Life Cycle Assessment of Bio-EcoMatter®

Lightweight mortar for revoke and coating

Bio-EcoMatter

Residuos Y Materiales

Developed by

360 soluciones cambio climático

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1. Introduction

1.1. Company description

360 Soluciones Cambio Climático is an environmental engineering and consulting firm committed to R&D and innovation for the development of sustainable solutions and services for a variety of sectors, especially related to clean energy, circular economy and waste recovery. Its Innovation Department counts with different national and European patents, including Bio-EcoMatter: a new mortar without cement and sand manufactured from agro-industrial waste.

As a result of 360 Soluciones Cambio Climático's continuous concern about the environment and the improvement of its products and services, it counts with the following certifications: ISO 9001 Quality Management Systems and ISO 14001 Environmental Management System, both since 2022.

1.2. Product description

Bio-EcoMatter is a mortar with a patented formula in which cement and sand are completely substituted by agro-industrial waste and additives. It is a lightweight mortar for revoke and coating suitable for both indoor and outdoor environments, as well as for masonry and decoration.

This bio-mortar is characterized by its mechanical strength and workability, as well as for its durability and breathability. Furthermore, 56% of the raw materials used to manufacture the mortar are residual products, in accordance with the definition provided by the European Commission in the Communication 2010/C 160/025.

Bio-EcoMatter is available in single paper bags of 20 kg instead of 25 kg like traditional mortars thanks to its better performance in terms of square meters covered by the same amount of dry product with respect to traditional mortars.

Furthermore, thanks to the hydraulic lime contained in the mortar, it is able to absorb atmospheric CO_2 where applied, and it does not produce emissions of volatile compounds as well as formaldehyde.

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2. The study

2.1. Overview

The Life Cycle Assessment (or "LCA") is considered the most comprehensive and extensive tool for quantifying the environmental performance of a product throughout its life cycle, from the extraction of raw materials to the final disposal of the product. It is used to recognize environmental hot spots in the life cycle of a product and identify improvement opportunities, as well as to analyze the contribution of each life cycle stage to the overall environmental footprint and use data to support decisions. Other applications of LCA include Environmental Product Declarations and comparison between products for both external and internal communication.

This study aims at carrying out an LCA to determine the environmental impacts of Bio-EcoMatter and how the product is performing with respect to traditional mortars on the market by analyzing the following impact categories: Abiotic Depletion Potential (ADP) for minerals and metals (elements, or non-fossil resources) and for fossil resources, Global Warming Potential (GWP), Acidification Potential (AP), Eutrophication Potential (EP), Photochemical Ozone Creation potential (POCP), Ozone depletion Potential (ODP),

According to PréConsultants, LCA for external communication should conform to the relevant ISO standards:

- ISO 14040: Principles and Framework.
- ISO 14044: Requirements and Guidelines.
- ISO 14024, 14021 and 14025: Environmental labels and declarations of Type I, II and III respectively.

The assessment has been carried out according to the relevant Product Category Rules (PCR). PCRs are specific guidelines for the calculation of the environmental impact of products within the same product category (group of products with the same characteristics). PCRs contain strict requirements that leave less room for interpretation than general LCA. The relevant PCR for this study is "GlobalEPD-RCP006-Mortars" provided by AENOR. Once the PCR has been identified, the LCA was performed according to the specifications in the study.

The software Simapro 9.4.0.2. developed by PréConsultants has been used to model and carry out the LCA, integrated with the database Ecoinvent 3.8.

A comparative analysis has been carried out in Section 2.3.3.3. with a traditional cement and lime-based mortar fulfilling the same function as Bio-EcoMatter.

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2.2. Methodology

An LCA study consists of 4 interconnected parts:

- The definition of the **Goal and Scope** of the study, including the boundaries of the system and the declared functional unit.
- The **Life Cycle Inventory** (LCI), where inputs and outputs of the system are collected and analyzed. When a system is multifunctional an adequate methodology to allocate impacts among the co-products shall be selected.
- The **Life Cycle Impact Assessment** (LCIA), where inventory data are characterized by specific environmental impacts according to the selected impact methodology.
- **Interpretation of the results** in accordance with ISO 14040 and with the goal and scope of the study, in order to draw conclusions. If allocation procedures during the LCI phase are applicable, a sensitivity analysis shall be carried out to illustrate the consequences and results of applying alternative procedures, in accordance with ISO 14044.

2.3. Life Cycle Assessment

2.3.1. Goal and Scope definition

2.3.1.a. Goal definition

The goal of the study is the assessment of the environmental impacts generated by Bio-EcoMatter, comparing its performance against similar products available on the market (mortars for revoke and coating).

2.3.1.b. Scope of the study

The scope of the study is a Cradle-to-Grave (A1-C4) analysis, as stated in the relevant PCR. The products covered by the product category are pre-dosed mortars, composed of cement and/or lime, additives, aggregates, and fibers to which only water is added on site. The technical definition and specifications of its multiple varieties are detailed in the rule: "UNE-EN 998-1 Specifications of masonry mortars. Part 1: Mortars for revoke and coating".

Product Stage	A1	Obtention of raw materials	X
	A2	Transport to factory	X
	A3	Manufacturing	X
Construction	A4	Transport to construction site	X
	A5	Installation/construction	X
Use Stage	B1	Use	NR
	B2	Maintenance	NR
	B3	Reparation	NR
	B4	Substitution	NR
	B5	Rehabilitation	NR
	B6	Use of energy	NR
	B7	Use of water	NR
End-of-life	C1	Deconstruction/demolition	NR
	C2	Transport	X
	C3	Waste treatment	NR
	C4	Elimination	NR
	D	Reutilization, recuperation, recycling benefits	MNE

**NR: Not relevant, MNE: Module Not Evaluated*

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2.3.1.c. **Functional unit**

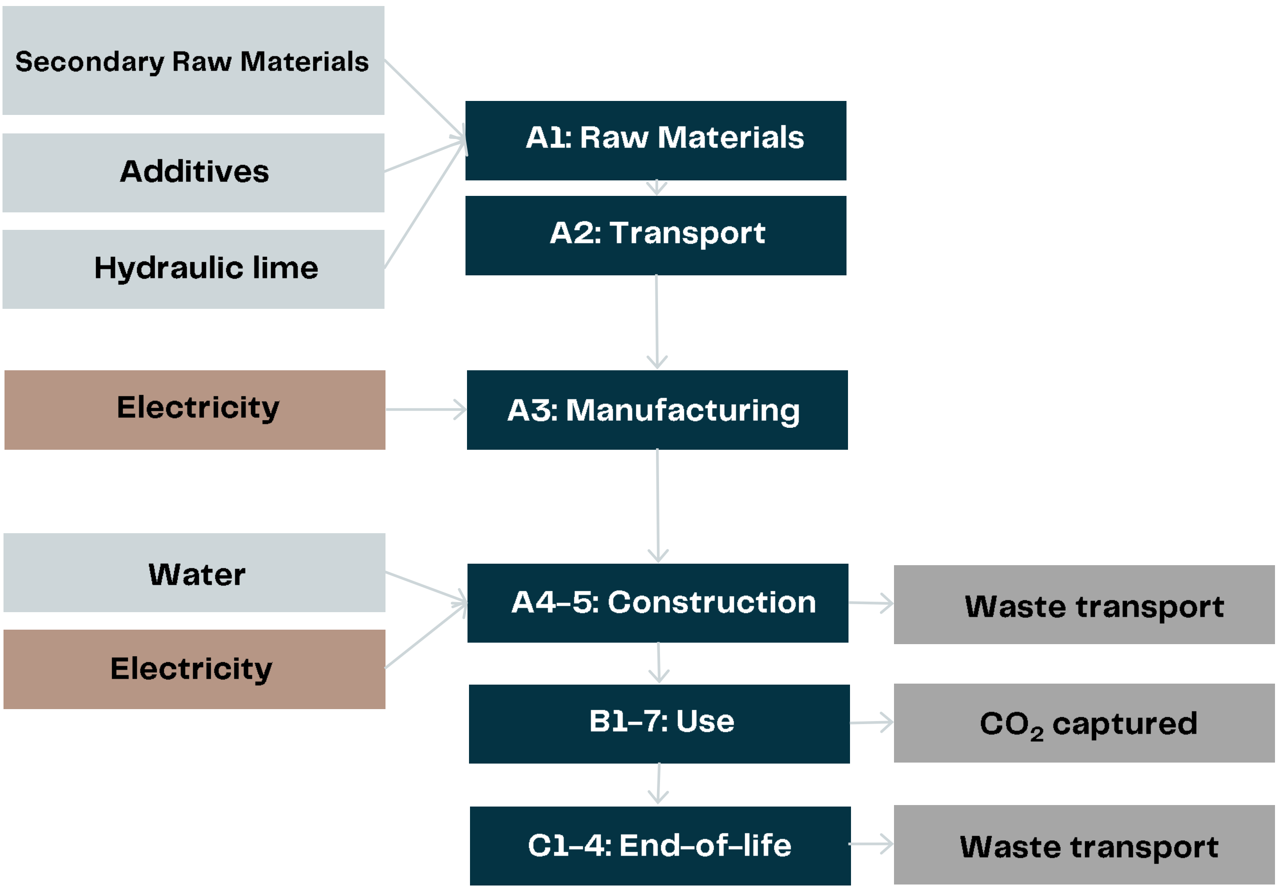
According to the PCR, the generic functional unit is considered: providing technical properties on 1 m² of facade covered with monolayer mortar with an expected life of 25 years.

Table 1. Functional unit details.

Parameter	Data
Reference layer thickness of applied product	1 cm
Typical density of mortar	1.450 kg/m³
Reference mass by 1 m²	8,3 kg
Reference Service Life (RSL)	25 years

2.3.2. Life Cycle Inventory (LCI)

Figure 1. System boundaries of Bio-EcoMatter



2.3.2.a. **Included processes**

PRODUCT STAGE A1-A3

Product stage includes the following modules: Raw materials extraction and processing (A1), Raw materials transportation to production plant (A2) and Manufacturing (A3). As allowed by UNE-EN 15804 regulation, the results of A1, A2 and A3 modules have been grouped into a single stage (A1-A3).

A1 Raw material supply: This module includes the extraction and processing of raw materials, such as hydraulic lime and additives, as well as the valorization processes of residual products into Secondary Raw Materials.

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According to the Polluter Pays Principles applied in the PCR as a methodological choice for the reuse, recycling and recovery allocations, the subsequent user of a residual product shall carry the environmental impact from the processing and refinement of waste but not the impact caused in the earlier life cycles. Thus, the energy required for the valorization of secondary raw material is taken into account, as well as the processing of final residues, including any remaining packaging not leaving the factory gate with the product.

Table 2. Product composition

Product composition	
Hydraulic lime	±40-50%
Secondary Raw Materials	±50-60%
Additives	±0-5%

A2 Transportation: This module includes transport of all raw and secondary materials (including packaging) considered in module A1, from the place of extraction, production or processing to the factory door. Also includes internal transport in the factory. The specific distance for each raw material has been entered. The type of lorry considered for the whole LCA is a lorry of 16-32 metric ton. For those materials that has been selected from the Ecoinvent database, the transportation was already included.

A3 Manufacturing: this module includes the manufacturing of the construction product and packaging materials used. The manufacturing process consists in mixing the dry components of the mortar. The module also includes the use of auxiliary materials (for example oils), internal recycling and manufacture of packaging or material used for packaging the final product already ready for distribution (e.g., bags, film and pallets).

The product is sold in paper bags of 20 kg of dry mortar. Each kraft paper bag weighs 85 grams. The energy consumed for the mixing of raw materials has been included in this module.

CONSTRUCTION STAGE A4-5

A4 Transport: this process stage considers the transport to the construction site. For this module, the scenario established in Annex I of the relevant PCR has been considered: transported by road using a heavy-duty truck for a predetermined distance of 200 km, including the empty return trip.

A5 Installation: during this phase, different types of instruments and ancillary materials are required. Their environmental impacts regarding to product life cycle have not been considered, since these are negligible due to the number of reuses performed with the mentioned elements. The most common installation scenario for the product under study is the manual application: water is added to the dry mortar and mixed manually or mechanically until homogeneous and workable. The blended product is spread on the support with a trowel and let to dry. The water and energy required by this process are considered.

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The specific amount of water needed for the production of 1 unit of Bio-EcoMatter has been entered, while for the energy consumption the scenario established in Annex I of the relevant PCR has been considered. In the same way, the only waste considered according to Annex I of the PCR is the mortar packaging and it is transported by road using a heavy-duty truck for a predetermined distance of 50 km, not including the empty return trip.

Table 3. Product installation in the building

Parameter	Value/kg mortar
Auxiliary materials for the installation	-
Water use	±0,2-0,5 l/kg
Energy consumption	Electricity: 0,03 Wh/kg
Waste of materials on site before waste treatment, generated by the product installation	Packaging paper bags: 0,00425 kg/kg

USE STAGE B1-7

B1 Use: the product under study does not generate emissions to air, water or ground during its use phase. Thus, this stage is considered not relevant according to the PCR.

It is important to highlight that, once the product is applied, during the lime carbonation (or mineralization by carbonation) phase, the lime contained in the mortar captures CO_2 from the atmosphere, which reacts with the lime to produce calcium carbonate crystals. The calcium carbonate crystals are larger than the lime and they form in available spaces, such as cracks, and grow, thereby sealing the cracks. This 'self-healing' characteristic reduces water penetration and increases the durability of mortars [Eula]. Thus, Bio-EcoMatter captures atmospheric CO_2 where it is applied due to the lime cycle. This chemical process has been estimated as 118,27 g of CO_2 fixation per kg of mortar.

For the sake of comparability with other mortars' LCA and following the relevant PCR for the product, this module has not been considered.

B2 Maintenance: the product under study does not require any type of maintenance during its RSL (25 years).

B3 Repair: the product under study does not require any type of repair during its RSL (25 years).

B4 Replacement: the product under study does not require any type of replacement during its RSL (25 years).

B5 Refurbishment: the product under study does not require any type of refurbishment during its RSL (25 years)

B6-7 Operational water and energy use: being mortars static construction materials, they require no water or energy in the use stage.

END-OF-LIFE STAGE C1-4

This stage considers the modules C1 Demolition, C2 Transport and C3-4 Waste treatment and disposal.

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C1 Demolition: During the building destruction, the quantity of extra energy required to break the mortar can be neglected compared to the energy required to demolish the structure of the building.

C2-4 Transport and waste treatment: Mortars are considered a not-hazardous rigid material and can be recycled as crushed material. The End-of-life scenario considered for this product is the crushing and recovery of the used mortar into secondary material, which will be incorporated in a new product life cycle. Thus, according to the polluter pays principle, only the waste transportation to the recycling plant has been taken into account. The scenario established in Annex I of the relevant PCR has been considered: transported by road using a heavy-duty truck for a predetermined distance of 50 km, not including the empty return trip.

Table 4. End-of-life scenario

Parameter	Value	Unit of measure
Collection process	0 8,3	Kg collected separately Kg collected with mixed construction waste
Recuperation system	0 8,3 0	Kg for reutilization Kg for recycling Kg for energy valorization
Distance to recycling site	50	km
Elimination	0	kg
Type of vehicle	Heavy duty truck 16-32 ton EURO VI	

2.3.2.b. **Allocation**

During the life cycle of Bio-EcoMatter there are no multifunctional processes, thus allocation procedures are not necessary for this study.

2.3.2. Life Cycle Impact Assessment (LCIA)

As indicated by the PCR, the relevant methodology on SimaPro has been identified in "CML-IA, version 4.1", as the study has been developed in compliance with the Environmental Product Declaration guidelines established by ISO 14025 and a PCR published by AENOR. The impact categories analyzed in this study are:

- Global Warming Potential (GWP): increase in Greenhouse Gas Emissions that can lead to an overheating of the planet and therefore a change in its conditions. It is measured in kg CO_2 equivalent.
- Acidification Potential (AP): consists of the disposal of acids resulting from the release of nitrogen and sulfur oxides into the atmosphere. These cause a wide range of impacts on soil, groundwater, surface water, organisms, ecosystems, and materials (buildings), It is measured in kg SO_2 equivalent.
- Eutrophication Potential (EP): impacts due to excessive levels of macronutrients, nitrogen and phosphorus that represent an increase in biomass production in aquatic ecosystems and can eliminate any type of aerobic life in the ecosystem, measured in kg PO_4 eq.

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- Photochemical Ozone Creation potential (POCP): quantifies the relative abilities of volatile organic compounds (VOCs) to produce ground level ozone. It is measured in kg C_2H_4 (ethylene) equivalent.
- Ozone depletion Potential (ODP): decrease in the ozone layer that causes an increase in the amount of UV-B radiation that reaches the surface of the earth, affecting human health, agricultural production, degradation of plastic materials and ecosystems. It is measured in units related to the effect that produces 1 kg of CFC-11.
- Abiotic Depletion Potential (ADP) for all non-renewable material resources and ADP for fossil resources: decrease in the availability of natural resources. Abiotic and energy resources are included in this category. It is measured in kg of Sb (antimony) equivalent and MJ.

CML-IA is a LCA methodology developed by the Center of Environmental Science (CML) of Leiden University in The Netherlands. The CML-IA (baseline) method elaborates the problem-oriented (midpoint) approach.

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3. Results

Figure 2. Contribution analysis of LCA of 1m² of Bio-EcoMatter

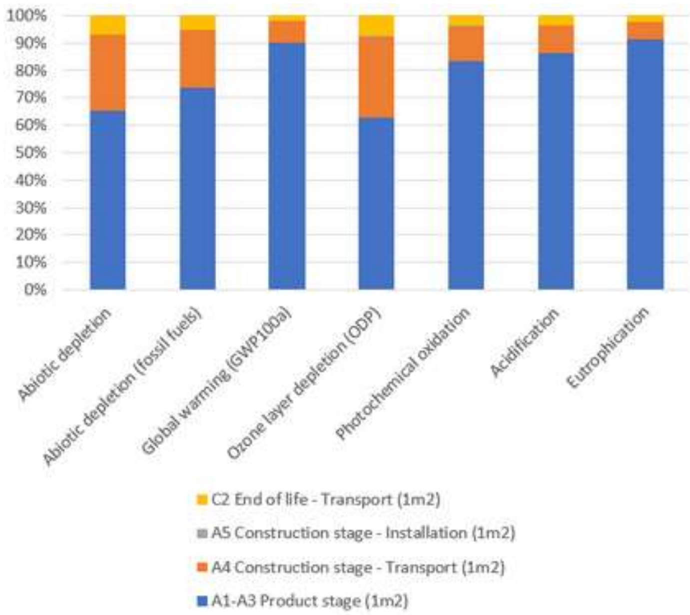

Table 5. Impact Evaluation of LCA of 1m² of Bio-EcoMatter

Impact category	Unit	Total	A1-A3	A4	A5	B1-7	C1-4
Abiotic depletion	kg Sb eq	3,46E-06	2,25E-06	9,59E-07	9,27E-09	NR	2,40E-07
Abiotic depletion (fossil fuels)	MJ	1,93E+01	1,42E+01	4,01E+00	2,66E-02	NR	1,02E+00
Global warming (GWP100a)	kg CO_2 eq	3,45E+00	3,12E+00	2,68E-01	2,25E-03	NR	6,83E-02
Ozone layer depletion (ODP)	kg CFC-11 eq	1,68E-07	1,05E-07	4,96E-08	1,67E-10	NR	1,26E-08
Photochemical oxidation	kg C_2H_4 eq	2,46E-04	2,04E-04	3,18E-05	5,92E-07	NR	8,90E-06
Acidification	kg SO_2 eq	6,29E-03	5,44E-03	6,30E-04	1,20E-05	NR	2,17E-04
Eutrophication	kg PO_4 eq	2,17E-03	1,99E-03	1,32E-04	4,62E-06	NR	4,84E-05

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Table 6. Impact Evaluation of LCA of 1m² of Bio-EcoMatter in percentage

Impact category	Total	A1-A3	A4	A5	B1-7	C1-4
Abiotic depletion	100%	65,09%	27,71%	0,27%	NR	6,93%
Abiotic depletion (fossil fuels)	100%	73,79%	20,78%	0,14%	NR	5,29%
Global warming (GWP100a)	100%	90,20%	7,76%	0,07%	NR	1,98%
Ozone layer depletion	100%	62,77%	29,59%	0,10%	NR	7,54%
Photochemical oxidation	100%	83,19%	12,95%	0,24%	NR	3,62%
Acidification	100%	86,35%	10,01%	0,19%	NR	3,45%
Eutrophication	100%	91,48%	6,08%	0,21%	NR	2,23%

3.1. Interpretation of results

Analysis by stage

As we can see from Table 5 and 6, the potential environmental impacts of 1kg Bio-EcoMatter are mainly produced on the product stage (A1-A3). This stage registers the greater impact values in all the environmental impact categories under study, representing approximately between 92% and 63% of the impact in all categories considered.

The module A4 (transport from the factory to the construction site), shows a moderate environmental contribution over a large part of the assessed indicators, with the highest contribution being 29,59% of the total impact in the category of Ozone Layer Depletion. On the other hand, module A5 (installation in the construction site) presents the slightest contribution to the total environmental impacts of the product, with values lower than 0,3% in all impact categories.

With reference to B1-7 (use stage), the environmental benefits that arise from the atmospheric CO2 produced during the carbonation process of lime contained in the product that is then captured once the mortar is applied on the installation site, has not been considered as per relevant PCR. Moreover, the product does not require any type of maintenance, water nor energy consumption.

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Thus, the impact during the use stage is zero, or Not Relevant.

As for C1-C4 module, the only stage that is included in this study is the transport of waste from the construction to the recycling site. The most relevant impacts of this phase are Ozone Layer Depletion (7,54%), Abiotic Depletion of Elements (6,93%) and of Fossil Fuels (5,29%).

Analysis by impact category

Emissions of antimony equivalent (Sb eq) in the category of Abiotic Depletion related to Elements amounts to 3,46E-06 kg, of which 65% can be traced back to the production stage. This is mostly caused by the depletion of non-renewable resources during the production process of hydraulic lime. For what concerns the Abiotic Depletion related to Fossil fuel, the total amount is 19,3 MJ of which almost 21% of the contribution is due to the transport from the factory gate to the construction site, 5,3% to the transport of the waste to the recycling site and 73,8% to the product stage (almost 68% related to hydraulic lime production).

In terms of Global Warming Potential (GWP), 1 kg of Bio-EcoMatter generates 0,416 kg of CO_2 eq, while 1m^2 generates approximately 3,45 kg. Most of the impact can be traced to hydraulic lime. Overall, the product stage represents 90,2% of the total carbon footprint of the product, while only hydraulic lime is responsible for 88% of the total GWP. It shall be noted that, during the use phase, around 118,27 g CO_2 for each kg of mortar are absorbed by the carbonation process of the lime, although this stage is not considered relevant according to the PCR. Thus, total carbon footprint would result in 0,298 kg of CO_2 eq per kg of Bio-EcoMatter and 3,33 kg per m^2.

Total Ozone Depletion Potential (ODP) results in 1,68E-07 kg of CFC-11 eq. distributed as follows: 62,8% in the product stage, 29,6% in the transport to construction site phase, 0,1% in the installation phase, and 7,5% generated by the transport of the construction waste to the recycling site. Such distribution of the impact might be due to the ozone depletion potential of the fuels used for vehicles and to the heavy fuel oils used in the production of hydraulic lime.

Of the total 2,46E-04 kg of C_2H_4 generated in the Photochemical Oxidation (POCP) category, 83,2% is related to the product stage, almost 13% in the construction stage (A4-5) and 3,6% is related to the transport in the end-of-life stage. Similar results are obtained for the acidification potential (AP), where the total 6,29E-03 kg of SO2 eq generated are distributed respectively as: 86,4%, 10% and 3,6%.

For what concerns Eutrophication Potential (EP) around 91,5% of the 2,17E-03 kg of PO_4 eq are generated in the product stage. In this stage 89% of the eutrophication impact is generated by hydraulic lime (mainly by the hard coal used in its production process) and approximately 8,5% can be traced back to

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the production of the kraft paper used for the packaging of Bio-EcoMatter.

It shall be taken into account that, although hydraulic lime always results as the highest contributor in each impact category considered, 56% of the additional components are Secondary Raw Materials, hence its environmental impact before the valorization process has not been taken into account.

3.2. Comparative analysis

In order to have a complete picture of the real environmental impact of Bio-EcoMatter, the product shall be compared to traditional construction materials that fulfill the same function. For this purpose, another mortar for revoke and coating has selected, based on the degree of comparability of the LCA (the mortar counts with an Environmental Product Declaration developed following the same PCR as Bio-EcoMatter).

The EPD object of this comparison study is: EPD n. 006-004 rev.2 "Mortars for revoke and coating" developed by Grupo PUMA S.L. that includes 24 references in the study.

The analysis has been performed on the functional unit of the product (1 m^2 of façade covered with monolayer mortar with 25 RSL). Specifications of Bio-EcoMatter's (BEM) and Grupo Puma's (GP) functional unit are reported in Table 7.

Table 7. Functional unit details.

Parameter	BEM	GP
Reference layer thickness of applied product (mm)	10	10
Typical density of mortar (kg/m3)	1.450	1.413
Reference mass by 1 m2 (kg)	8,3	14,46

Table 8. Comparative LCA of Bio-EcoMatter and Grupo Puma

Impact category	BEM	GP
Abiotic depletion	-	+92%
Abiotic depletion (fossil fuels)	-	+49%
Global warming (GWP100a)	-	+12%
Ozone layer depletion (ODP)	-	+56%
Photochemical oxidation	-	+73%
Acidification	-	+44%
Eutrophication	-	+3%

The results of the comparative analysis reported in Table 8 and Figure 3 prove that the new SRM-based mortar shows better environmental behavior in all the categories and with respect to the traditional mortars selected.

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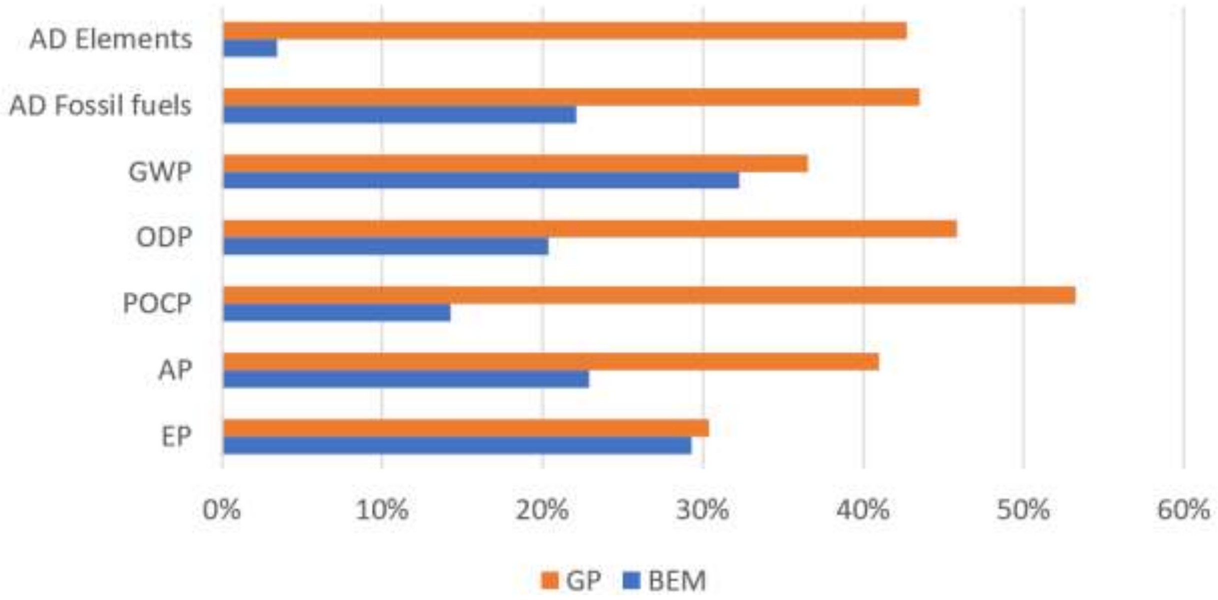
Figure 3. Comparison of 1 m² of Bio-EcoMatter and Grupo Puma.



The main result is that Bio-EcoMatter is able to reduce up to 92% of the impact in terms of depletion of abiotic resources, due to the fact that it substitutes both cement and sand, which are considered nonrenewable resources, with agro-industrial waste, which is considered a renewable one. Moreover, it reduces approximately 50% of the consumption of fossil fuels, with respect to traditional mortars, especially in the production stage.

In terms of carbon footprint, or Global Warming Potential, Bio-EcoMatter counts with a total carbon footprint 12% lower than GP mortar:

-In the production stage (A1-3), 12,73% lower than GP

– In the construction stage

- Transport (A4), 44% higher than GP and 9,8% lower than CC. This is due to the fact that for Bio-EcoMatter the 200km scenario established in the Annex I of the PCR has been used for Bio-EcoMatter, while the other EPD used real average logistic data. In particular, Grupo Puma accounted for transport by road and water for around 100 km. Thus, a reliable comparison cannot be carried out until real data on Bio-EcoMatter's logistics can be obtained.
- Installation (A5%), 35,5% lower with respect to GP. This is due to the better cover performance of Bio-EcoMatter, for which less product is needed to cover the same surface, thus generating less impact in the installation stage.

-In the end-of-life stage (C1-4),

- Transport (C2), between 23 and 18% lower than the other mortars. This is due to the smaller functional unit of Bio-EcoMatter.
- Elimination (C4), assuming that the mortar is 100% recycled and since this LCA has been developed according to the Cut-off methodology, the recycling process of Bio-EcoMatter

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shall not be included in this study, but it shall be considered in the LCA of the following product. Thus, the impact in this stage is zero and it represents 100% less carbon footprint with respect to the other mortars. Such impact is determined by methodological choices.

As for the Ozone Depletion Potential, Bio-EcoMatter generates approximately 56% less CFC-11 equivalent than the other mortar, while it achieves reducing 73% of the impact in terms of Photochemical oxidation.

In the same way, the new SRM-based mortar performs better both in terms of Acidification Potential (-44%), and Eutrophication Potential (-3%).

Figure 4. Application of 1 m^2 of BEM and other cement mortar..

Figure 5. Fresh application of BEM

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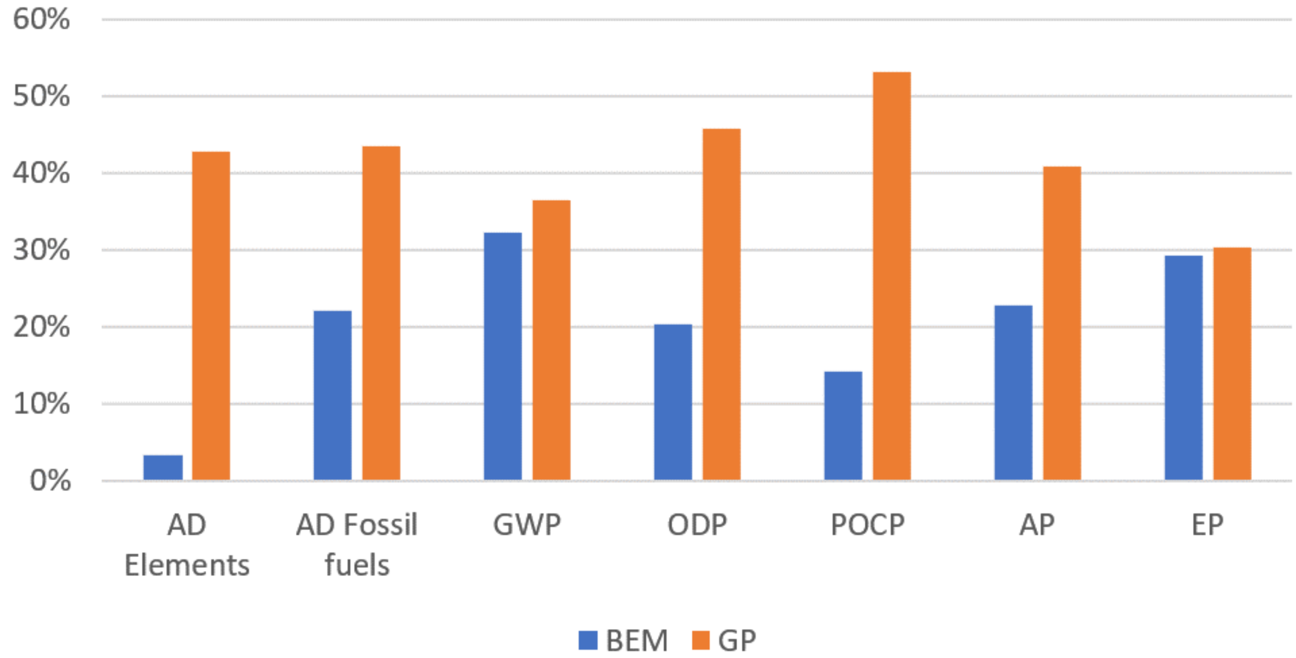
4. Conclusions

Figure 6. Comparison of 1 m² of Bio-EcoMatter and Grupo Puma..



From this study results that Bio-EcoMatter can claim important improvement in the environmental profile with respect to traditional cement and lime mortars. Among the main results:

- Over 90% reduction of abiotic depletion of elements and almost 50% reduction of fossil fuel consumption.
- Up to 12% reduction of carbon footprint.
- More than 55% improvement in terms of ozone depletion potential and 70% in terms of photochemical oxidation potential.
- Reduction of almost 45% of acidification potential's related environmental impacts related and up to 3% of those related to eutrophication.

Such positive environmental results are mainly due to the complete substitution of cement and sand achieved by Bio-EcoMatter and by its improved performance: to fulfill the same function (covering 1 m² of façade with one layer of mortar), only 8,3kg of Bio-EcoMatter are required, instead of approximately 14kg of traditional mortars. This generates economic and environmental advantages thanks to the high efficiency of each kg of raw material as well as to the reduction of energy consumption and packaging, the optimization of the logistic unit, etc.

The relative high impact of the production of hydraulic lime in Bio-EcoMatter's environmental profile is due to the "Polluter Pays Principle" methodology applied throughout the study, for which the subsequent user of a residual product shall carry the environmental impact from the processing and refinement of waste but not the impact caused in the earlier

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life cycles. Thus, the Secondary Raw Materials (56% of the product) do not have any environmental impact other than the ones generated during the valorization process. For this reason, the impact of hydraulic lime production, being among the few raw materials not proceeding from waste, is the highest one.

On the other hand, the actual carbon footprint of the product would be further reduced if the carbon absorption achieved during lime's carbonation process (approximately 28% of Bio-EcoMatter's carbon footprint) and the CO_2 sequestrated by the biomass from which the Secondary Raw Materials are generated had been taken into account.

The present study was developed in the framework of the Growth and Harvest – **Metabuilding** project "Bio-EcoMatter" Agreement n. 689. The results obtained from this Life Cycle Assessment are based on pre-industrial data of the product determined during the project.

metabuilding

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The group of work behind this study is composed of:

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- Jessica Lelli, Master of Resource Economics and Sustainable Development, Head of Sustainability Department of 360 Soluciones Cambio Climático.

This document is signed by Lorena Rodríguez Lara, Bachelor of Environmental Sciences, CEO and Founder.

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Bio-EcoMatter, for a more efficient, circular and sustainable construction sector.

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