STUDY OF FLUORINE CONTENT VARIATION IN ORE (CLAY) FROM THE CORUMBATAÍ FORMATION AT THE SANTA GERTRUDES CERAMIC DISTRICT, BRAZIL

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1. SUMMARY

Gaseous emissions from the ceramic process have been studied in several countries, mainly due to the presence of environmental harmful gaseous contaminants. Fluoride is one of the contaminants of concern, as a consequence of the harm caused directly in flora and indirectly in human beings, resulting especially in bone and bone tissue diseases, respiratory diseases and materials corrosion. These studies show that the quantity of fluoride emitted depends on several factors, such as: ceramic body firing cycle, fuel used, and the genesis and mineralogical composition of the mineral raw materials.

The total fluoride content was measured in samples of different petrologic compositions from the Corumbataí Formation, used as raw materials in ceramic tile companies of the Santa Gertrudes/SP industrial district, Brazil. The emission of ceramic material during the firing cycle was also continuously monitored on a laboratory scale. The effect of firing variables, such as firing cycle, kiln atmosphere, raw materials composition and fluoride content in gaseous emissions, was also studied.

The results obtained of the mineral composition, by XRD analysis; chemical data, determined by X-ray fluorescence (XRF); and analysis slabs show that the mineralogical composition of the samples presents a certain homogeneity. However, the fluorine results confirmed that the concentrations varied not only in different petrologic compositions of the same deposit, but also between average values in the samples of the studied deposits. In the fossiliferous level, the obtained value was 4896 mgF^-/kg, which was greater than the values found in the other levels, with concentrations between 1237 and 1494 mgF^-/kg. On the other hand, a more altered level, possibly more leached and consisting of alkaline feldspar (albite) of hydrothermal origin, presented 112 mgF^-/kg. This behaviour can imply significant variations among the fluorine concentrations in ceramic compositions, which, depending on the operation parameters during the firing process, will influence fluorine emissions in the ceramic factories of Santa Gertrudes (Brazil).

The fluorine concentration was obtained by potentiometry simultaneously / continuously within the evolution of the firing cycle, and then the fluorine content results were converted in mgF^-/kg. Fluorine emission (figure 1) occurred during two distinct periods, i.e. above 950°C and at 1132°C (maximum concentration). The most important period corresponds to the dehydroxylation of clay (illite), which occurs at 950°C, since the ceramic material had not yet vitrified. At the temperature of 1132°C during the industrial process, the glazing phase probably seals the ceramic piece and the gases cannot evolve (are trapped). As the material vitrifies, the fluorine concentration decreases, while the diffusion paths to the atmosphere decrease. During the lab tests, the ceramic material was not glazed, thus showing the fluorine emission at that temperature. To test this hypothesis, it will be necessary to perform new tests with ceramic specimens in different production phases.

To study the behaviour of the fluoride emissions in ceramic firing processes, testing different ceramic compositions, process parameters and firing curves, the laboratory scale must simulate the industrial firing process. In this way, the present laboratory methodology was shown to be efficient, despite the fact that the heating rate was not similar. Controlled variations in firing, favouring fluoride reabsorption on ceramic bodies, can result in reduction of polluting impact of the companies in Santa Gertrudes/SP district, Brazil.

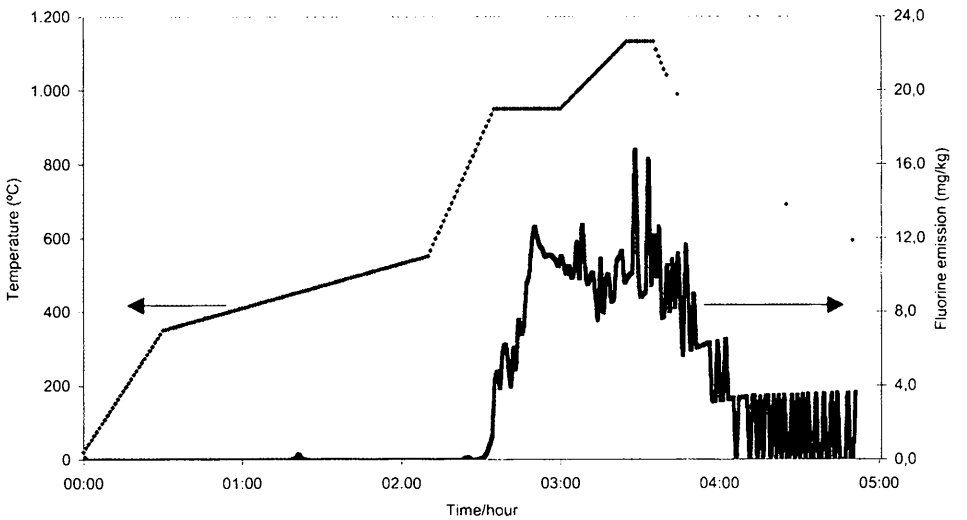

Figure 1. Fluorine emission vs temperature (firing curve)

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