

ECODESIGN OF PACKAGING FOR INKJET INKS

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ABSTRACT

Inkjet decoration of ceramic tiles by the digital application of glazes and inks has increased exponentially in the ceramic industry thanks to its numerous advantages. Currently, most inks are sold in small containers (5 kg) to facilitate storage, transport and handling while also preserving their physical and chemical properties. However, such practices result in a significant amount of polluted plastic that is very difficult to recycle and the loss of a considerable amount of ink that remains in the empty receptacle.

The main objective behind this study was to reduce the environmental impact of these containers by applying ecodesign techniques to the ink-packaging along the entire value chain.

Several measures were applied to packaging design and to its reuse and recycling operations to increase the amount of recyclable content in packaging, enable its reuse, improve recycling techniques, and recover ink remainders.

INTRODUCTION

Inkjet decoration of ceramic tiles by digital application of glazes and inks has increased exponentially in the ceramic sector given its numerous advantages. Unlike conventional forms of application, glazes and inks for inkjet decoration need to be sold in special conditions using small receptacles (5 kg). This size facilitates their storage and transport along production lines, and the shaking by hand before they are included into the process, while also ensuring their physical and chemical properties remain stable and the suspensions do not age prematurely. However, such practices lead to over 2 million units of polluted plastic packaging (500 t) being generated every year. The recycling of this polluted plastic is highly complex and therefore uncommon, given the poor quality of the secondary material (stained recycled plastic shavings) and scarce profitability when conventional recycling techniques are used. Furthermore, current receptacle designs retain 5% of the ink after emptying, which accounts for losses of around €3.4 million.

OBJECTIVES

The main goal of the project presented here is to reduce the environmental impact of the current system of refilling inkjet machines, implement ecodesigns in ink packaging and manage its waste better, all steps aiming at the Circular Economy, i.e., enabling precious resources to remain permanently in the economy.

METHOD

The steps taken to achieve the afore-mentioned aim are:

- 1. Contextualisation of the problem:** this means analysing the present situation to identify and evaluate the different stakeholders along the value chain involved in the manufacture, use, and management of packaging and its waste, and assessing different ecodesign alternatives from a technical, sustainable and circular point of view.
- 2. Redesigning** current packaging to facilitate **transport, unloading, cleaning and filling.** To do so, different models of receptacle were defined and assessed, and the ability to drain the ink retained on the walls inside was studied using 3D printed prototypes. In addition, packaging is also being produced on an industrial scale with the aid of collaborating companies.
- 3. Design and application of recycling technologies:** adapting and optimising conventional recycling systems (crushing, washing and drying) to eliminate inks from the surface of the receptacle (recycling of used packaging) and assessing the use of innovative techniques to eliminate organic waste and odours from washed glaze and ink containers. Furthermore, the secondary material obtained with this technique is being studied to analyse its possible incorporation into new polymer compositions.

4. Assessment of circularity and sustainability. The product and the new business model are reviewed to ensure that the newly proposed solution, which implements ecodesigns at various stages of the life cycle, effectively represents an environmental improvement over the current situation.

5. Treatment of effluents and solid waste: designing and applying technologies to treat and recover liquid effluents and solid waste generated during the cleaning of the receptacles for reuse and/or recycling.

RESULTS

Although at the time this technical communication is being written up, the project has not yet been completed, to date, a number of difficulties and complications have emerged, which evidence the real problems, and thus different stakeholders in the value chain have withdrawn it during the execution of the project. However, it is possible to anticipate that the results will:

- Define a network of motivated stakeholders in the value chain involved in the manufacture, supply and application of inkjet inks and the waste they generate
- Provide redesigned containers that enable them to be reused up to 5 times and with only 2% by weight of ink retained in them after emptying, compared to the current 5%.
- Allow for damaged or non-reusable packaging to be recycled using more sustainable techniques than traditional, CO₂-intensive methods.
- Identify processes to treat the liquid effluents generated when ink receptacles are cleaned and a recycling procedure that allows the inorganic solids and heavy metals present in ink remainders to be recovered and reused in ceramic body, glaze or ink formulations.
- Produce ceramic tiles with recycled contents generated during the washing of these ink and glaze receptacles.

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