsus.no
	Norway	web	www.norsus.no

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