



Baumacol Basic, FlexUni and FlexMarmor Medio

Tile Adhesives

by BAUMIT Bulgaria EOOD

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1. General Information

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This declaration is the type III Environmental Product Declaration (EPD) based on EN 15804 and verified according to ISO 14025. It contains information about the impact of declared construction materials on environment and their aspects verified by the independent Advisory Board according to ISO 14025.

Basically, a comparison, or evaluation of EPD data is possible only if all the compared data were created according to EN 15804.

Life Cycle analysis (LCA): Modules A1-A3, C1-C4 and Module D in accordance with EN 15804 (Cradle to Gate with options)

Declared durability: 50 years under normal conditions of use

Product standard: BDS EN 12004

PCR: ITB-EPD General PCR v1.4/2014

Representativeness: BG, RER, GLO

Declared unit: 1 ton of dry mix for tile adhesive

LCA scope: Product stage (modules A1-A3), End-of-life stage (C1-C4) and Benefits and loads beyond the system boundary (module D)

Year of preparing the characteristic: 2021

2. Product Description

BAUMIT BAUMACOL BASIC

BAUMIT Baumacol Basic is a factory-made, cement-based adhesive mortar of class C1. It is used for laying different types of tiles (ceramic, clinker, earthenware, mosaic, etc.) using thin-bed method. It is suitable for laying ceramic tiles, slabs, mosaic, earthenware, split tiles and clinker slabs, for use on mineral-based substrates like concrete, cement-based plasters and tile adhesive, lightweight and aerated concretes, gypsum masonry panels/blocks, and for the bonding of building and insulation panels. It is convenient for indoor and outdoor use in all types of premises such as living rooms, bathrooms, commercial wet rooms and swimming pools. It is not suitable for substrates subjected to thermal stress. Baumacol Basic consists of Portland cement, limestone crushed stone and an additive. The product covers the requirements of the European standard EN 12004. Baumacol Basic is packed as a dry mix in bags with unit mass 25 kg.

BAUMIT FLEXUNI

BAUMIT FlexUni is a factory-made, malleable, highly tempered, water- and frost-resistant, cement-based tile adhesive mortar of class C2 T. FlexUni is used for laying tiles using thin-bed method. It is suitable for laying stoneware, earthenware and porcelain stoneware tiles and slabs both indoors and outdoors, in dry and wet premises, on floor heating systems and anhydrite tile adhesive. It consists of Portland cement, limestone crushed stone and additives. FlexUni covers the requirements of the European standard EN 12004. FlexUni is packed as a dry mix in bags with unit mass 25 kg.

BAUMIT FLEXMARMOR MEDIO

BAUMIT FlexMarmor Medio is a factory-made, cement-based tile adhesive mortar of class C2 TE S1. FlexMarmor Medio is used for laying tiles using medium-bed method. It is suitable for laying ceramic tiles, large-format tiles, glass ceramics, marble and other natural stoneware tiles and slabs, both indoors and outdoors. It is suitable at premises with increased thermal and/or static loads, for swimming pools and for tile-on-tile adhesion. It consists of Portland cement, limestone crushed stone and additives. FlexMarmor Medio covers the requirements of the European standard EN 12004. FlexMarmor Medio is packed as a dry mix in bags with unit mass 25 kg.

Figure 1, Figure 2 and Figure 3 show pictures of packed Baumacol Basic, FlexUni and FlexMarmor Medio.



Figure 1: Packed Baumacol Basic



Figure 2: Packed FlexUni



Figure 3: Packed FlexMarmor Medio

Table 1 lists the essential characteristics of Baumacol Basic, FlexUni and FlexMarmor Medio as per the Product technical specifications.

Table 1: Technical characteristics of Baumacol Basic, FlexUni and FlexMarmor Medio

Characteristics	Value/Class			Units	Technical specification
	Baumacol Basic	FlexUni	FlexMarmor Medio		
Grain size	< 0.3	< 0.3	< 0.3	mm	EN 12004
Layer thickness	< 4.0	< 5.0	3-20	mm	EN 12004
Reaction to fire	A1	A1	A1	class	EN 12004
Water demand	≈ 0.28	≈ 0.32	≈ 0.25	l/kg	EN 12004
Application time	≈ 4	≈ 4	≈ 4	hours	EN 12004
Open time	≈ 20	≈ 20	≈ 30	min	EN 12004
Consumption rate	≈ 3	≈ 3	≈ 3	kg/m ²	EN 12004



3. LCA Information

FUNCTIONAL UNIT	1 ton tile adhesive
SYSTEM BOUNDARIES	Cradle to Gate + options: Modules A1-A3, C1-C4 and Module D
DECLARED DURABILITY	50 years under normal conditions of use
CUT-OFF CRITERIA	<p>As per EN 15804, in the case that there is not enough information, the process energy and materials representing less than 1% of the energy and mass used per module can be excluded (if they do not cause significant impacts). The addition of all the inputs and outputs excluded is less than 5% of the whole mass and energy used, as well of the emissions to environment occurred.</p> <p>Flows related to human activities such as employee transport are excluded. In accordance with EN 15804 the construction of plants, production of machines and transportation systems are excluded.</p> <p>Environmental burden of the administrative building is partly considered. Collected data covers all components used for the manufacturing of the tile adhesive mixes, electricity consumption and fuels use.</p> <p>The total sum of omitted processes is close to 0% of the whole mass of inputs and outputs.</p>
ASSUMPTIONS AND LIMITATIONS	<p>Generic data from ecoinvent v.3.6 database is used to model the components of the tile adhesives that are delivered by external suppliers and the manufacturer does not have influence on their production.</p> <p>Packaging materials and packaging waste are considered in the assessment of all components of Baumacol Basic, FlexUni and FlexMarmor Medio.</p>
GEOGRAPHICAL COVERAGE AND TIME PERIOD	<p>All data related to the tile adhesives is collected from BAUMIT Bulgaria EOOD and represents the manufacturing process in 2018.</p> <p>Assessment of transport of all components covers all used transport types, external and internal transport activities.</p>
DATA QUALITY	<p>The information on the production process of the tile adhesive is collected from BAUMIT Bulgaria EOOD.</p> <p>Information on the transport and composition of components is provided by BAUMIT Bulgaria EOOD.</p> <p>Information on the production process of additives is accounted as presented in ecoinvent v.3.6 database.</p>
ALLOCATION	<p>The factory of BAUMIT Bulgaria EOOD in Elin Pelin produces various construction products for external and internal finishing layers of buildings. The manufacturing processes for all tile adhesives are equivalent with slight variance in terms of working regime of drying and mixing stations. Even though, allocation is done regarding energy and fuel use, and generated waste. Environmental impacts, resource use and waste generation are calculated based on yearly data about the inputs/outputs and the yearly production of tile adhesives for 2018.</p>

4. Manufacturing process

The received fraction of crushed stone is 20/60 mm and it is dried in an oven, if necessary. This fraction is then crushed in a coarse crusher and subsequently sieved into seven smaller fractions. The smaller fractions are fed into pipelines and then carried to silos.

The other ingredients – Portland cement CEM I 52.5 N and the additives are delivered as dry substances. Portland cement is delivered by dry bulk cement transportation truck and is discharged into the factory silo (in the factory tower) through pneumatic compressed air pipe system. The additives are delivered in PE big bags and are also discharged into the factory silo.

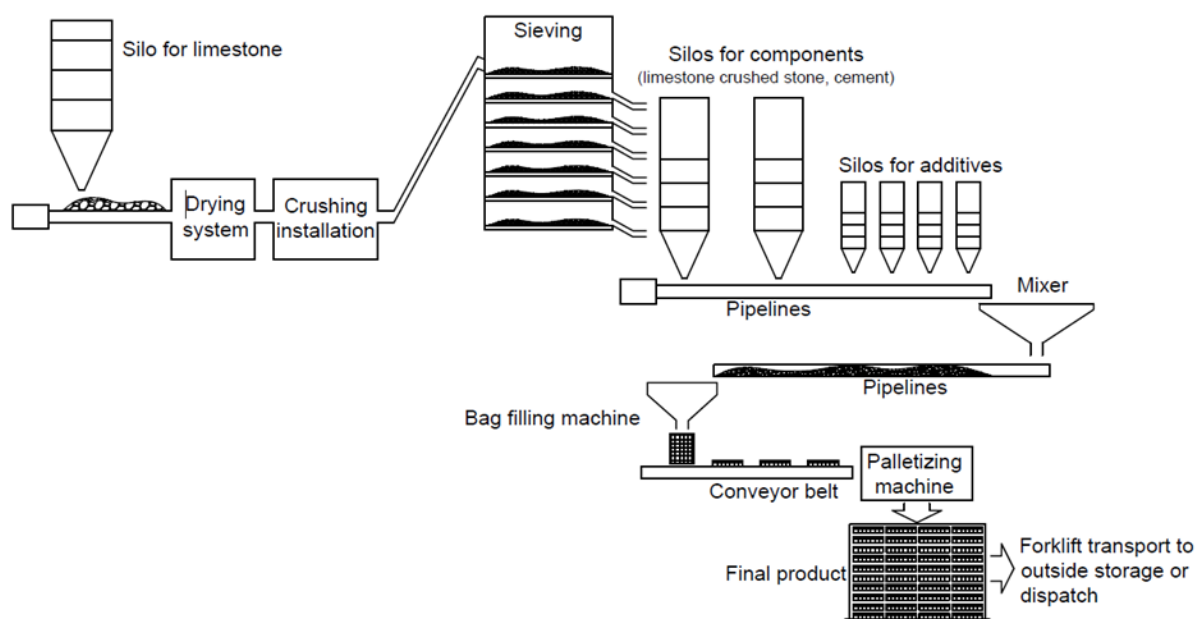


Figure 4: Production process of Baumacol Basic, FlexUni and FlexMarmor Medio

After the predefined quantity of each material is set, the materials are dosed and released on gravity pipelines that take them to a mixing facility. The ready mix is then transported to a machine for bag-filling. All products are packed in paper bags with mass 25 kg. The sealed bags are transported to the palletizing station through conveying belt. The bags are arranged on the pallets and covered by elastic polyethylene film. The pallets are transported by forklifts to an outside storage space.

5. System boundaries

Module A1: Raw materials supply and transport

The production processes of the Portland cement and limestone crushed stone and the additives are considered using referent data for the ecoinvent database. Production of packaging materials is also considered using referent data from the ecoinvent database.

Module A2: Transport of raw materials to the production site

The transport to the factory of the Portland cement, limestone crushed stone, additives and packaging materials is considered using real data from the manufacturer.



Module A3: Manufacturing

This includes the process of crushing, drying, sieving, dosing, packaging and palletizing. Energy and fuel consumption are considered in full based on 1-year consumption data provided by the manufacturer.

Module C1: Deconstruction/Demolition of the building

Module C1 describes the process of removal of tile adhesives in the context of pavement/flooring replacement. Data is assembled based on the developed scenario.

BAUMIT Bulgaria manufactures and offers construction products since 1995, i.e. for 25 years, but the requirements for selective demolition and separate collection of C&DW are applicable only for 9 years and no concrete data for the end of life of the considered products – tile adhesive mortars, is available, because the service life of cladding/flooring, where the tile adhesives have been used, is considered to be longer (ca. 10 to 15 years).

The following scenario is developed, based on existing practices in Bulgaria in regards with the construction and demolition waste (C&DW) management and the requirements of the national legislation (WMA, 2012 and Ordinance on C&DW management, 2012 and 2017) for selective demolition and a material recovery degree for some C&DW, such as waste from ceramics (70%), etc.

The demolition of the tile adhesives is considered as a part of the entire cladding/flooring removal. There are no specific demolition methods, applied in Bulgaria. General purposes electric handheld Jack Hammer concrete breaker is used. The tile adhesive usually remains to tiles debris. The C&DW from the tile adhesives demolition forms waste code 17 01 03 (tiles and ceramics) or 17 01 07 (mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06), as per the European Waste Catalogue (EWC), depending on the nature of the tiles bonded by this adhesive to the substrate and the degree of demolition of the substrate.

Module C2: Transport to waste treatment facility

Module C2 refers to the transport of the C&D waste containing tile adhesives to a facility for waste recovery. Data is assembled based on developed scenario.

There are requirements for recovery degree of C&DW of code 17 01 03 (at least 70%) and no requirements to the recovery degree of C&DW of code 17 01 07. However, due to economic reasons (too expensive landfilling), 100% of that waste of the both codes is transported to a waste treatment facility for recovery operations. The C&DW of codes 17 01 03 and 17 01 07 which contains tile adhesives waste is transported to a site for recovery in a backfilling operation. If a preliminary treatment (crushing) is necessary to reduce the debris to a suitable grain size, it is done on the same site and there is no additional transportation.

The following assumptions are made to calculate the impacts of this module:

Table 2: Information on assumed transport for module C2

Parameter	Data
Waste code	17 01 03 or 17 01 07
Bulk density of waste	1600 kg/m ³
Treatment type	Recovery operations R10 or R12
Collection of waste by	Loader with bucket capacity 3,6 m ³ , tipping load 13.7 tons, operating weight 18.4 tons, Euro IV emissions class, rated power 165 kW / 224HP.
Transport of waste by	Lorry of the size class 7.5-16 tons, Euro IV emissions class.
Distance of transportation	25 km



Module C3: Waste processing

Module C3 accounts for the environmental impacts during the processing of C&DW containing tile adhesive waste at the waste recovery facility. Data is assembled based on developed scenarios.

The tile adhesive-containing waste for recovery operations is classified as ‘non-hazardous waste’ of codes 17 01 03 (when mixed to tiles only) or 17 01 07 (when mixed with debris from tiles and cements screeds from floorings or cement-based plasters from claddings).

As a preliminary treatment, only a rough crushing is applied to achieve a suitable grain size.

Table 3: Information on assumed processing for module C3

Parameter	Data	
Waste code	17 01 03	17 01 07
Treatment type	Preliminary crushing and recovery in backfilling	
Factory transport of waste and recovered material	Loader with bucket capacity 3.6 m ³ , tipping load 13.7 tons, operating weight 18.4 tons, Euro IV emissions class, rated power 165 kW / 224HP.	
Waste crushing and screening	Mobile impact crushing equipment: Feed opening 1,320 x 900 mm; Engine 310 kW / 415 HP and Weight 43 300 kg	
Distance of in-plant transportation	500 m	

Module C4: Disposal

Module C4 should consider the effects from tile adhesive containing C&DW that is disposed. In the developed scenario no disposal operations are considered.

Module D: Benefits and loads beyond the system boundary

Module D regards the effects and impact of the secondary material derived from recycling of tile adhesive containing C&D waste.

When the treated C&DW of codes 17 01 03 and 17 01 07 containing tile adhesives is used as backfilling material, it contributes to the savings of natural raw materials.

However, there is a high variety and thus, high uncertainty, regarding the development of scenarios for Module D, which makes it difficult to model and calculate. The positive impacts associated to the recovery of tile adhesives waste are neglected and the impacts related to module D are considered zero.



6. LCA Results

Declared unit

The declaration refers to 1 ton of tile adhesive dry mix.

Table 4: Description of the system boundary

Environmental assessment information (☒ – Included in LCA, MNA – Module not assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction – assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/ demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential
☒	☒	☒	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	☒	☒	☒	☒	☒

The following tables provide the LCA results on the evaluated environmental categories. A list of the used abbreviations is given below:

- GWP-total Global warming potential total (sum of GWP-fossil, GWP-biogenic and GWP-luluc)
- 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 Ozone depletion potential
- AP Acidification potential
- EP-freshwater Eutrophication potential, fraction of nutrients reaching freshwater end compartment
- EP-marine Eutrophication potential, fraction of nutrients reaching marine end compartment
- EP-terrestrial Eutrophication potential, Accumulated Exceedance
- POCP Photochemical ozone creation potential
- ADP-minerals & metals Abiotic depletion potential for non-fossil resources
- ADP-fossil fuels Abiotic depletion potential of fossil resources
- RPER Renewable primary energy resources
- NRPER Non-renewable primary energy resources
- ETP-fw Eco-toxicity freshwater (Potential Comparative Toxic Unit for ecosystems)
- HTP-c Human toxicity, cancer effects (Potential Comparative Toxic Unit for humans)
- HTP-nc Human toxicity, non-cancer effects (Potential Comparative Toxic Unit for humans)
- IRP Ionizing radiation, human health (Potential Human exposure efficiency relative to U-235)
- SQP Land use related impacts/ Soil quality (Potential soil quality index)
- PM Particulate Matter emissions (Potential incidence of disease due to PM emissions)



Table 5: Environmental information about 1 ton Baumacol Basic tile adhesive dry mix

Environmental impacts for 1 ton Baumacol Basic									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
GWP-total	kg CO ₂ -eq.	2.78E+02	8.88E+00	2.44E+01	1.50E+01	7.81E+00	2.79E+00	0.00E+00	0.00E+00
GWP-fossil	kg CO ₂ -eq.	2.76E+02	8.88E+00	2.43E+01	1.50E+01	7.81E+00	2.78E+00	0.00E+00	0.00E+00
GWP-biogenic	kg CO ₂ -eq.	2.10E+00	0.00E+00	1.84E-02	1.07E-02	0.00E+00	1.77E-03	0.00E+00	0.00E+00
GWP-luluc	kg CO ₂ -eq.	3.71E-03	7.09E-05	1.86E-05	1.46E-05	5.73E-05	8.08E-06	0.00E+00	0.00E+00
ODP	kg CFC 11-eq.	1.13E-05	2.06E-06	1.15E-06	7.15E-07	1.72E-06	5.56E-07	0.00E+00	0.00E+00
AP	mol H ⁺ -eq.	6.74E-01	2.07E-02	1.72E-01	1.08E-01	1.69E-02	5.90E-03	0.00E+00	0.00E+00
EP-freshwater	kg PO ₄ -eq.	3.37E-02	6.50E-04	5.47E-02	3.36E-02	5.50E-04	3.90E-04	0.00E+00	0.00E+00
EP-marine	kg N-eq.	1.71E-01	2.90E-03	2.54E-02	1.57E-02	2.31E-03	8.50E-04	0.00E+00	0.00E+00
EP-terrestrial	mol N-eq.	1.94E+00	3.09E-02	1.52E-01	9.49E-02	2.45E-02	8.70E-03	0.00E+00	0.00E+00
POCP	kg NMVOC-eq.	4.86E-01	1.62E-02	4.50E-02	2.82E-02	1.23E-02	4.06E-03	0.00E+00	0.00E+00
ADP-minerals&metals	kg Sb-eq.	1.27E-03	2.00E-04	6.64E-05	8.96E-05	2.00E-04	4.82E-06	0.00E+00	0.00E+00
ADP-fossil	MJ	1.34E+03	1.35E+02	3.81E+02	2.34E+02	1.12E+02	3.81E+01	0.00E+00	0.00E+00
WDP	m ³	5.56E+03	1.18E+02	5.35E+03	3.25E+03	1.03E+02	1.00E+02	0.00E+00	0.00E+00

Additional environmental impacts for 1 ton Baumacol Basic									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
ETP-fw	CTUe	1.25E+01	5.11E+00	1.25E+00	1.65E+00	2.47E+00	2.21E-01	0.00E+00	0.00E+00
HTP-c	CTUh	4.23E-08	2.65E-09	7.49E-09	5.77E-09	3.47E-09	1.74E-09	0.00E+00	0.00E+00
HTP-nc	CTUh	3.41E-06	1.70E-07	1.44E-06	9.67E-07	1.29E-07	3.53E-08	0.00E+00	0.00E+00
IRP	kBq U-235-eq.	1.25E+01	7.00E-01	1.19E+01	7.23E+00	5.78E-01	3.20E-01	0.00E+00	0.00E+00
SQP	-	1.62E+03	1.87E+02	2.45E+01	1.66E+01	6.94E+01	4.64E+00	0.00E+00	0.00E+00
PM	Disease incidence	4.00E-06	6.74E-07	2.75E-07	1.87E-07	4.25E-07	1.23E-07	0.00E+00	0.00E+00

Resource use for 1 ton Baumacol Basic									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
RPER excluding RPER used as raw materials	MJ	6.68E+01	1.83E+00	2.93E+01	2.41E+01	1.54E+00	1.24E+00	0.00E+00	0.00E+00
RPER used as raw materials	MJ	1.01E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.68E+02	1.83E+00	2.93E+01	2.41E+01	1.54E+00	1.24E+00	0.00E+00	0.00E+00
NRPER excluding NRPER used as raw materials	MJ	1.53E+03	1.37E+02	5.88E+02	3.60E+02	1.15E+02	4.12E+01	0.00E+00	0.00E+00
NRPER used as raw materials	MJ	0.00E+00	1.00E+00	2.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	1.53E+03	1.38E+02	5.90E+02	3.60E+02	1.15E+02	4.12E+01	0.00E+00	0.00E+00
Use of secondary material	kg	3.56E+00	5.12E-02	4.10E-02	2.99E-02	5.59E-02	2.17E-02	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	5.67E+00	6.47E-02	1.19E+00	7.28E-01	5.36E-02	9.49E-02	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	7.47E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m ³	8.36E-01	9.79E-03	1.69E-01	1.05E-01	7.75E-03	6.09E-03	0.00E+00	0.00E+00



Output flows and waste categories for 1 ton Baumacol Basic									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	4.93E+00	1.36E-01	3.13E-01	2.14E-01	1.31E-01	5.89E-02	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	1.63E+02	1.20E+01	0.00E+00	1.63E+02	5.62E+00	1.85E+00	0.00E+00	0.00E+00
Radioactive waste disposed	kg	6.31E-03	9.40E-04	2.95E-03	1.79E-03	7.80E-04	2.80E-04	0.00E+00	0.00E+00
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	2.89E+00	4.33E-02	1.84E+01	1.67E-02	4.83E-02	1.97E-02	0.00E+00	0.00E+00
Materials for energy recovery	kg	6.21E-02	7.10E-04	1.17E-02	7.19E-03	6.00E-04	9.40E-04	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Biogenic carbon content	Unit	
Biogenic carbon content in product	kg C	1.17E+00
Biogenic carbon content in accompanying packaging	kg C	3.04E+00



Table 6: Environmental information about 1 ton FlexUni tile adhesive dry mix

Environmental impacts for 1 ton FlexUni									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
GWP-total	kg CO ₂ -eq.	4.16E+02	1.63E+01	2.26E+01	1.50E+01	7.81E+00	2.79E+00	0.00E+00	0.00E+00
GWP-fossil	kg CO ₂ -eq.	4.14E+02	1.63E+01	2.26E+01	1.50E+01	7.81E+00	2.78E+00	0.00E+00	0.00E+00
GWP-biogenic	kg CO ₂ -eq.	2.30E+00	0.00E+00	1.70E-02	1.07E-02	0.00E+00	1.77E-03	0.00E+00	0.00E+00
GWP-luluc	kg CO ₂ -eq.	4.21E-03	1.30E-04	1.73E-05	1.46E-05	5.73E-05	8.08E-06	0.00E+00	0.00E+00
ODP	kg CFC 11-eq.	1.86E-05	3.62E-06	1.07E-06	7.15E-07	1.72E-06	5.56E-07	0.00E+00	0.00E+00
AP	mol H ⁺ -eq.	1.08E+00	6.91E-02	1.60E-01	1.08E-01	1.69E-02	5.90E-03	0.00E+00	0.00E+00
EP-freshwater	kg PO ₄ -eq.	5.55E-02	1.34E-03	5.08E-02	3.36E-02	5.50E-04	3.90E-04	0.00E+00	0.00E+00
EP-marine	kg N-eq.	2.54E-01	2.13E-02	2.36E-02	1.57E-02	2.31E-03	8.50E-04	0.00E+00	0.00E+00
EP-terrestrial	mol N-eq.	2.83E+00	2.32E-01	1.41E-01	9.49E-02	2.45E-02	8.70E-03	0.00E+00	0.00E+00
POCP	kg NMVOC-eq.	7.83E-01	6.93E-02	4.18E-02	2.82E-02	1.23E-02	4.06E-03	0.00E+00	0.00E+00
ADP-minerals&metals	kg Sb-eq.	2.34E-03	4.00E-04	6.17E-05	8.96E-05	2.00E-04	4.82E-06	0.00E+00	0.00E+00
ADP-fossil	MJ	3.61E+03	2.45E+02	3.54E+02	2.34E+02	1.12E+02	3.81E+01	0.00E+00	0.00E+00
WDP	m ³	9.39E+03	1.04E+02	4.96E+03	3.25E+03	1.03E+02	1.00E+02	0.00E+00	0.00E+00

Additional environmental impacts for 1 ton FlexUni									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
ETP-fw	CTUe	6.47E+00	8.48E+00	1.16E+00	1.65E+00	2.47E+00	2.21E-01	0.00E+00	0.00E+00
HTP-c	CTUh	1.77E-08	4.90E-09	6.96E-09	5.77E-09	3.47E-09	1.74E-09	0.00E+00	0.00E+00
HTP-nc	CTUh	1.40E-06	3.34E-07	1.33E-06	9.67E-07	1.29E-07	3.53E-08	0.00E+00	0.00E+00
IRP	kBq U-235-eq.	4.94E+00	1.16E+00	1.10E+01	7.23E+00	5.78E-01	3.20E-01	0.00E+00	0.00E+00
SQP	-	5.39E+02	2.83E+02	2.28E+01	1.66E+01	6.94E+01	4.64E+00	0.00E+00	0.00E+00
PM	Disease incidence	2.07E-06	1.20E-06	2.56E-07	1.87E-07	4.25E-07	1.23E-07	0.00E+00	0.00E+00

Resource use for 1 ton FlexUni									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
RPER excluding RPER used as raw materials	MJ	1.33E+02	2.81E+00	2.72E+01	2.41E+01	1.54E+00	1.24E+00	0.00E+00	0.00E+00
RPER used as raw materials	MJ	1.26E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	2.59E+02	2.81E+00	2.72E+01	2.41E+01	1.54E+00	1.24E+00	0.00E+00	0.00E+00
NRPER excluding NRPER used as raw materials	MJ	3.95E+03	2.49E+02	5.48E+02	3.60E+02	1.15E+02	4.12E+01	0.00E+00	0.00E+00
NRPER used as raw materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.95E+03	2.49E+02	5.48E+02	3.60E+02	1.15E+02	4.12E+01	0.00E+00	0.00E+00
Use of secondary material	kg	4.02E+00	9.34E-02	3.81E-02	2.99E-02	5.59E-02	2.17E-02	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	9.39E+00	6.59E-02	1.11E+00	7.28E-01	5.36E-02	9.49E-02	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	1.35E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m ³	2.49E+00	1.33E-02	1.57E-01	1.05E-01	7.75E-03	6.09E-03	0.00E+00	0.00E+00



Output flows and waste categories for 1 ton FlexUni									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	8.05E+00	3.01E-01	2.90E-01	2.14E-01	1.31E-01	5.89E-02	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	2.68E+02	1.98E+01	0.00E+00	1.63E+02	5.62E+00	1.85E+00	0.00E+00	0.00E+00
Radioactive waste disposed	kg	1.02E-02	1.64E-03	2.74E-03	1.79E-03	7.80E-04	2.80E-04	0.00E+00	0.00E+00
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	3.15E+00	7.86E-02	1.84E+01	1.67E-02	4.83E-02	1.97E-02	0.00E+00	0.00E+00
Materials for energy recovery	kg	1.07E-01	8.10E-04	1.09E-02	7.19E-03	6.00E-04	9.40E-04	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Biogenic carbon content	Unit	
Biogenic carbon content in product	kg C	1.56E+00
Biogenic carbon content in accompanying packaging	kg C	3.05E+01



Table 7: Environmental information about 1 ton FlexMarmor Medio tile adhesive dry mix

Environmental impacts for 1 ton FlexMarmor Medio									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
GWP-total	kg CO ₂ -eq.	4.72E+02	4.36E+01	2.22E+01	1.50E+01	7.81E+00	2.79E+00	0.00E+00	0.00E+00
GWP-fossil	kg CO ₂ -eq.	4.70E+02	4.36E+01	2.22E+01	1.50E+01	7.81E+00	2.78E+00	0.00E+00	0.00E+00
GWP-biogenic	kg CO ₂ -eq.	1.89E+00	0.00E+00	1.67E-02	1.07E-02	0.00E+00	1.77E-03	0.00E+00	0.00E+00
GWP-luluc	kg CO ₂ -eq.	4.47E-03	3.40E-04	1.70E-05	1.46E-05	5.73E-05	8.08E-06	0.00E+00	0.00E+00
ODP	kg CFC 11-eq.	2.16E-05	9.59E-06	1.05E-06	7.15E-07	1.72E-06	5.56E-07	0.00E+00	0.00E+00
AP	mol H ⁺ -eq.	1.28E+00	2.00E-01	1.57E-01	1.08E-01	1.69E-02	5.90E-03	0.00E+00	0.00E+00
EP-freshwater	kg PO ₄ -eq.	6.61E-02	3.66E-03	4.99E-02	3.36E-02	5.50E-04	3.90E-04	0.00E+00	0.00E+00
EP-marine	kg N-eq.	2.92E-01	6.47E-02	2.32E-02	1.57E-02	2.31E-03	8.50E-04	0.00E+00	0.00E+00
EP-terrestrial	mol N-eq.	3.23E+00	7.05E-01	1.39E-01	9.49E-02	2.45E-02	8.70E-03	0.00E+00	0.00E+00
POCP	kg NMVOC-eq.	9.51E-01	2.04E-01	4.10E-02	2.82E-02	1.23E-02	4.06E-03	0.00E+00	0.00E+00
ADP-minerals&metals	kg Sb-eq.	3.00E-03	1.12E-03	6.05E-05	8.96E-05	2.00E-04	4.82E-06	0.00E+00	0.00E+00
ADP-fossil	MJ	5.41E+03	6.54E+02	3.48E+02	2.34E+02	1.12E+02	3.81E+01	0.00E+00	0.00E+00
WDP	m ³	1.11E+04	2.33E+02	4.87E+03	3.25E+03	1.03E+02	1.00E+02	0.00E+00	0.00E+00

Additional environmental impacts for 1 ton FlexMarmor Medio									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
ETP-fw	CTUe	4.81E+01	2.16E+01	1.14E+00	1.65E+00	2.47E+00	2.21E-01	0.00E+00	0.00E+00
HTP-c	CTUh	7.99E-08	1.33E-08	6.83E-09	5.77E-09	3.47E-09	1.74E-09	0.00E+00	0.00E+00
HTP-nc	CTUh	6.92E-06	9.09E-07	1.31E-06	9.67E-07	1.29E-07	3.53E-08	0.00E+00	0.00E+00
IRP	kBq U-235-eq.	2.47E+01	3.05E+00	1.08E+01	7.23E+00	5.78E-01	3.20E-01	0.00E+00	0.00E+00
SQP	-	2.62E+03	6.76E+02	2.24E+01	1.66E+01	6.94E+01	4.64E+00	0.00E+00	0.00E+00
PM	Disease incidence	8.32E-06	3.12E-06	2.51E-07	1.87E-07	4.25E-07	1.23E-07	0.00E+00	0.00E+00

Resource use for 1 ton FlexMarmor Medio									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
RPER excluding RPER used as raw materials	MJ	1.68E+02	7.33E+00	2.67E+01	2.41E+01	1.54E+00	1.24E+00	0.00E+00	0.00E+00
RPER used as raw materials	MJ	1.38E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	3.06E+02	7.33E+00	2.67E+01	2.41E+01	1.54E+00	1.24E+00	0.00E+00	0.00E+00
NRPER excluding NRPER used as raw materials	MJ	5.84E+03	6.62E+02	5.38E+02	3.60E+02	1.15E+02	4.12E+01	0.00E+00	0.00E+00
NRPER used as raw materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	5.84E+03	6.62E+02	5.38E+02	3.60E+02	1.15E+02	4.12E+01	0.00E+00	0.00E+00
Use of secondary material	kg	4.37E+00	2.53E-01	3.74E-02	2.99E-02	5.59E-02	2.17E-02	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	1.10E+01	1.54E-01	1.09E+00	7.28E-01	5.36E-02	9.49E-02	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	1.51E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m ³	3.40E+00	3.31E-02	1.54E-01	1.05E-01	7.75E-03	6.09E-03	0.00E+00	0.00E+00



Output flows and waste categories for 1 ton FlexMarmor Medio									
Indicator	Unit	A1	A2	A3	C1	C2	C3	C4	D
Hazardous waste disposed	kg	9.62E+00	8.32E-01	2.85E-01	2.14E-01	1.31E-01	5.89E-02	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	3.19E+02	4.92E+01	0.00E+00	1.63E+02	5.62E+00	1.85E+00	0.00E+00	0.00E+00
Radioactive waste disposed	kg	1.17E-02	4.32E-03	2.69E-03	1.79E-03	7.80E-04	2.80E-04	0.00E+00	0.00E+00
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	3.35E+00	2.12E-01	1.84E+01	1.67E-02	4.83E-02	1.97E-02	0.00E+00	0.00E+00
Materials for energy recovery	kg	1.31E-01	1.95E-03	1.07E-02	7.19E-03	6.00E-04	9.40E-04	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Biogenic carbon content	Unit	
Biogenic carbon content in product	kg C	1.76E+00
Biogenic carbon content in accompanying packaging	kg C	3.05E+01

7. Interpretation

Figure 5 illustrates the shares of product stage modules A1, A2, A3 and end-of-life stage (modules C1-C4) in some environmental impacts of Baumacol Basic, FlexUni and FlexMarmor Medio. It can be concluded that the primary share on most indicators is formed by the acquisition of raw materials and pre-products (module A1). Their transport to manufacturer’s site (module A2) is of smaller significance and has more distinctive impacts on ODP and ADPE indicators. The production process (module A3) and related use of machines powered by electricity and fuels also forms relatively small contributions on most indicators.

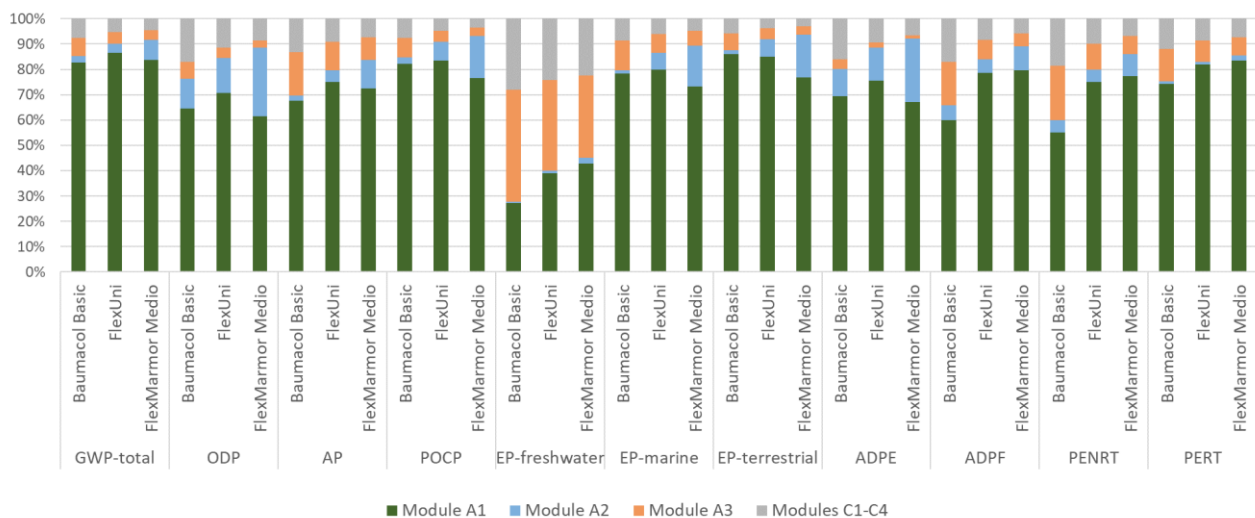


Figure 5: Shares of product stage modules A1, A2, A3 and end-of-life stage (modules C1-C4) in some environmental impacts of Baumacol Basic and, FlexUni and FlexMarmor Medio



The environmental impacts for the end of life stage (modules C1-C4) arise from the operation of machines necessary for the processing of tile adhesives waste from tile adhesives. These operations include collecting and loading of waste, transport to treatment facility, etc. Since the impacts from machines operation arise mainly from the use of fuels, the indicators of importance are the ozone depletion potential (ODP), abiotic depletion potentials for mineral and fossil resources (ADPE and ADPF), the use of non-renewable resources (PENRT) and the carbon footprint (GWP-total).

8. EPD verification

The process of verification of an EPD is in accordance with ISO 14025, clause 8.1.3 and ISO 21930, clause 9. After verification, this EPD is valid for a 5 years period. EPD does not have to be recalculated after 5 years if the underlying data has not changed significantly.

CEN standard EN 15804 serves as the core PCR along with ITB PCR A	
Independent verification corresponding to ISO 14025 (subclause 8.1.3)	
<input checked="" type="checkbox"/> external	<input type="checkbox"/> internal
Verification of EPD: PhD Eng. Halina Prejzner, PhD Eng. Justyna Tomaszewska	
LCI audit and input data verification: PhD Eng. Roumiana Zaharieva, PhD Eng. Yana Kancheva, PhD Eng. Justyna Tomaszewska	
LCA auditor: PhD Eng. Roumiana Zaharieva, PhD Eng. Yana Kancheva	
Verification of procedures and declaration: PhD Eng. Justyna Tomaszewska	

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