VOLATILE ORGANIC COMPOUND EMISSIONS IN CERAMIC TILE MANUFACTURE

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1. INTRODUCTION

Volatile organic compounds (VOCs) are released when fuels such as petrol, timber, coal, or natural gas are burned. They are also released by solvents, paints, and other products used in industrial processes.

In the ceramic industry, the presence of organic matter is associated with the raw materials of the tile body and the different additives used in the decoration stage. In both cases, their presence varies widely: by way of example, the concentrations in the tile body range from 0.05 to 0.5% by weight. This organic matter leads to the presence of VOCs, mainly in emissions of flue gases from decoration lines and from firing kilns.

From a regulatory viewpoint, VOC emissions are not envisaged in the BREF document for ceramics. However, there are legislative initiatives in Spain as well as in other European countries for this parameter to be assigned an emission limit value of 50 mg/m_0^3. On the other hand, this pollutant is included in the Pollutant Release and Transfer Register (PRTR), its notification being compulsory by the activities detailed in Regulation 166/2006, which include the ceramic industry.

The main reason for the present study is to ascertain the situation of the Spanish ceramic sector with regard to VOC emissions. The study has focused, in a first phase, on characterising the emissions from the decoration and firing stages of large-sized porcelain tile, differentiating between: glazed and unglazed tiles, and decoration by rotogravure or inkjet printing.

2. METHODOLOGY

The VOCs were determined by means of continuous measurement equipment that uses the flame ionisation detection (FID) technique. The methodology followed is based on the UNE EN 12619 and UNE EN 13526 standards. The results have been expressed as total carbon (COT) in milligrams per cubic metre under normal temperature and pressure conditions, and dry gas corrected at a reference percentage of 18% O_2 (mg/m_0^3).

3. RESULTS

The first of the studied sources corresponded to the decoration stage. The VOC emissions were only determined when the emissions were channelled, as in the case of inkjet decoration. In all cases the results were below 5 mg/m_0^3.

The results corresponding to the emissions of the porcelain tile firing stage are summarised in Table 1.

Nº	Size	Company	Average C_{COT} (mg/m_0^3)	Decorating technique
1	50 x 100	C	2	Unglazed
2	30 X 60	D	2	Unglazed
3	60 x 60	B	2	Rotogravure
4	45 X 45	E	2	Inkjet
5	60 x 60	B	5	Inkjet
6	60 x 60	B	6	Rotogravure
7	45 x 90	B	7	Rotogravure
8	45 x 90	B	8	Rotogravure
9	60 x 60	B	9	Rotogravure
10	30 X 60	D	9	Rotogravure
11	30 X 60	D	11	Rotogravure
12	45 x 45	A	17	Rotogravure
13	50 x 100	C	17	Inkjet
14	50 x 100	C'	17	Inkjet
15	60 x 60	A	20	Inkjet
16	60 x 60	B	20	Inkjet
17	60 x 60	A	30	Inkjet
18	50 x 100	C	35	Inkjet
19	50 x 100	C	36	Inkjet
20	30 X 60	D	41	Inkjet

Table 1. VOC emissions during the firing of white-coloured porcelain tile

The emission results set out in the table display a **wide range** though **in no case is the threshold of 50 mg/m_0^3 exceeded**. This variability stems from the decorating technique applied: for example, in rotogravure the use of water-based inks decreases the VOC emissions as a result of the use of smaller quantities of organic compounds in their composition. These inks sometimes replace solvent-based inks. On the other hand, inkjet decoration exhibits a pronounced variability, since it depends on numerous variables (raw materials and additives contained, and the quantity used in printing).

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