



Deliverable n° D3.1

Green worktops Type 1 test report and pictures

Summary:

One of LIFE GREEN COMPOSITE's objectives is the development of new panels for worktops from recycling of DELTA's sink waste mixed with other composite material waste, such as fiberglass and rigid foam waste. The project foresees the development by GEES RECYCLING of three types of new panels made from more than 90 % recycled materials.

The development of the first type of panel, called "green worktop Type 1", achieved positive results as evidenced by the tests conducted and herewith reported.

The production trials and related evaluation tests are documented by a photo report.

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Project acronym:	LIFE21-ENV-IT-LIFE GREEN COMPOSITE
Project title:	Greening kitchen sinks and worktops: exploiting industrial symbiosis to produce acrylic mineral composites from recycled and tracked production waste in a replicable circular value chain
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Call identifier:	LIFE-2021-SAP-ENV
Start date of the project:	01/08/2022
Duration:	36 months
Website:	EU Funding & Tender Portal



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Table of content

1. Executive summary	3
2. Introduction.....	3
3. Preparatory operations	4
4. Type of worktops to be developed	4
4.1 Green worktops Type 1.....	5
4.1.1 Production trials and evaluation	6
4.1.2 Test report: Mechanical performances from CATAS laboratory testing report	9
4.1.3 Test report: Resistance to stains, chemicals and cleaning products	12
4.1.4 Photographic test report	19
4.1.5 Report of CNC Cutting cutting and milling of the Type 1 Panels	24
5. Conclusions.....	26

1. Executive summary

One of the goals of LIFE GREEN COMPOSITE is the development of new kitchen worktops that, besides other recycled waste materials, contain recycled sink waste produced in the manufacturing process of DELTA, to obtain specific performance characteristics.

GEES' strategy aims to strengthen the circular economy at the heart of its production, through the industrial symbiosis initiated with DELTA, focusing on the following objectives:

- ♣ Create recycling routes for Delta sink waste not reusable by Delta itself and for other solid surfaces materials
- ♣ Create new kitchen worktops from circular economy and recycling instead of using non-renewable resources
- ♣ Introduce 'green resins' for the production of solid colour panels

Expected results are: finished products like kitchen worktops, panels and other furniture components.

To achieve these results, GEES is developing and testing different recipes and techniques to produce three new types of panels, obtained with >90% recycled materials, suitable for kitchen countertops and other applications in the furniture sector.

The first type of panel under development is the so called "green worktops Type 1". For this type, the production and evaluation tests carried out so far have yielded positive results and made it possible to confirm the hypothesized recipe.

This document reports on the results of production trials and evaluation tests for the production of these green worktops Type 1.

It provides firstly a description of the preparatory activities which underpin the new production. Secondly, it provides a description of the three types of innovative panels envisaged in the project. Finally, it reports the results of the production and evaluation tests of the green worktops Type 1 panels, illustrated by pictures of the finished products.

2. Introduction

Recycling of composites is to date a complicated process, and this applies even more for mineral-filled composite. It is impossible to separate the organic part from the inorganic part, as they are chemically bound to achieve the highest mechanical properties.

At the same time, the use of recycled materials in the manufacturing of acrylic mineral composites is still limited, due to the complex processing techniques, that are very dependent on extremely pure materials.

In Europe, about 1,5 Million kitchen sinks are yearly produced in this material, showing an increasing appreciation by consumers due to their particular properties.

About 17 % of the overall production constitutes waste: considering an average weight of 14 kg per sink, this implies that in Europe yearly 21.000 ton of raw materials are used for the production of these kitchen sinks,

producing an amount of waste of about 3.654 ton. These scraps and refuses are for about 98 % landfilled as special industrial waste (cod. CER 070213 plastic waste), consisting in mineral waste heavily polluted by polymers.

LIFE GREEN COMPOSITE aims to reduce such industrial waste by demonstrating on a pilot and industrial scale circular solutions for the reuse of acrylic mineral composite waste and the production of such composites from secondary raw materials. The basic idea pursued by GEES in partnership with DELTA is to create a pathway to utilize composite sink waste, while improving the quality of the worktops and panels already produced by GEES with other waste materials.

3. Preparatory operations

To be able to proceed with production trials of the new panels incorporating DELTA's waste (ref. Task 3.1), GEES had to develop and install the following equipment:

- Separate and specific feeding silo, to store the sink waste granulate, suitable for the containment of high density material and dust.
- Feeding , dosing and mixing equipment to work in parallel with existing ones, special care was given to PMMA/MMA eventual emissions
- New distributor for mould filling, conceived to be able to lay thin layers of sink waste granulate, and in conjunction with the existing machinery to make multilayer panels
- New moulds, with special adapters to obtain the near-finished kitchen top with the rounded / chamfered edges, seeking to reduce the finishing operations, their impacts and costs

GEES completed these operations during 2022, the installed equipment and start-up trials confirmed that their functioning was conform the requirements and expectations and results are confirming expectations.

4. Type of worktops to be developed

GEES RECYCLING is using its proprietary technology to test new mixtures of very different raw materials, developing new recycled composites with specific performance and characteristics such as low density, water resistance, impact and stain resistance, UV behavior and antibacterial qualities by mixing additives or active components.

In the context of LIFE GREEN COMPOSITE, three types of panels are planned for production, all three consisting of secondary raw materials >90%, sourced through a circular supply chain, but with different Delta sink waste contents:

- Type 1: Grained panel, Monolayer: composed of 70% Delta sink waste (0,6-6 mm), 25% various polysterenes and fibreglass waste from wind turbine blades, 5% polyurethane resin; Representing top quality product, with high density, that can be milled and worked as a natural stone, with possibility of having much thicker slabs respect actual products.
- Type 2: Solid colour panel, Multilayer: composed of a visible layer (20%) and an invisible layer (80%). The visible layer will have the similar composition as the grained panel but will be coated with 100% recycled

material (DELTA dispersion) The 100% recovery resin is from Delta, that is studied for the new applications for GEES Medium quality product –(reduced density)

- Type 3: Solid colour panel Multilayer: composed of a visible layer (20%) and an invisible layer (80%). The invisible layer consists of 95% various light composites and core material scraps, glass fibre and PVC; 5% polyurethane resin Resulting in a Lower quality slab with low density. Outer surface in sink waste composite/dispersion and inner core in recycled low-density rigid foam, to be placed on markets that are currently dominated by wood-particle laminates

The first type of panel, referred to as the Type 1 worktop, was subjected to the production tests and related evaluations shown below.

4.1 Green worktops Type 1

The first panel the production of which was tested by GEES in the framework of WP3 (Task 3.2) is the coarse-grained panel monolayer, referred to as ‘Type 1 worktop’, the composition of which was assumed during the proposal phase based on previous pilot tests as shown in Table 1 below.

GRAINED PANEL MONOLAYER (TYPE 1)	70%	DELTA sink waste
	25%	Various polyester + glass fiber waste from wind turbine blades
	5%	Polyurethane resin

Table 1. Green worktops Type 1 - composition.

As with all waste we recycle, DELTA sink scraps are tested according to the law to be declared as non-hazardous, and tracked within our system to follow the recycling process from waste arrival to granulation to the final product.

The waste component derived from sinks for Type 1 worktop (70%) is obtained from mechanical granulation of defective sinks and waste parts, resulting in:

70 % Sink waste, of which:

- 40 % Shredded sinks
- 30% Dust and powder

Following pictures show the source materials and the different stages of the secondary raw materials.



(a) Waste sinks

(b) Sink fragments

(c) Granulated sinks

(d) Dust and powder

The complementary waste component derived from other industrial waste (25%) for the production of green worktops Type 1 is in part derived from industrial fiberglass waste, in part from rigid foam waste:

25% Other composite waste, of which:

- ≈17 % Fiberglass from various industrial productions and windmill blades
- ≈ 8 % low density rigid foam



(e) Fiberglass from industrial waste and windmill blades

(f) low density rigid foam

The hypothesized composition was confirmed by the production trials and subsequent test results. After some refinements, the production test results for single-layer coarse-grained panels are very satisfactory.

4.1.1 Production trials and evaluation

GEES conducted a few production trials for the transformation of waste mixtures into rigid panels and tested the materials obtained to evaluate the results.

- 5 different production trials were carried out:

Deliverable D3.1: Green worktops Type 1 test report and pictures

- 101.22 October 2022 lot # 206 – Thickness 20 mm D. 1243
- 101.29 January 2023 lot # 211 – Thickness 20 mm D. 1055
- 102.05 March 2023 lot # 222 – Thickness 18 mm D. 1673
- 103.12 July 2023 lot # 229 – Thickness 22 mm D. 1162
- 104.45 October 2023 lot # 265 – Thickness 24 mm D. 1135

All the materials produced were then tested to evaluate the results according to a standard procedure:

1. Density calculation and verification of average deviation – tools : scale and calibre
2. Planarity verification- tools: rectified planarity bench , calibre
3. Surface roughness and porosity – tools : magnifying lens

Where results were not satisfactory, trials were repeated, varying the heating curve of the mould, casting time and hardening and full polymerisation time.

Test results are reported here following:

- 101.22 October 2022 lot # 206 – Thickness 20 mm D. 1243
 - Density average : 1243 , lowest 1155 highest 1360 result out of tolerances
 - Planarity : Good : < 3 mm over 2500 mm lengthwise . < 2 mm broadwise
 - Surface roughness : Good , no evident porosity
- 101.29 January 2023 lot # 211 – Thickness 20 mm D. 1055
 - Density average : 1055 , lowest 1001 highest 1260 result out of tolerances
 - Planarity : bad : > 5mm over 2500 mm lengthwise . > 3,5 mm broadwise
 - Surface roughness : bad, evident porosity
- 102.05 March 2023 lot # 222 – Thickness 18 mm D. 1673
 - Density average : 1673 , lowest 1295 highest 1695 result out of tolerances
 - Planarity : Good : < 3 mm over 2500 mm lengthwise . < 2 mm broadwise
 - Surface roughness : Good , no evident porosity
- 103.12 July 2023 lot 229 – Thickness 22 mm D. 1162
 - Density average : 1162 , lowest 1010 highest 1210 result in tolerances
 - Planarity : Good : < 3 mm over 2500 mm lengthwise . < 2 mm broadwise
 - Surface roughness : Good , no evident porosity, bad Edge consistency
- 104.45 October 2023 lot 265– Thickness 24 mm D. 1135
 - Density average : 1135 , lowest 1015 highest 1156 result in tolerances
 - Planarity : Very Good : < 1,5 mm over 2500 mm lengthwise . < 1 mm broadwise
 - Surface roughness : very Good , no evident porosity , natural hydrophoby

The panel produced by last production trial (test 104.45) gave the best result according to the standard evaluation above described and was therefore subjected to a more comprehensive evaluation through additional tests.

The 104.45 Production was done in different thickness , for getting ready-to-market panels in standard industrial size

Thickness mm	Lenght	Width	Application	Quality control
28	2500	1250	Kitchentops	Very good
22	2500	1250	Showertrays	Very Good
15	2500	1250	Furniture parts	Very good

Further investigation were carried out to verify the requirements for its usability as kitchen worktop. In particular, tests were conducted to verify hydrophobic behaviour and flame resistance, which are essential qualities for these products.

With regard to the panel behaviour in contact with water, an important characteristic was observed: hydrophobic behaviour is already present in the uncoated and untreated panels (see picture 5 in §4.1.2). On this basis, it is credible that this recipe can guarantee good impermeability and hydrophobicity over the entire mass of the material.

The panel was then subjected to a flame test; results were comforting since no flame propagation, low smoke and no droplets were observed. A strong self-extinguishment capacity was noted, which led us to perform official flame behaviour tests following EN 13501 FL. (see picture 7 in §4.1.2) . During the test the panel seemed to develop a kind of incandescence, probably due to the quartz content. The back side of the panel remained totally intact and the weight loss was less than 2,5%, confirming excellent flame resistance.

Another important aspect observed is the adaptability of the panel material to Computer Numerical Control milling using standard joinery woodworking machines with carbide tools, resulting in clean, fracture-free edges (see picture 8 in §4.1.2).

Life Green Production tests Composite Type 1

Test #	Period	Lot #	Thickness	Density avg	Density Max	Density min	In tolerance	Planarity	Surface	Edge
101.22	Oct 22	206	20	1243	1360	1155	No	<3	Good	Good
101.29	Jan 23	211	20	1055	1260	1155	No	>5	Bad	Bad
102.05	Mar 23	222	18	1673	1695	1295	No	<3	Good	Bad
103.12	July 23	229	22	1162	1210	1010	Yes	<3	Good	Bad
104.45	Oct 23	247	24	1135	1156	1015	Yes	<1,5	Very good	Very Good

4.1.2 Test report: Mechanical performances from CATAS laboratory testing report

Here are the test report 362777 from CATAS Laboratories , for the main mechanical characteristics, flexion, compression and traction



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TEST REPORT 362777 / 1

Revision: 0
Date of sample receipt: 29/12/23
Date of test: 18/01/24
Date of issue: 23/01/24

Sample name: Pannello Life Green Composite.

GEES RECYCLING S.R.L.
VIA MONTE COLOMBERA 22
33081 AVIANO (PN)
ITALIA

Plastics - Flexural properties UNI EN ISO 178:2019

Sample description: Not declared
Test method: A (one speed of testing)
Nominal thickness: 21 mm
Support span: 336 mm
Specimen preparation: Performed by the customer
Test direction: Not identifiable Specimen shape: Parallelepiped
Conditioning: > 72 h (23±2 °C and 50±5% r.h.) Testing temperature: 20±5°C
Testing equipment: Instron dynamometer mod. 5585 Test speed: 5 mm/min
Tested surface: Not identifiable

Risultati della prova:

Specimen n°	Width mm	Thickness mm	Maximum load N	Flexural strength MPa	Modulus of elasticity MPa
1	19,7	21,33	169	9,5	3.105
2	19,2	21,04	161	9,5	2.864
3	19,8	21,33	210	11,7	3.345
4	20,3	21,04	138	7,7	2.911
5	19,1	21,34	163	9,4	3.437
6	20,4	21,34	208	11,3	3.400
7	19,6	21,04	130	7,6	2.476
Mean Value				9,5	3.077
Standard deviation				1,6	351

Notes:

- Test ref. declared by the customer: Progetto 101074703-LIFE21-ENV-IT LIFE GREEN COMPOSITE
- Chemical analysis of the tested material has not been carried out.
- The company who asked for the test has collected and sampled the specimens.

This test report is part of a PDF file digitally signed by Franco Bullian.

The managing director
Dr. Franco Bullian



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TEST REPORT 362777 / 2

Revision: 0
Date of sample receipt: 29/12/23
Date of test: 17/01/24
Date of issue: 23/01/24

GEES RECYCLING S.R.L.
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Sample name: Pannello Life Green Composite.

Plastics - Compressive strength UNI EN ISO 604:2008

Sample description declared: Not declared
Specimen shape and load direction: Parallelepiped and a compressive load is applied on the specimen surface
Nominal thickness: 21 mm
Conditioning: > 72h (23±2 °C and 50±5 % r.h.)
Test conditions: 23±2 °C and 50±5 % r.h.
Test equipment: Instron dynamometer mod. 5985
Load applicators: Steel plates (Ø 150 mm)
Test speed: 2 mm/min

Test results:

Specimen n°	Width mm	Length mm	Maximum load N	Compressive strength MPa
1	20,26	19,98	13.451	33,2
2	20,44	20,04	15.270	37,3
3	20,41	20,43	15.351	36,8
4	19,92	20,11	14.573	36,4
5	20,52	19,78	15.494	38,2
6	20,32	20,12	13.847	33,9
7	19,30	19,91	12.803	33,3
8	20,49	19,32	15.074	38,1
Mean value				35,9
Standard deviation				2,1
Coeff. of var.				5,8 %

Notes:

- Test ref. declared by the customer: Progetto 101074703-LIFE21-ENV-IT LIFE GREEN COMPOSITE
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- The company who asked for the test has collected and sampled the specimens.

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TEST REPORT
362777 / 3

Revision: 0
Date of sample receipt: 29/12/23
Date of test: 19/01/24
Date of issue: 23/01/24

GEES RECYCLING S.R.L.
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ITALIA

Sample name: Pannello Life Green Composite.

Plastics - Tensile strength UNI EN ISO 527-1:2019

Type of specimen: Rectilinear
Specimens direction: Not identifiable
Test equipment: Instron dynamometer mod. 5585
Speed of testing: 5 mm/min
Extension indicator: Instron type 2620-601
Gauge length: 50 mm
Conditioning: > 72 h (23±2 °C and 50±5% r.h.)
Test room conditions: 20±5 °C

Test results:

Specimen n°	Specimen width mm	Specimen thickness mm	Maximum load N	Tensile strength at maximum load MPa	Modulus of elasticity MPa	Elongation at maximum load %
1	50,12	21,00	5.047	4,80	4.192	0,2
2	50,09	21,00	5.951	5,66	3.680	0,2
3	49,95	21,12	5.475	5,19	3.995	0,2
4	49,62	21,00	5.265	5,05	3.628	0,2
5	50,20	21,01	6.460	6,12	3.555	0,3
6	49,98	21,20	4.905	4,63	4.067	0,2
7	50,20	21,08	5.590	5,28	4.493	0,2
Mean value	50,02	21,06	5.528	5,25	3.944	0,2
Std. dev.	0,20	0,08	539	0,51	342	0,0
Coeff. of var.	0,40%	0,38%	10%	9,71%	9%	0,0%

Notes:

- Test ref. declared by the customer: Progetto 101074703-LIFE21-ENV-IT LIFE GREEN COMPOSITE
- Chemical analysis of the tested material has not been carried out.
- The company who asked for the test has collected and sampled the specimens.

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We have done a comparison between the materials on the market for kitchentops with some difficulties due to large differences in type of tests and data, probably because we find ceramic and stone products, Wood and wood-derived, High Pressure Laminates and composite Solid Surfaces.

Comparison between different kitchentops materials: Mechanical performance

Material	Compressive strenght Mpa	Flexural static strenght Mpa	Flexural dynamic strenght Mpa	Modulus of elasticity Mpa	Tensile Strenght Mpa	Modulus of elasticity Mpa	Elongation at Max load %	Specific Density
Porcelained Gres Mirage	41,4	13	0,35	NA	NA	NA	NA	2,1
MDF Laminated TOP	NA	0,2	NA	2200	0,55			0,79
LG HI-Macs Solid surface	NA	64,3	NA	7730	56,3	NA	1,1	1,65
Duopal Top HPL	NA	80	NA	9000	NA	NA	NA	1,39
Agglomerated marble	90	22	NA	NA	NA	NA	NA	2,45
Deco LGC 104.45	35,9	9,5	8,9	3077	5,25	3944	0,2	1,14

The result is positive for Life Green Composite materials

- Mechanical performance is acceptable with a good compromise between compressive and flexural strenght .
- Density is the lower of all products -bad the MDF – that has lower performances and can't be used as mass material

Results are encouraging and push for further developments , like the introduction of R-PMMA as binder or co-binder that may increase a lot the flexural performances

4.1.3 Test report: Resistance to stains, chemicals and cleaning products

The use as Kitchentop or table top material requires to have a good resistance to the events may happens like stains of any food product, liquids acids or basic and cleaning products

Two tests were done by Delta using standard procedures for kitchen sinks (higher requirements respect kitchentops) of two different versions of the “Deco LGC” as the Type 1 104.45 was branded.

Deco LGC “as is” not coated , with test result 19/2023

Deco LGC with Acryling Monocomponent Coating , test result 02/2024

Here excerpts from tests results from Delta Plados

RELAZIONE TECNICA 19/2023

Chemical resistance test

SUBSTANCE	TYPE
1. Acid acetic (CH ₃ COOH), 10% V/V	Acids
2. Sodium Hydroxide (NaOH), 5% m/m	Basis
3. Etanol (CH ₃ CH ₂ OH), 70% V/V	Alcol
4. Sodium hypochlorite (NaOCl), 5% di chlore (Cl ₂)	Whitening
5. Methylene Blue, 1% m/m	Colorant

Resistance test to house cleaning products

DETERGENTS
Lysoform
Viakal
Cif Cream
Bleach
Ammonia
Alcool
Multiuse Cleaner

Resistance test to chemicals and coloring agents

Family	Product	Valutazione e conformità			
		After rinsing with water	Cleaning with sponge and water	Cleaning with alumina and sponge >12 h	After Drying of substrate
1 - Acids	Acetic Acid (CH ₃ COOH), 10% V/V	E	E	/	B
2 - Alkali	Soda bleach (NaOH), 5% m/m	A/B	A/B	/	A/B
3 - Alcool	Etanol (C ₂ H ₅ OH), 70% V/V	E	E	/	E
4 -Bleach	Bleach (NaOCl), 5% chlore active (Cl ₂) ¹	E	E	/	E
5 - Colorantsi	Metylene Blue, 1% m/m	B	B	B	B

Salts^c	Sodium chloride (NaCl) 170g/l, diluted at 50%	E	E	/	E
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Resistance of surfaces to domestic cleaning products

	Valutazione e conformità		
Product	After rinsing with water	Cleaning with sponge and water	After Drying of substrate
1. Lysoform Bathroom Gel	E	E	C
2. Viakal	E	E	D
3. Cif cream	E	E	B
4. Bleach	E	E	C
5. Ammonia	E	E	E
6. Alcool	E	E	E
7. Multiuse (Glassex)	E	E	E

These test results show good performance also for the uncoated product , comparable with Porcelained gres – Class C , a more realistic evaluation is done with the following test result , since all materials for Kitchentops have a protective coating or laminate Surface .

RELAZIONE TECNICA 02/2024

Resistance test to chemicals and coloring agents

		Valutazione e conformità		
1 - Acids	Acetic Acid (CH ₃ COOH), 10% V/V	After rinsing with water	Cleaning with sponge and water	Cleaning with alumina and sponge >12 h
2 - Alkali	Soda bleach (NaOH), 5% m/m	E	E	/
3 - Alcool	Etanol (C ₂ H ₅ OH), 70% V/V	E	E	/

4 -Bleach	Bleach (NaOCl), 5% chlore active (Cl ₂) ²	E	E	/
5 - Colorants	Metylene Blue, 1% m/m	E	E	/
Salts^c	Sodium chlorure (NaCl) 170g/l, diluited al 50%	B	B	B
1 - Acids	Acetic Acid (CH ₃ COOH), 10% V/V	E	E	/

Resistance of surfaces to domestic cleaning products

Product	Valutazione e conformità	
	After rinsing with water	Cleaning with sponge and water
1. Lysoform Bathroom Gel	E	E
2. Viakal	E	E
3. Cif cream	E	E
4. Bleach	E	E
5. Ammonia	E	E
6. Alcool	E	E
7. Multiuse (Glassex)	E	E

Legenda of results

A. Surface deformation (NC)

B. Evident change of colour and brilliance (NC)

C. Moderate change of colour and brilliance rillantezza (NC)

D. Light change of colour and brilliance, visibile only at certain viewsights (NC)

E. No visible change (C)

Results are more than encouraging , need just to improve the resistance to coloring agents like Methylene blue , obtainable with different coatings.

Here also the Catas laboratory results on panels for kitchentops following EN 12720:2013 - Coated



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LAB N° 0827 L
Membro degli MRA EA, IAF e ILAC

TEST REPORT

363029 / 1

Revision: 0
Date of sample receipt: 29/12/23
Date of test: 16/01/24
Date of issue: 24/01/24

Sample name: Pannello Life Green Composite trattato.

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Surface resistance to cold liquids UNI EN 12720:2013

	Contact time							Description of rating:
	24 h	16 h	6 h	1 h	10 min	2 min	10 sec	
Acetic acid (10%)	-	5	-	/	-	/	-	/ not necessary - not required by the CEN/TS 16209:2022 standard
Acetone	-	-	-	-	5	-	/	5 = no change 4 = minor change (only visible under reflected light) 3 = moderate change (visible from several viewing directions) 2 = significant change in colour or gloss, slight change of structure 1 = strong change, strong change of structure
Ammonia (10%)	-	5	-	/	-	/	-	
Citric acid (10%)	-	5	-	/	-	-	-	
Cleaning solution	-	5	/	/	/	/	-	
Coffee	-	2	3	-	4	5	-	
Ethanol (48%)	-	-	5	/	-	/	-	
Mustard	-	3	4	-	-	-	-	
Paraffin oil	5	-	/	/	/	-	-	
Red wine	-	4	4	-	5	/	-	
Water	5	-	-	/	/	-	-	

Reached class
CEN/TS 16209:2022*

C

* Classification not covered by accreditation.

Notes:

- chemical analysis of the tested material has not been carried out;
- the staining agents and the contact time are according to CEN/TS 16209:2022 standard.
- Conditioning period: from 29/12/2023 to 16/01/2024.

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TEST REPORT
363029 / 2

Revision: 0
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Date of test: 22/01/24
Date of issue: 24/01/24

GEES RECYCLING S.R.L.
VIA MONTE COLOMBERA 22
33081 AVIANO (PN)
ITALIA

Sample name: Pannello Life Green Composite trattato.

Surface resistance to wet heat UNI EN 12721:2013

Test results:

Temperature °C	Rating	Remarks
55	5	No visible changes.
70	5	No visible changes.
85	5	No visible changes.
100	5	No visible changes.

Reached class
CEN/TS 16209:2022*

A+

* Classification not covered by accreditation.

Note:

- chemical analysis of the tested material has not been carried out;
- the temperatures are according to CEN/TS 16209:2022 standard.
- Conditioning period: from 29/12/2023 to 22/01/2024.

This test report is part of a PDF file digitally signed by Franco Bullan.

The managing director
Dr. Franco Bullan

Results are very good, and permit to be confident in a market-ready product

Test of effects of light exposure following EN 15187:2007



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TEST REPORT 363029 / 3		GEES RECYCLING S.R.L. VIA MONTE COLOMBERA 22 33081 AVIANO (PN) ITALIA
Revision:	0	
Date of sample receipt:	29/12/23	
Date of test:	26/01/24	
Date of issue:	31/01/24	
Sample name:	Pannello Life Green Composite trattato.	

Effects of light exposure UNI EN 15187:2007

Apparatus: Atlas C.i. 3000+ w.o.
Radiation source: Xenon arc lamp
Irradiance at 420 nm: 1,25 W/m²
Inner filter: borosilicate
Outer filter: soda-lime
Black panel temperature: 55 ± 2 °C
Irradiance determination system: automatic
Relative humidity: 50 ± 10%
Blue wool standard assessment: visual
N. of observers: 2
Test duration: until grade 4 color change of the blue wool standard n. 6 in the grey scale

Test results:

Grey scale ISO 105 A02	Remarks
4/5	///

Light fastness:

Grey scale	Blue wool standard n.
> 4	> 6

Notes:

- Chemical analysis of the tested material was not carried out.
- Conditioning period: from 29/12/2023 to 26/01/2024.
- The evaluation of the sample was performed by comparing the part exposed to the light against the reference part.

This test report is part of a PDF file digitally signed by Franco Bulian.

The managing director
Dr. Franco Bulian

Also light fastness is comparable to the best materials

4.1.4 Photographic test report

The photo report of the tests includes photos of all panels produced by the production tests (pictures 1 to 4) and of the additional tests performed on the panel produced in test 104.45 (pictures 5 to 8).

Picture 1: Test 101.22 right and Test 101.29 left



Evaluation: Good consistency and compactness for 101.22; lower density of 101.29 but too fragile and dust-prone

Picture 2: Test 102.05



Evaluation: very compact due to higher dust % in recipe, too much dense at >1,6 specific gravity

Picture 3: Test 103.12



Evaluation: low density, good aesthetical aspect, too fragile as shown from edge damage from cutting

Picture 4: Test 104.45



Evaluation: very good compactness, excellence appearance made from coarsely shredded sink waste, fiberglass and rigid foam. Recipe defined. Specific gravity: 1.16

Picture 5. Hydrophobic behaviour of test 104.45



Evaluation: hydrophobic behaviour already present in untreated and uncoated panels

Picture 6. Gloss coating test of 104.45



Evaluation: the test confirmed the possibility to obtain an high-gloss surface by coating

Picture 7. Flame behaviour tests following EN 13501 FL

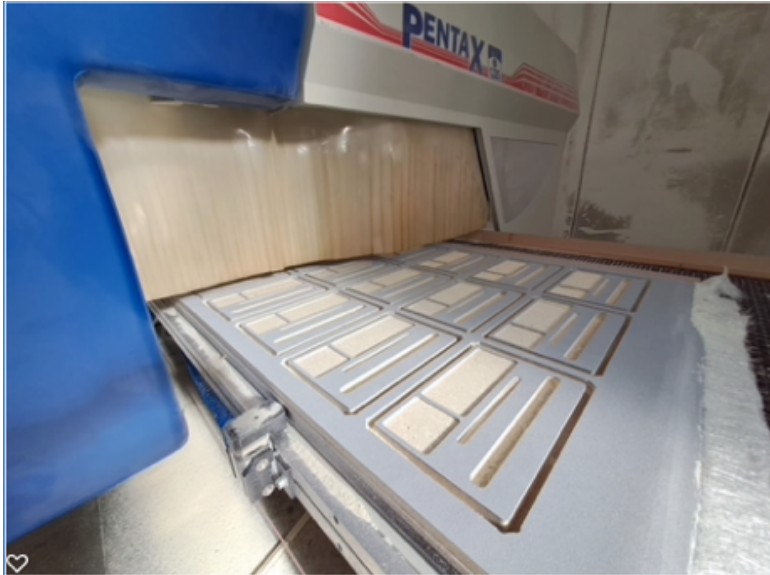


Evaluation: self-extinguishing behaviour and very good flame resistance

4.1.5 Report of CNC Cutting cutting and milling of the Type 1 Panels

Each panel made was refiled on the production line and calibrated using a double-sanding line.

We have also verified the feasibility of milling on our CMS PENTAX CNC 5-axes machining centre.



Milling was feasible and not different from our other recycled composites materials

We did also test the use of an hand-operated milling machine , of the type commonly used for on-site operations, with good results – as always with composite materials – a diamond or carbide tool is advised to get repeatable results.



5. Conclusions

Experiments and production trials have shown that the production of kitchen tops from recycling of kitchen sinks and other composite waste is feasible and achievable on the same production line of lower density recycled composites.

Once the right process recipe is found and modifications are made, material obtained is solid, compact, naturally hydrophobic, thus confirming to reach the properties required for a mass market application. Capable to be milled and cutted on CNC machines or standard with specific diamond or carbide tooling.

Another very important result of the tests described above is that the production of this new type of panels doesn't require any more energy than those made from other types of waste feedstock , so the LCA of the new material is likely to be as favorable as that of other standard Gees' products.