NATSTOCER Project

Sludge-free process for the production of innovative natural stone-like tiles

ecodesign | eco-innovation | circular economy | Life-Cycle assessment | production process | eco-friendly product | environmental impact

PROJECT DESCRIPTION

The NATSTOCER project made it possible to create a production plant capable of producing ceramic tiles similar to natural stone through an innovative treatment that completely modifies the traditional surface finishing phase (polishing / lapping / brushing) avoiding use of water and making it possible to apply these processes also on structured surfaces.

OBJECTIVES

The aim of the project was to create a closed circular process where the solid waste produced is reused within the production cycle, as abrasive material first and subsequently as second raw material.

Among the **results achieved** there is a significant reduction in sanding sludge production, water use and energy consumption as well as the complete recycling of the solid waste produced.

PROJECT PHASES

The project envisaged the realization of three main phases as follows:

1. Design and construction of the press loading system
2. Design and implementation of the micro-structuring and material recovery system
3. Production tests and environmental balance of the plant

More specifically, the main steps of the project focused on:

- design and construction of the press loading system through the implementation of several tests to identify which was the ideal raw material mixture. From these tests the **mixture denominated "Ecostone"** was obtained, by recycling the waste from the ceramic processing cycle;
- modification of the enamel preparation system, thus obtaining sample materials capable of offering a different resistance to wear and erosion after firing; the system was modified by making changes to the grinding system and developing an automated agitator control system capable of supplying the required colors to the various "alsing" mills;
- development of a series of trial products with different wear and erosion resistance characteristics, using the new mixtures created with the identified raw materials, and subsequently performance of dry abrasion checks. After the necessary changes to the single systems, new products have been created with characteristics like those of natural stones: the "Ecostone" mixture has met the expectations regarding the required technical characteristics.
- design and construction of the micro-structuring and material recovery system with the installation of nozzles, operating at pressure conditions of 1-7 bar, made with material more resistant than that used for traditional nozzles. Subsequently a nozzle movement driving and controlling system was designed, with possibility to be applied also to products other than nozzles;
- design of the plant for micro-finishing operations and of another plant for continuous sieving, in addition to the dimensioning and construction of the tile transport system. Tests of the systems in different configurations, abrasion tests and a large number of further tests were carried out to reach a normal production speed and to obtain an appropriate

aesthetic effect for the marketing of the developed products.

The tests carried out have allowed to arrive at the correct configuration of the entire production process and therefore to the expected final result. The technical actions and the production tests ended with the assembly of the production line and with the environmental and energy balance. During the final tests all parameters - related to energy consumption, waste production, water consumption -, necessary for a comparative analysis of LCA with the traditional system, were assessed and measured.

As had been foreseen, **the plant has brought improvements regarding some environmental indicators and benefits:**

- the production capacity of the new plant is slightly lower than that of a traditional finishing plant, but energy consumption is significantly decreased (0,51 kWh/ m2 instead of 2,28 kWh/ m2);
- the waste produced by the new plant (steel cylinders used for the micro-finishing phase) can be easily recycled in the steel industry;
- **no water is used in the new system**, while the traditional process used around 600l/ m2.

PROJECT RESULTS

The modification introduced has led to a reduction in the production capacity, from 500,000 m2/ year to 400,000 m2/ year, but allowed the achievement of several **environmental benefits**.

So, the NATSTOCER project achieved excellent results in the improvement of environmental performances, such as the **reduction of production of fine powders of more than half a ton per year compared to conventional polishing, while sanding sludge was completely eliminated (400 tons/ year).** The sintered waste was reduced by 100 tons/ year, and all corundum (aluminum oxide) normally considered waste, equal to 10 tons/ year, was recycled.

The project also made it possible to achieve other results: a more efficient use of natural resources, through the **reduction of water consumption by 390 tons/ year and the reduction of energy consumption by 688.000 kWh/ year**.

In addition, the new plant allows to obtain a product capable of replacing **natural stone**, with a possible **saving of this natural resource equal to 12.000 m3/ year**.

Also, the economic benefits obtained are more than satisfactory: savings related to the non-production of sludge and consequent no need of its transport and disposal in landfills amount to € 74,000 / year. The reduced water consumption results in a saving of 360 ??€/ year; while the savings related to energy consumption is of 80.000 €/ year is. Finally, the reduction in the solid waste production allows to save 11.400 € / year. Overall, the tested innovative system saves 165.000 € / year.

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Acronym
NATSTOCER

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