REUSE OF CERAMIC TILE WASTE IN MANUFACTURING FILTER PLATES

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In the course of the glazed ceramic tile manufacturing process, fired tile scrap is generated, which can account for 3% (by mass) of final production. This waste consists of tiles that have dimensional or aesthetic defects, which as end products have been immobilised by firing. At present, most of this waste is landfilled (between 60 and 70%), only a small part being reused (in prefabricated concrete or as chamotte).

This study is being carried out in the frame of a European project, in which it is sought to valorise fired tile scrap (chamotte) as well as wastes from different agricultural or industrial processes (olive oil solid residue and marble powder). This will be done by manufacturing low-cost ceramic membranes (filter plates), to be used in biological membrane reactors (BMRs) for urban wastewater treatment. The influence of the wastes used on the properties of the resulting filter plates (amount used, waste characteristics, waste pre-treatments used, etc.) will be evaluated on a pilot scale. In addition, a replicability study will be performed in which wastes from different important geographic areas of European ceramic tile manufacture (Italy and Turkey) will be used.

The first experimental results on a laboratory scale have yielded waste-bearing ceramic membranes consisting of a substrate and several selective layers (Fig. 1). The fired tile scrap was used both in the composition of the substrate, made by extrusion, and in the selective layers obtained by engobing. The amount of chamotte used in each part of the product matched the product's required end properties, the largest possible quantity (between 15 and 30% by weight) being introduced into the respective compositions.

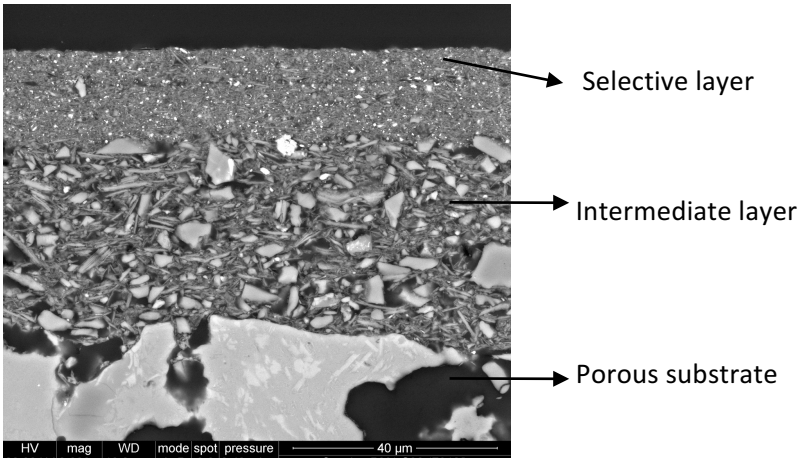

Figure 1. *Microstructure of the ceramic membrane made on introducing chamotte from fired tile scrap.*

The resulting substrate properties lay within the following ranges: water permeability between 6500 and 7000 $L \cdot h^{-1} \cdot m^{-2} \cdot bar^{-1}$, average pore size between 3 and 5 µm, apparent porosity between 30 and 40% and bulk density between 1.3 and 1.5 $g \cdot cm^{-3}$. These results are consistent with those reported in the literature for this type of ceramic materials.

The ceramic membranes made will be used in a biological membrane reactor (BMR) for urban wastewater treatment. The BMR technology has been widely viewed as one of the most innovative and efficient technologies for urban and industrial wastewater treatment. However, BMRs with ceramic membranes have not been implemented in urban wastewater treatment because of their high price, as commercial ceramic membranes are made from pure ceramic oxides (such as alumina, zirconia, and titania), which are expensive owing to the use of high-cost raw materials and complex manufacturing process. Consequently, low-cost ceramic membranes made from wastes (including fired tile scrap) constitute a good alternative to commercial ceramic membranes.

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