STAINS IN GLAZED CERAMIC TILE ENGOBE: STAIN WITH PIGMENTATION

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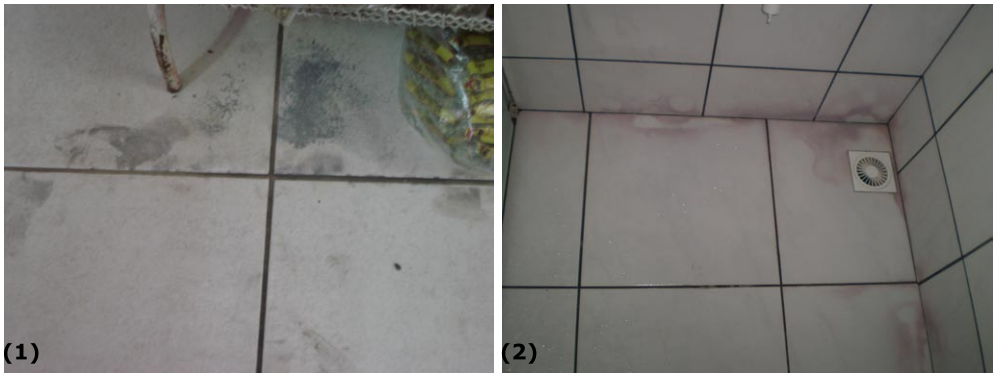
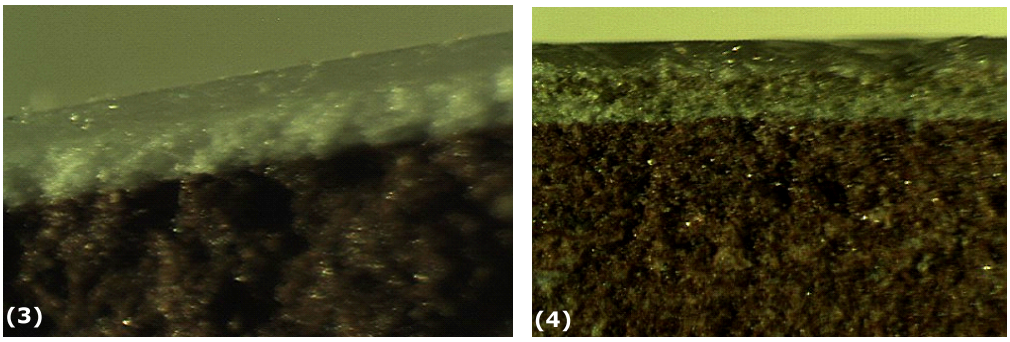
This work addresses the subject of stains in engobes and seeks to clarify how intense changes of colour occur as a result of colorant depositions. Unlike water stains, in which only water is present in the engobe, the colour changes in the case of stains with pigments are more intense (Figures 1 and 2). In addition, it may be observed that this type of colorant stain is necessarily associated with the susceptibility of the stain to water. Therefore, the water transported to the engobe is always involved in every manifestation of this type of stain: it is either the transporting vehicle of the colouring agent or it is the medium that allows the organic structures to develop, which will produce a strong colour.



Figures 1 and 2 – Cases found of stains on the glaze.

As in the case of stains involving only the transport and lodging of water in the engobe (Figures 3 and 4), stains in which agents with pigments are present also affect light-coloured and transparent types of glazes, obtained either by wet or dry milling from different manufacturers.



Figures 3 and 4 – Cross-sectional micrographs of a sample without and with staining on the glaze.

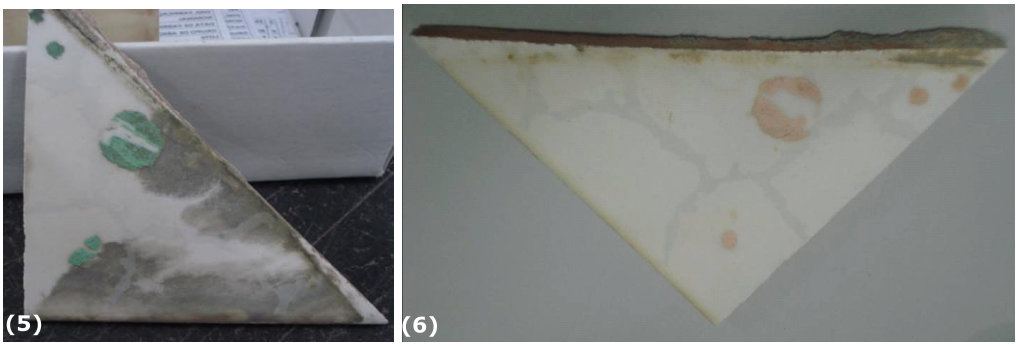
For the lodging of colouring agents in the engobe, in this study, three assumptions were tested:

1) The migration of organic colorants (present in pen and printing ink and household cleaning products, hair dyes and other commonly used products in daily life), which are transported together with ambient water of the installation area. This case is particularly favoured by poorly prepared grouts and the presence of cuts in ceramic tiles.

2) Crystallisation of soluble salts in the engobe layer, which are transported in the form of an aqueous solution to the engobe; the differences observed in the colours stem from the different chemical compositions of these salts coming from the ceramic tiling system.

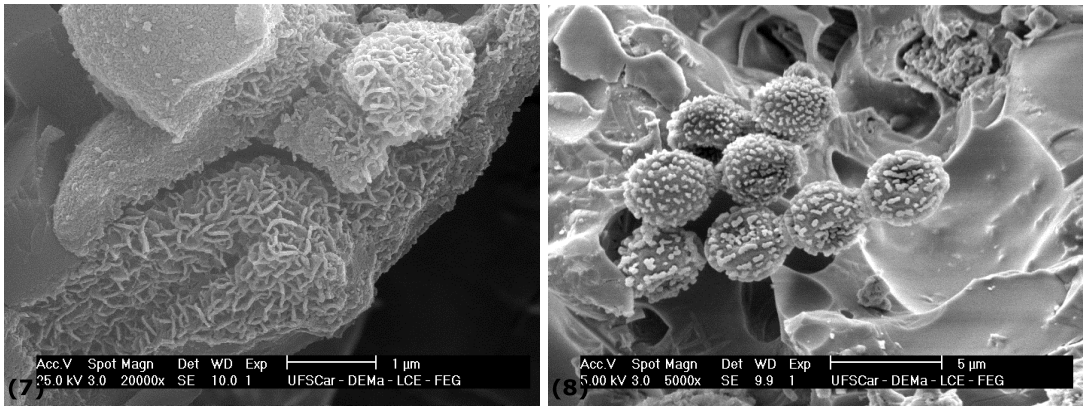
3) Stains relating to cultures of living organisms, encouraged by damp, are found in the engobe layer, the differences in colour stemming from the different varieties of organisms.

The purpose of this study was to identify the origin of the most common stains. The tests were performed using an optical microscope and a scanning electron microscope (with EDS analysis). It was observed that, after refiring the sample at temperatures of 550° C, the stains disappeared (Figures 5 and 6). This led us to consider that the origin of the pathology lay outside ceramic product.



Figures 5 and 6 – Sample before and after refiring at 550ºC.

It was also observed that this occurred with greater frequency in humid areas (coastal regions, for example). Scanning electron microscopy (SEM), accompanied by micro-analysis, revealed the presence of elements foreign to the glazes and engobes (chlorine, for example). SEM observation showed structures in the regions with stains that could not be identified as structures found in ceramic products. These structures resembled bacteria and fungi, which reached the tile with the penetration of damp or moisture. At the same time, microbiological analyses were conducted that indicated the presence of bacteria. Therefore, for the three types of origin for the appearance of stains on the glazes, these are deemed to stem from external causes, facilitated by water or humidity.



Figures 7 and 8 – Micrographs obtained in different samples with stains.