Firm of the Future

Product Carbon Footprint Report

Latex concentrate, low ammonia

Corrie MacColl Limited

product carbon footprint CO_2

Latex concentrate low ammonia

Future Proof powered by Nature

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Based on the route from production to customer:
Hevecam – Kribi – Antwerp

Summary

This report presents the Product Carbon Footprint (PCF) of one metric tonne of low-ammonia (LA) latex concentrate (LC) supplied by Corrie MacColl.

Corrie MacColl commissioned this study to quantify the greenhouse gas emissions associated with the production and distribution of latex concentrate and to provide transparent climate information to customers and other stakeholders.
The assessment was carried out in accordance with ISO 14067:2018 and the principles for life cycle assessment set out in ISO 14040 and ISO 14044. Greenhouse gas emissions were characterised using the EN 15804+A2 GWP100 methodology. The study applies a ‘cradle-to-port’ system boundary, which encompasses the establishment and maintenance of plantations, the harvesting of latex, transport to the processing facility, the concentration and stabilisation of latex, packaging and distribution, until the seagoing vessel arrives at the customer’s nearest port.

The functional unit is:
One metric tonne (1,000 kg) of low-ammonia (LA) latex concentrate (LC), delivered to the customer’s nearest seaport.

The calculated product carbon footprint is:
145.70 kg CO_2-eq per metric tonne of low-ammonia (LA) latex concentrate (LC)

This total comprises 248.48 kg CO_2-eq from fossil greenhouse gas emissions, −104.76 kg CO_2-eq from net biogenic carbon fluxes and 1.98 kg CO_2-eq from land use and land-use change.

Distribution makes the largest contribution (95.83 kg CO_2-eq), mainly due to maritime transport. Production and packaging contribute 41.46 kg CO_2-eq, followed by transport to the processing facility (33.34 kg CO_2-eq). The extraction of natural resources and raw materials contributes −24.93 kg CO_2-eq, reflecting the significant uptake of carbon from the atmosphere by the growing rubber trees.

This study provides Corrie MacColl with a transparent and scientifically robust assessment of the climate impact of low-ammonia (LA) latex concentrate (LC). It identifies the key sources of emissions and forms a solid basis for communication with customers, sustainability reporting and future CO_2 reduction initiatives.

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1. Introduction

This chapter describes the background, objective and context of the Product Carbon Footprint (PCF) study. It provides the reader with an overview of the purpose of the analysis and the context in which it was carried out.

1.1 Background and Purpose

Corrie MacColl is one of the world's leading suppliers of natural rubber and produces low-ammonia latex concentrate (LC) from responsibly sourced natural rubber latex. As sustainability and climate transparency become increasingly important in global supply chains, understanding the greenhouse gas emissions associated with products is essential for customers, regulators and other stakeholders.

In order to provide transparent and scientifically sound information on the climate impact of its latex concentrate products, Corrie MacColl commissioned Firm of the Future to carry out a Product Carbon Footprint (PCF) analysis. The analysis quantifies the greenhouse gas emissions associated with the product's entire life cycle within the defined system boundaries, expressed in kilograms of carbon dioxide equivalents (kg CO_2-eq).

1.2 Intended Application

This report has been prepared in accordance with ISO 14067:2018, which sets out the principles, requirements and guidelines for quantifying and reporting the carbon footprint of products. The study is based on the principles of life cycle assessment as defined in ISO 14040 and ISO 14044, with the focus exclusively on climate change impacts.

The intended aim of this study is to quantify and communicate the product carbon footprint (PCF) of Corrie MacColl's low-ammonia (LA) latex concentrate (LC). The results are intended to support internal sustainability management, communication with customers and initiatives to reduce greenhouse gas emissions throughout the supply chain.

The intended target audience comprises Corrie MacColl, its customers, supply chain partners and other stakeholders interested in the product's climate impact.

This study is not intended to support comparative claims made to the public.

1.3 Reading Guide

This report describes the methodology and results of the Product Carbon Footprint (PCF) analysis for low-ammonia (LA) latex concentrate (LC).
Following this introduction, Chapter 2 describes the methodological framework, including the scope, functional unit, system boundaries, data quality, key assumptions and sensitivity analysis.
Chapter 3 presents the life cycle inventory (LCI) and describes the primary and background data used to model the product system. The inventory is structured according to the successive life cycle stages, from plantation management and raw

material extraction through latex harvesting, production, packaging and distribution to the customer’s nearest seaport.

Chapter 4 presents the results of the Product Carbon Footprint, including total greenhouse gas emissions, the contribution of the various life-cycle stages, the biogenic carbon balance and the contribution analysis.

The report concludes with the references in Chapter 5.

2. Methodology

This chapter describes the methodological framework applied for the analysis of the Product Carbon Footprint (PCF). It explains the standards, calculation methods, functional unit, system boundaries and key assumptions that form the basis of the study.

2.1 Methodological Approach

The Product Carbon Footprint (PCF) analysis was carried out in accordance with the principles and requirements of ISO 14067:2018, which sets out the method for quantifying and reporting the carbon footprint of products. The analysis follows the life cycle assessment framework as described in ISO 14040 and ISO 14044, with the focus exclusively on greenhouse gas emissions.

Greenhouse gas emissions have been quantified over a 100-year time horizon (GWP100) using the climate change characterisation factors as set out in EN 15804+A2 and are reported in kilograms of carbon dioxide equivalent (kg CO_2-eq). The analysis covers all greenhouse gases included in the life-cycle inventory datasets used and characterised using the selected impact assessment method.

The primary data are derived from operational records collected at the Hevecam plantation and processing facility in Cameroon for the 2025 production year. Where site-specific data were unavailable, technical calculations, representative assumptions and literature sources were used to complete the inventory.

The background data for the life-cycle inventory are sourced from the ecoinvent database (version 3.10.1). The effects of climate change have been characterised using the EF v3.1 EN 15804 method. For most background processes, datasets for 'Global' (GLO) and 'Rest-of-World' (RoW) were deliberately selected in order to develop a generic model for the Product Carbon Footprint that is applicable to multiple production sites for latex concentrate. Country-specific datasets were only used where location-specific modelling was deemed essential, such as for electricity generation.

2.2 Scope and functional unit

The functional unit of this Product Carbon Footprint analysis is defined as:

One metric tonne (1,000 kg) of latex concentrate (LC) with a low ammonia content (LA), delivered to the customer's nearest seaport.

The analysis follows a 'cradle-to-port' system boundary and includes all significant greenhouse gas emissions associated with the production and delivery of the semi-finished rubber product.

The reference flow comprises all significant material, energy, water, packaging and auxiliary input required to produce and deliver one metric tonne of latex concentrate within the defined system boundaries. Insignificant inputs with a negligible contribution to the total PCF are excluded in accordance with the cut-off criteria as described in section 2.2.5.

2.2.1 Product description

The product assessed in this study is low-ammonia (LA) latex concentrate (LC), produced from natural rubber latex obtained from mature *Hevea brasiliensis* trees. Concentration and stabilisation increase the dry rubber content, whilst the latex remains in liquid form for storage and transport. Latex concentrate is supplied as a semi-finished product for the manufacture of dipped latex products, adhesives, foam and a wide range of industrial and consumer goods.

2.2.2 Scalability

The results of the Product Carbon Footprint are reported per functional unit of one metric tonne of low-ammonia (LA) latex concentrate (LC). The reported carbon footprint can be scaled proportionally for different production volumes, provided that the production technology, material composition, energy sources and transport scenarios remain unchanged.

2.2.3 System boundaries

The analysis follows a ‘cradle-to-port’ system boundary. Table 1 shows the life-cycle stages that have been included.

Life-cycle stage	**Included**
Raw material supply	✓
Transport to the factory	✓
Production	✓
Transport to the customer’s nearest seaport	✓
Production of processed products	Not included
Operational phase	Not included
End of life	Not included
Benefits outside the system boundaries	Not included

Table 1: *System boundaries for the assessment of the product’s carbon footprint.*

2.2.4 Process description

Figure 1 shows the product system and the system boundary taken into account in this PCF analysis.

The product system begins with the establishment and maintenance of a rubber plantation, followed by the harvesting of natural latex and its transport to the processing facility.

At the processing facility, the latex from the field is concentrated and stabilised to produce latex concentrate (LC) with a low ammonia content (LA). During this process, electricity, water, processing chemicals, packaging materials and auxiliary materials are consumed. The water removed during the concentration process is treated as waste water before being discharged.

The packaged latex concentrate is then distributed to the customer's nearest seaport, where the product leaves the defined system boundary.

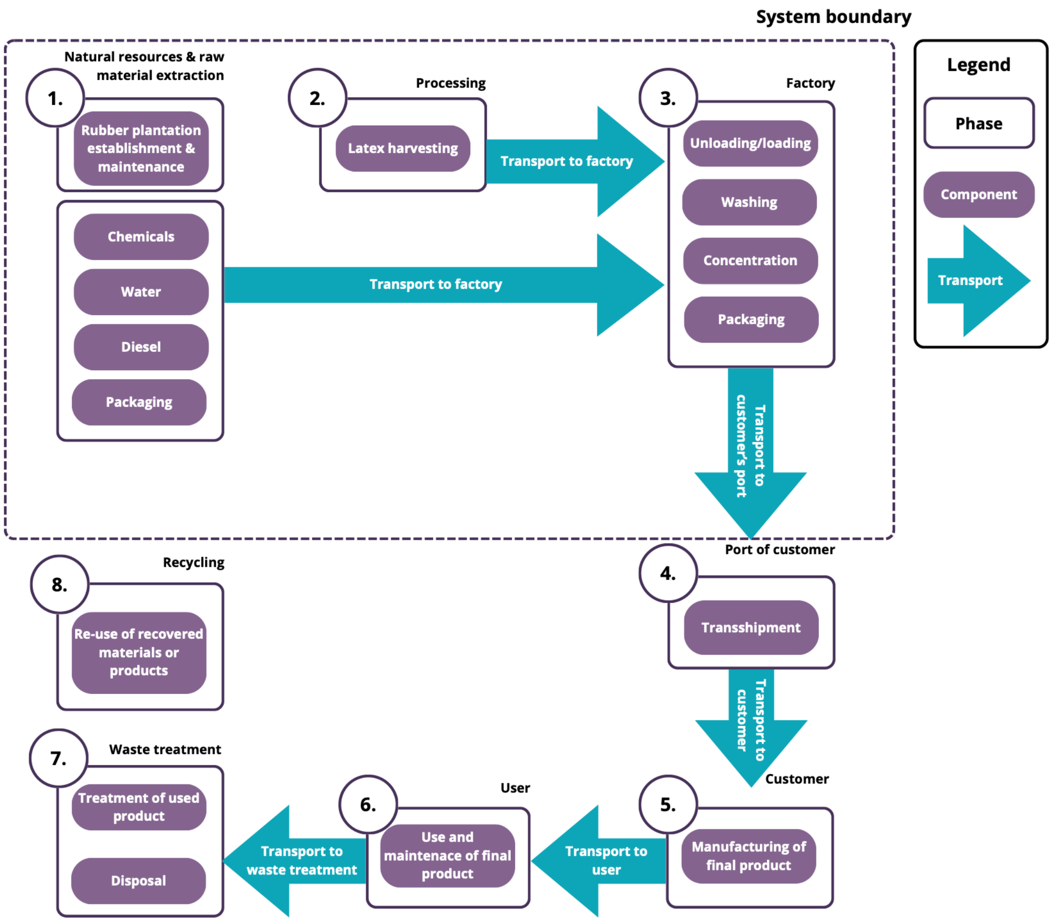

Figure 1: *Diagram of the system boundaries for the product's carbon footprint analysis*

2.2.5 Cut-off criteria

All significant material and energy flows contributing to the Product Carbon Footprint have been included in the analysis.
Input flows that make only a negligible contribution to total greenhouse gas emissions have been excluded, provided this does not materially affect the results or conclusions of the study.

2.2.6 Consistency

Consistency has been ensured through the uniform application of system boundaries, calculation methods, characterisation factors, assumptions and allocation procedures throughout the analysis.

Where available, operational data from the Hevecam plantation and processing facility have been used. Where operational data were not available, representative assumptions and technical calculations have been consistently applied to comparable processes to ensure a transparent and reproducible analysis.

2.2.7 Sensitivity analysis

The Product Carbon Footprint analysis is primarily based on site-specific operational data collected at the Hevecam plantation and processing facility. Where primary data were not available, technical calculations and representative assumptions were applied to complete the life cycle inventory (LCI). The assumptions applied are considered to have only a limited, immaterial impact on the reported Product Carbon Footprint and the conclusions of the analysis.

3. Life Cycle Inventory (LCI)

This chapter describes the life cycle inventory (LCI) of Corrie MacColl's low-ammonia (LA) latex concentrate (LC). The LCI forms the quantitative basis for the PCF analysis and encompasses all significant material, energy and transport flows within the defined 'cradle-to-port' system boundaries.
All inventory data presented in this chapter relate to the functional unit of one metric tonne of low-ammonia (LA) latex concentrate (LC), delivered to the customer's nearest seaport.

3.1 Data collection

The primary data have been quantified on the basis of operational records collected at the Hevecam plantation and at the processing facility in Cameroon. These records reflect the operational activities for the production year 2025 and include production volumes, as well as the consumption of energy, water, chemicals and packaging materials.

Background data for materials, energy, transport and supporting processes were obtained from the ecoinvent database (version 3.10.1). For most background processes, a conscious decision was made to use global-level (GLO) or 'rest of the world' (RoW) datasets, in order to obtain a generic model for the Product Carbon Footprint that can be applied across multiple latex concentrate production sites. Where a site-specific dataset was required, such as for electricity consumption, country-specific datasets were used.

The inventory data used in this study are drawn from three different data categories:

- **Measured** – Values derived directly from operational data. For most means of production, the quantities allocated to the functional unit are determined by relating the total annual consumption and production data for 2025 to one metric tonne of latex concentrate.
- **Calculated** – Values derived from primary operational data in combination with technical calculations, allocation procedures or assumptions, such as transport requirements, production ratios or material requirements.
- **Estimated** – Values determined on the basis of technical judgement, available process information or literature sources where no actual operational data was available.

The quality of the inventory data has been assessed in accordance with the data quality principles set out in ISO 14044. The assessment considered the temporal, geographical and technological representativeness of the data, as well as the completeness, consistency and accuracy of the inventory.

Data quality aspect	Assessment	Justification
Temporal representativeness	High	The data relate to operational activities during the production year 2025. The background data are sourced from ecoinvent version 3.10.1.
Geographical representativeness	Medium–High	The data is sourced from the Hevecam plantation and processing facility in Cameroon. The background datasets have been deliberately selected based on Global (GLO) and Rest-of-World (RoW) datasets, where applicable, to develop a generic Product Carbon Footprint model that can be applied to all of Corrie MacColl's international LCA production sites.
Technological representativeness	High	The selected datasets represent technologies considered to be representative of the cultivation, processing, transport and energy systems included in this assessment. Where no exact process-specific datasets were available, the most representative available datasets were selected based on the technology used.
Completeness	High	All material and energy flows expected to make a material contribution to the Product Carbon Footprint have been included. Minor flows with a negligible impact have been excluded in accordance with the cut-off criteria described in section 2.2.5.
Consistency	High	Throughout the assessment, consistent use has been made of the same methodological framework, the same system boundaries, characterisation factors, modelling assumptions and the same version of the ecoinvent database.
Accuracy	Medium-High	Most of the inventory data is derived from measured operational data. Where primary data was unavailable, technical calculations, literature sources and expert judgement were used.

Table 2: *Assessment of the inventory's data quality*

Overall, the inventory is considered to be a reliable representation of the Product Carbon Footprint of low-ammonia (LA) latex concentrate (LC).

3.2 Natural Resources & Raw Material Extraction

The first stage of the product system involves the extraction of raw materials required for the manufacture of low-ammonia (LA) latex concentrate (LC). This includes the cultivation of *Hevea* brasiliensis trees for the production of natural latex, as well as the upstream production of auxiliary materials and processing chemicals required during the concentration process.
Natural latex is produced from mature *Hevea* brasiliensis trees grown on rainwater-fed plantations, which require no additional irrigation. The baseline data on plantation activities are sourced from the Hevecam plantation in Cameroon. The inventory covers the planting of rubber trees, plantation maintenance and the management of pruning waste.
The number of rubber trees allocated to the functional unit has been determined using site-specific production data in combination with expert information on the average lifetime latex yield per rubber tree in the field. The calculation is based on the quantity of field latex required to produce one metric tonne of latex concentrate and the corresponding average yield per tree over its entire lifespan (30 years). The estimated quantity of pruning waste is determined on the basis of the ratio between the annual quantity of pruning waste produced (kg) and the total annual quantity of latex extracted (kg).

The upstream production of auxiliary materials, including stabilisers, processing chemicals, electricity, packaging materials and other means of production, is represented using appropriate life-cycle inventory datasets from the ecoinvent database (version 3.10.1). The quantities of these materials have been determined using operational data from the Hevecam processing facility and are shown in the production phase, where they are consumed.

Table 3 below shows the breakdown of raw material extraction for the production of 1 tonne of LC LA.

Material/process	Quantity	Unit	Source: ecoinvent 3.10.1	Data quality
Production of rubber saplings	5.78	trees	Seedling production (based on: tree seedling production, in an unheated greenhouse (RoW) I EN15804)	Calculated
Establishment and maintenance of a rubber tree plantation	5.78	trees	Establishing an orchard (based on establishing an orchard (RoW) I EN15804)	Calculated
Water	8.20	m^3	water (based on the market	Measured

			for tap water (RoW) I EN15804)	
Ammonia	2.50	kg	market for ammonia, anhydrous, liquid (RoW) I EN15804	Measured
Formic acid	1.22	kg	market for formic acid (RoW) I EN15804	Measured
Zinc oxide	0.23	kg	market for zinc oxide (GLO) I EN15804	Measured
Diammonium phosphate	0.14	kg	market for diammonium phosphate (RoW) I EN15804	Measured
Bentonite	0.01	kg	market for bentonite (GLO) I EN15804	Measured
Potassium hydroxide	0.00	kg	market for potassium hydroxide (GLO) I EN15804	Measured
Formaldehyde	0.09	kg	market for formaldehyde (RoW) I EN15804	Measured
Fatty acid	0.60	kg	market for fatty acid (GLO) I EN15804	Measured
Methanol	0.01	kg	market for methanol (RoW) I EN15804	Measured
Sulphuric acid	1.01	kg	market for sulphuric acid (RoW) I EN15804	Measured
Organic chemicals	0.26	kg	market for organic chemicals (GLO) I EN15804	Measured

Table 3: *Breakdown of raw material extraction for the production of 1 tonne of LC LA*

3.3 Latex harvesting and transport to the processing facility

Natural latex is harvested by hand from mature Hevea brasiliensis trees by tapping the bark. Harvesting is carried out using simple, reusable tools and collection buckets, which are assumed to make a negligible contribution to the total Product Carbon Footprint due to their long service life.

After harvesting, the liquid field latex is transported from the plantation to the processing facility. The operational data reflecting this transport phase were obtained from the Hevecam production system. As no site-specific transport distances from individual plantations to the processing facility were available, an average transport distance of 50 km was used as a representative value for local transport.
The quantity of field latex required to produce one metric tonne of latex concentrate was determined using primary production data. This quantity was then used to calculate the transport requirements associated with delivering the field latex to the processing facility.

Material/process	Quantity	Unit	Source: ecoinvent 3.10.1	Data quality
Transport by tractor and trailer	87.99	Metric tonnes*km	market for transport, tractor and trailer, agricultural (RoW) I EN15804	Calculated

Table 4: *Breakdown of transport to the processing facility*

3.4 Latex Concentrate Manufacturing & Packaging

During the production phase, field latex is processed into latex concentrate (LC) with a low ammonia content (LA). The operational data reflecting this process are sourced from the Hevecam processing facility in Cameroon.

The production process consists of several successive processing steps, including:

- washing;
- spin-dry;
- packaging

The inventory for this stage includes the consumption of electricity, processing chemicals, water, packaging materials and other internal material handling operations. During the concentration process, some of the water naturally present in the field latex is removed to increase the dry rubber content from approximately 35% to 60%. As a result, the volume of waste water requiring treatment exceeds the volume of fresh water added during processing.

No site-specific consumption data is available for individual processing stages or machines. Instead, the quantities allocated to the functional unit have been determined by attributing the total annual consumption of each input to the total annual production of latex concentrate at the Hevecam processing facility for the year 2025. This approach yields representative average consumption values per metric tonne of latex concentrate.

In order to determine a PCF for Corrie MacColl's total latex concentrate portfolio, electricity consumption has been modelled using a weighted electricity mix that reflects the geographical origin of the processed latex. The electricity mix consists of 50% Cameroon, 25% Thailand and 25% Malaysia, which corresponds to the relative contribution of these production sites to the total supply of latex concentrate. Other background processes have been modelled using 'Global' or 'Rest-of-World' datasets from ecoinvent, which are considered sufficiently representative for this generic PCF model.

Diesel consumption for operating the pumps has been estimated, as site-specific data on actual fuel consumption were not available. In addition, the mass of the production equipment has been determined on the basis of a representative estimate, as detailed specifications of the equipment used were lacking.

The embedded greenhouse gas emissions from the production equipment have been allocated to the functional unit based on an estimated average machine mass, an annual operating time of 1,920 operating hours and an assumed service life of 25 years. This service life is consistent with the background data used.

Given the very limited contribution of both the diesel consumption of the pumps and the production equipment to the total Product Carbon Footprint (PCF), these assumptions have only a negligible impact on the final results. Table 5 provides an overview of the decomposition of the production and packaging of LC LA.

Material/process	**Quantity**	**Unit**	**Source: ecoinvent 3.10.1**	**Data quality**
Use of pump	0.27	L Diesel	market for water pump operation, diesel (GLO) I EN15804	Estimated
Machinery consumption	0.5	hours	use of LC machine (calculated to the hour based on the market for industrial machinery, heavy, unspecified (RoW) I EN15804)	Estimated
Electricity consumption of machinery	3.77	kWh	energy mix (based on 50% of the low-voltage electricity market (CM) I EN15804; 25% of the low-voltage electricity market (TH) I EN15804; 25% of the low-	Measured

			voltage electricity market (MY) I EN15804)	
Wastewater treatment	8.96	m³	treatment of wastewater, average, wastewater treatment (RoW) I EN15804	Calculated
Flexitank packaging	5.58	kg	flexitank (based on the market for low-density polyethylene granulate (GLO) I EN15804; treatment of waste plastic, mixture, municipal incineration (GLO) I EN15804)	Estimated

***Table 5**: Breakdown of the production and packaging of LC LA*

3.5 Distribution

Following production and packaging, the latex concentrate is prepared for distribution. This phase involves road transport from the processing facility to the export point and sea freight to the customer's nearest seaport.

To provide a representative transport scenario for the PCF analysis, a reference/distribution route has been defined. The route consists of road transport from the Hevecam production facility to the port of Kribi (Cameroon), followed by sea freight from the port of Kribi to the port of Antwerp (Belgium).

This reference route has been chosen to reflect a realistic export scenario for latex concentrate. Although the actual transport routes may vary (depending on the production location and final destination), the chosen route provides a transparent and reproducible basis for the PCF model. Alternative production facilities or customer locations can be assessed by adjusting the transport distances, whilst maintaining the same methodological approach. Table 6 shows the breakdown of the distribution of one metric tonne of LC LA.

Material/process	**Quantity**	**Unit**	**Source: ecoinvent 3.10.1**	**Data quality**
Transport by lorry	60	Metric tonnes*km	market group for transport, freight, lorry, unspecified (GLO) I EN15804	Calculated
Transport by container ship	8,500	Metric tonne*km	market for transport, freight, sea, container ship (GLO) I EN15804	Calculated

***Table 6:** Breakdown of the distribution of one metric tonne of LC LA*

For this Product Carbon Footprint (PCF) analysis, the system boundary has been defined as extending up to and including the arrival of the packaged latex concentrate at the customer's nearest seaport, with the unloading of the vessel falling outside the system boundary.

The inventory data presented in this chapter form the basis for the greenhouse gas calculations presented in the following chapter.

4. Results

This chapter presents the results of the Product Carbon Footprint (PCF) assessment for latex concentrate (LC) with a low ammonia content (LA). The results are expressed in kilograms of carbon dioxide equivalent (kg CO_2-eq) and are based on the life-cycle inventory described in Chapter 3.

4.1 Calculation of the Product Carbon Footprint

The Product Carbon Footprint has been calculated in accordance with the principles and requirements of ISO 14067:2018, using the life cycle assessment framework as defined in ISO 14040 and ISO 14044.

The assessment:

- quantifies greenhouse gas emissions using the EN 15804+A2 GWP100 characterisation factors;
- applies allocation procedures where necessary for processes with multiple inputs and outputs, recycling and reuse, in accordance with the principles of ISO 14044;
- uses background data from the life cycle inventory in the ecoinvent database (version 3.10.1).

4.2 Product Carbon Footprint Results

The product's carbon footprint is 145.70 kg CO_2-eq per metric tonne of low-ammonia (LA) latex concentrate (LC) within the defined 'cradle-to-port' system boundary.

Table 7 provides an overview of the contribution of each life-cycle stage, together with the associated greenhouse gas emissions from fossil fuels, biogenic sources and land use.

Greenhouse gas category	Total	Extraction of raw materials	Transport to the processing facility	Production and packaging	Distribution
kg CO_2-eq – total	**145.70**	**-24.93**	**33.34**	**41.46**	**95.83**
kg CO_2-eq – fossil	**248.48**	80.76	34.23	37.73	95.76
kg CO_2-eq – biogenic	**-104.76**	-107.51	-0.94	3.70	-0.01
kg CO_2-eq – land use	**1.98**	1.83	0.05	0.03	0.08

Table 7: *Weighted PCF results for one metric tonne of LC LA delivered to the customer's nearest seaport.*

4.3 Biogenic carbon uptake and emissions

During growth, rubber trees absorb approximately 105.73 kg of CO_2 from the atmosphere for every metric tonne of latex concentrate produced. This carbon is incorporated into the biomass of the rubber trees and the harvested latex.

A significant proportion of this biogenic carbon remains stored outside the 'cradle-to-port' system boundary. The carbon retained in the standing rubber trees is expected to remain stored for an average of approximately 15 years, based on a productive lifespan of the plantation of 30 years. The remaining carbon is contained in the produced latex concentrate and remains stored until the downstream latex products reach the end of their useful life.

The uptake by the rubber trees accounts for the vast majority of the biogenic carbon flows included in this assessment. Other biogenic material inputs contribute approximately 1 kg CO_2-eq and are therefore negligible by comparison. Consequently, the assessment reports a net biogenic contribution of –104.76 kg CO_2-eq.

4.4 Contribution analysis

The contribution analysis provides further insight into the processes and inventory flows that contribute most to the total product carbon footprint of low-ammonia (LA) latex concentrate (LC). By identifying the key contributors, the analysis maps out the stages of the production system that have the greatest influence on the reported greenhouse gas emissions.

Activity	**Stage**	**kg CO_2-eq – total**	**kg CO_2-eq – fossil**	**kg CO_2-eq – biogenic**	**kg CO_2-eq – land use**
	Total	**145.70**	**248.48**	**-104.77**	**1.98**
Freight container	Distribution	86.73	86.71	-0.03	0.05
Transport by tractor-trailer	Transport to the processing facility	33.34	34.23	-0.94	0.05
Flexitank	Production and packaging	31.33	31.29	0.02	0.02

Water	Natural resources and extraction of raw materials	10.35	10.33	0.01	0.01
Road freight transport (outside Europe)	Distribution	9.10	9.06	0.01	0.03
Ammonia	Natural resources and raw material extraction	8.12	8.08	0.04	0.00
Wastewater treatment	Production and packaging	7.31	3.63	3.67	0.01
Formic acid	Natural resources and extraction of raw materials	4.57	4.53	0.04	0.00
Electricity mix	Production and packaging	1.74	1.72	0.01	0.01
Pump	Production and packaging	1.02	1.02	0.00	0.00
Organic chemicals	Natural resources and raw material extraction	0.76	0.76	0.00	0.00
Fatty acids	Natural resources and extraction of raw materials	0.48	0.60	-1.87	1.75
Formaldehyde	Natural resources and raw material extraction	0.27	0.27	0.00	0.00

Diammonium phosphate	Natural resources and extraction of raw materials	0.24	0.24	0.00	0.00
Sulphuric acid	Natural resources and extraction of raw materials	0.18	0.18	0.00	0.00
Zinc oxide	Natural resources and extraction of raw materials	0.17	0.17	0.00	0.00
LC-line machinery	Production and packaging	0.06	0.06	0.00	0.00
Methanol	Natural resources and extraction of raw materials	0.01	0.01	0.00	0.00
Potassium hydroxide	Natural resources and extraction of raw materials	0.01	0.01	0.00	0.00
Bentonite	Natural resources and extraction of raw materials	0.00	0.00	0.00	0.00
Growing tree seedlings	Natural resources and raw material extraction	0.00	0.00	0.00	0.00
Establishment and maintenance of orchards	Natural resources and extraction of raw materials	-50.10	55.58	-105.73	0.05

Table 8: *Contribution analysis for the production of one metric tonne of LC LA*

Table 8 ranks the individual inventory streams based on their contribution to the total climate impact, whilst Figure 2 groups these contributions by life-cycle stage and distinguishes between fossil, biogenic and land-use-induced greenhouse gas emissions.

Distribution accounts for the largest share of the Product Carbon Footprint, at 95.83 kg CO_2-eq, which represents approximately 60 per cent of the total climate impact. Sea transport accounts for 86.73 kg CO_2-eq, whilst road transport contributes 9.10 kg CO_2-eq.

Production and packaging contribute 41.46 kg CO_2-eq. The production and disposal of flexitanks dominate this stage (31.33 kg CO_2-eq), followed by wastewater treatment (7.31 kg CO_2-eq). Electricity consumption (1.74 kg CO_2-eq), the operation of the pumps (1.02 kg CO_2-eq) and the embedded emissions from the production equipment (0.06 kg CO_2-eq) contribute only to a minor extent.

Transport to the processing facility accounts for 33.34 kg CO_2-eq. This relatively high contribution is due to the transport of liquid field latex, which contains considerably more water than the final latex concentrate and therefore requires a larger transport volume per functional unit.

Natural resources and raw material extraction contribute –24.93 kg CO_2-eq. Although this stage includes fossil greenhouse gas emissions associated with the establishment of plantations, auxiliary materials and processing chemicals, these emissions are more than offset by the uptake of carbon dioxide from the atmosphere during the growth of the rubber tree.

Figure 2 shows that fossil greenhouse gas emissions dominate the overall climate impact, whilst the uptake of biogenic carbon significantly reduces the product's net carbon footprint. Emissions associated with land use remain low across all life-cycle stages.

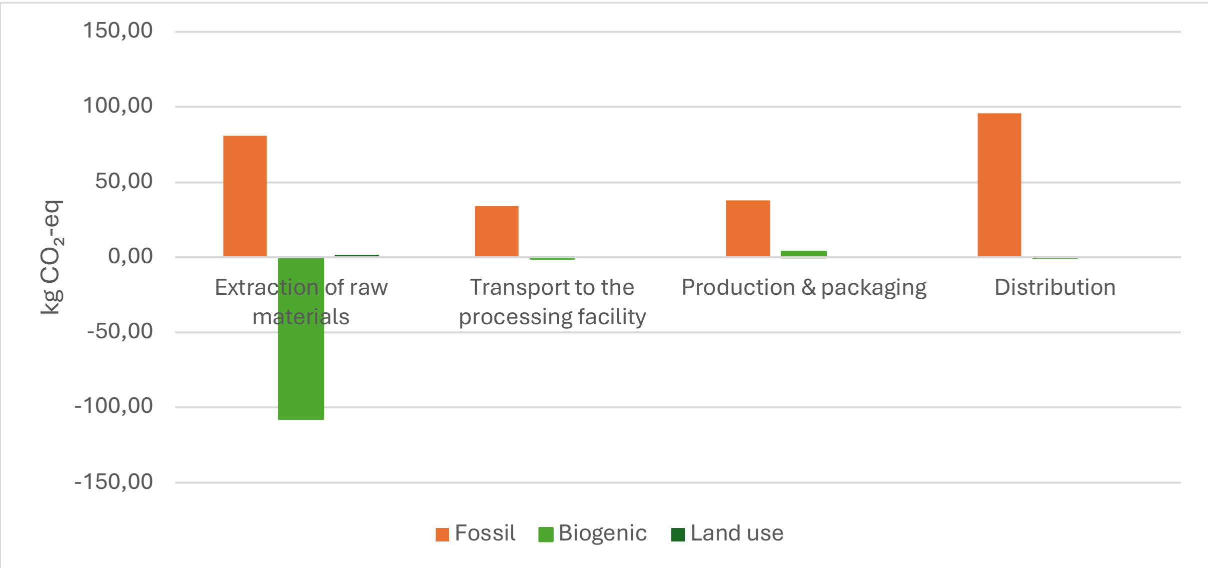

Figure 2. *Contributions to climate change by life-cycle stage for one metric tonne of low-ammonia latex concentrate.*

The reported Product Carbon Footprint is based on site-specific operational data collected at the Hevecam plantation and in the processing facility, supplemented with representative background data from the ecoinvent database. Although technical estimates were required for a limited number of inventory parameters, the analysis is considered to be a robust and consistent quantification of the greenhouse gas emissions associated with the production and distribution of low-ammonia latex concentrate within the defined 'cradle-to-port' system boundaries.

5. Refer

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