SANITARYWARE PRODUCTION
use of waste glass for saving energy and resources
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1. The sanitary ware production: facts, figures & challenges

The European Vitreous Sanitary ware (VSW) ceramic sector is well acknowledged at international level for its exceptional quality. The sector is characterized by a concentration of large, multinational groups, as well as by the vertical integration of highly competitive small and medium enterprises. Throughout the years, the sector has started a path toward sustainability, not only to chase cost reduction goals but also to address pragmatic efforts to control production processes efficiency and environmental performances. Particular care is always devoted to raw materials selection and to water and energy use optimization during the process, probably representing the most relevant hot spots from an environmental life cycle assessment point of view.

Environmental challenges

- Saving of virgin raw materials and transports optimization from quarries
- Energy saving during sanitary ware production processes
- Greenhouse gases emissions reduction
2. An innovative idea

SANITSER wants to contribute to the VSW ceramic sector innovation by replacing large amounts of virgin raw materials with glass cullet from urban solid waste recycling, resulting in energy intensity decrease during the production process.

Waste glass recycling from urban areas has in fact an interesting additional potential. Usually, the remaining scrap after the first industrial waste glass separation is still landfilled; thanks to an advanced separation process, SANITSER gives new life and value to this secondary material, providing an extra amount of useful glass to generate new products.
3. The SANITSER project

SANITSER is a LIFE project designed to support the European sanitary ware industry to increase efficiency while achieving a more responsible and environmentally-friendly way of operating. More in detail, the project had two main goals:

1. to introduce a significant percentage of recycled materials into the ceramic blend; thus, contributing to a urban waste reduction while lowering industry’s procurement costs;
2. to improve the environmental performances of the overall ceramic production process, through energy saving and reduction in CO₂ emissions.

Objectives

Partners

MINERALI INDUSTRIALI
produces and sales raw materials for glass, tiles, and sanitary production

GE.MI.CA.
produces ceramic glazes for ceramic industry such as vitreous china sanitary ware, fire clay shower floors, tableware of soft earthenware and porcelain

SE.TE.C.
is specialized in technologies for sanitary ware, tableware and other ceramic articles production

LIFE CYCLE ENGINEERING
provides environmental consulting services, offering professional solutions and tools for Life Cycle Assessment (LCA), eco-design, environmental communication and regulatory compliance
The vitreous sanitary ware (VSW) production typically implies the use of two different ceramic blends, for the ceramic body and for the glaze; the introduction of glass cullet in these blends reduces virgin raw materials use. The use of recycled materials in VSW formulations in place of feldspar and quartz permits to reduce the firing temperature of the ceramic body from 1250°C to 1170°C.

The firing curve obtained for the SANITSER slip is of about 17 hours, compared to the conventional 19-22 hours. A new glaze that can be used with the new slip formulation and processed with the new firing cycle was realized with a recycled content of nearly 20%.

The process

RECYCLED GLASS
The glass cullet adopted in SANITSER originates from an advanced treatment process of glass scraps discarded after the primary urban waste separation process. This glass, which is mixed with impurities, dirt and other materials, corresponds to around 200,000 tons/year, which can thus be recovered.

OTHER RAW MATERIALS
Besides glass scraps, other recycled raw materials are used to produce the SANITSER ceramic body. These include ceramic scraps, sand and minerals deriving from the recovery of historical white granite quarries. Moreover, different types of special glasses were introduced into the ceramic glaze formulation, such as boric glass and white cullet glass.
4. Project achievements

**Industrial results**

**SANITSER ceramic slip and glaze formulation**

Several laboratory tests were carried out to identify the best-performing formulations of SANITSER ceramic slip and glaze. The final SANITSER slip formulation contains more than 40% of recycled materials and the content of quartz is extremely reduced. This achievement is of the utmost importance from a social point of view, since the exposition to quartz is one of the main safety issues in this sector. The final SANITSER glaze formulation, fitting with the ceramic body, was created containing nearly 20% of recycled glass. It was realized in different colours and using also special antibacterial additives.

**Pilot Plants and Industrial tests**

Three pilot plants were realized during the project: the first for the preparation and treatment of SLG waste (assembled at Minerali Industriali), the second to develop the new glaze formulation (assembled at Ge.mi.ca) and the third to perform the whole sanitary ware production process (assembled at SETEC). After the conclusion of the internal pilot production and optimization phase, 4 ceramic manufacturers (Kerasan, Alice Ceramica, Scarabeo and Ceramica Amerina) have been involved to test SANITSER innovations at pre-industrial and industrial scale. They led to the production of about 2000 sanitary ware pieces.

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**Body and glaze composition**

**BODY**

**GLAZE**

<table>
<thead>
<tr>
<th>Recycled materials</th>
<th>Ball Clays</th>
<th>Feldspars</th>
<th>Ball Clays</th>
</tr>
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<tbody>
<tr>
<td>24%</td>
<td>24%</td>
<td>19%</td>
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<table>
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<th>Ball Clays</th>
<th>Feldspars</th>
<th>Ball Clays</th>
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<table>
<thead>
<tr>
<th>Recycled materials</th>
<th>Opacifiers</th>
<th>Quartz</th>
<th>Feldspars</th>
<th>Calcium carbonate</th>
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</thead>
<tbody>
<tr>
<td>19%</td>
<td>16%</td>
<td>29%</td>
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Economic achievements

Compared to the traditional technology, SANITSER process allows significant savings of costs related to raw materials and energy consumption.

COST SAVING
Results are referred to 1 kg of sanitary ware product

RAW MATERIALS

ENERGY CONSUMPTION

- up to -15%

- up to -10%

Social achievements

Social aspects related to the new SANITSER process are assessed throughout the Social Life Cycle Assessment (SLCA), a qualitative recognized approach along the whole life cycle based on UNEP-SETAC Guidelines.

High reduction of risk from silica exposure
Environmental achievements

Environmental benefits of SANITSER process respect to traditional technology are quantified through a Life Cycle Assessment (LCA), a scientific and internationally recognized methodology based on ISO 14040 standards.

RECYCLED MATERIALS CONTENT

Results are referred to 1 kg of sanitary ware product

TOTAL EMISSION OF CO₂ eq

Results are referred to 1 kg of sanitary ware product

ENERGY CONSUMPTION FOR FIRING

Results are referred to 1 kg of sanitary ware product

DISTANCES FOR RAW MATERIALS SUPPLY

Results are referred to 1 kg of sanitary ware product

Web based tool

During the project a web based tool was designed and developed to:

• collect quantitative data according to the Life Cycle Assessment (LCA) approach;
• calculate the main environmental indicators for evaluating the performance of the processes involved at different production level.

www.sanitser-tool.com
5. Dissemination and Networking

Targeted communication and dissemination activities were performed to raise awareness on the project's aims and outcomes.

For more information about dissemination and networking actions please visit website www.sanitser.eu.

Mid-term conference – presentation of preliminary results
6. **Partnerships**

![Collaborative image of partners](image)

- **aliceceramica**
- **KERASAN**
- **CERAMICA AMERINA**
- **SCARABEO**

Networking meeting with ECONOMICK project

7. **Further information & Contact details**

- **Project start date**: 01/07/2013
- **Project end date**: 31/03/2017
- **Project budget**: 2,3M€
- **Financial contribution requested**: 1,1M€

**Contact Details**

- **Coordinating Beneficiary**: Minerali Industriali Srl
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- **Project Website**: www.sanitser.eu

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**Scientific Articles in Sectorial Journals**

- Ceramic World Review 108/2014
- Ceramic World Review 109/2014
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