

# EXPERIENCE IN THE INDUSTRIAL SCALE-UP OF THE BIOGASAC SYSTEM FOR FLUORINE REMOVAL IN THE CERAMIC INDUSTRY

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## 1. INTRODUCTION

One of the main impacts of the environmental regulations applicable to ceramic industries is the removal of fluorine compounds from the emissions generated in the firing stage in traditional ceramics manufacturing processes, in particular in ceramic tile manufacture [1].

Fluorine emissions in the firing stage, according to the literature surveyed, range from 12 to 45 mg/m<sub>N</sub><sup>3</sup>. However, the applicable fluorine emission limit currently in force for ceramic tile manufacturing companies in the Valencian Region, according to the contents of their Integrated Environmental Authorisation (IEA), is 10 mg/m<sub>N</sub><sup>3</sup> [2]. The most widely implemented technology in Europe for abating such emissions in the ceramic tile industry is a reagent injection system followed by a fabric filter baghouse [3].

## 2. OBJETIVE

The consortium of organisations presenting this study has worked in the last few years on the development of emerging, alternative techniques to the traditional systems used for the removal of acid pollutants. In particular, the group has pursued the development of a reagent system with a fixed bed, consisting of small hollow cylinders with an optimised design and textural development to maximise the system's efficiency in hydrogen fluoride (HF) adsorption [1].

## 3. METHODOLOGY

After numerous trials had been conducted on a laboratory and semi-industrial scale with positive results, a demonstrator was constructed for industrial scale-up. The demonstrator consisted of a cylindrical reactor fitted with a cone that contained the above reagent, referenced HCA-W (Hollow Cylinder Adsorbent-White), through which the flue gases to be treated travelled. The unit was installed at the Azteca facilities, with a view to studying its efficiency on an industrial scale, making part of the kiln flue gases travel through this system. The following figures schematically illustrate the demonstrator, in addition to showing some photographs of the unit at the Azteca facilities and the reagent used:

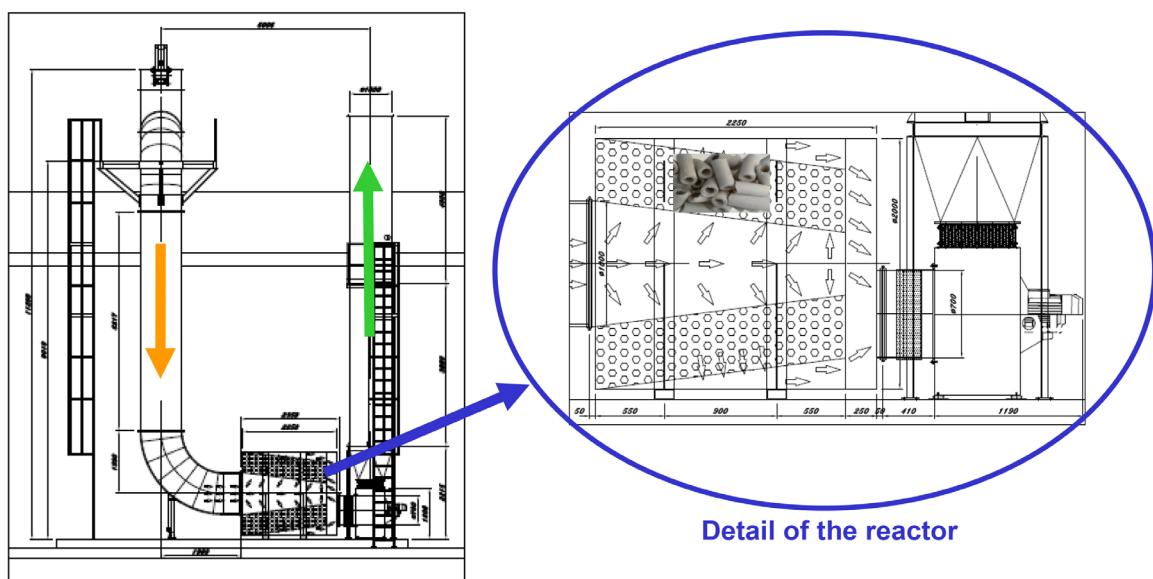


Figure 1. Scheme of the industrial demonstrator.



Figure 2. Fixed-bed system.



Figure 3. HCA-W adsorbent reagent.

In order to continuously determine the HF emission concentration in real time, a devoted laser analyser (Tunable Diode Laser-TDL) for the determination of the HF pollutant was used.

A picture of the laser analyser used in the measurement campaigns is shown in Figure 4.



Figure 4. Laser analyser for continuous measurement of HF.

#### 4. EXPERIMENTAL RESULTS

This study sets out the results obtained in the industrial campaign in which the performance of the HCA-W reagent was evaluated and studied, thus determining the efficiency of the system for removing acid pollutants, specifically HF.

Figure 5 shows the continuous evolution of the HF concentration, expressed in  $\text{mg/m}_\text{N}^3$  at 18%  $\text{O}_2$ , before and after the treatment system, as well as the system's HF removal efficiency.

The variations in the initial HF concentration in the course of the measurement campaign were related to changes in the products (variations in sizes, raw materials, or thicknesses, among other variables). However, the comparable figure in the different measurement campaigns was the system's HF removal efficiency, as it took into account the difference between the initial HF concentration and the HF concentration after the filter.

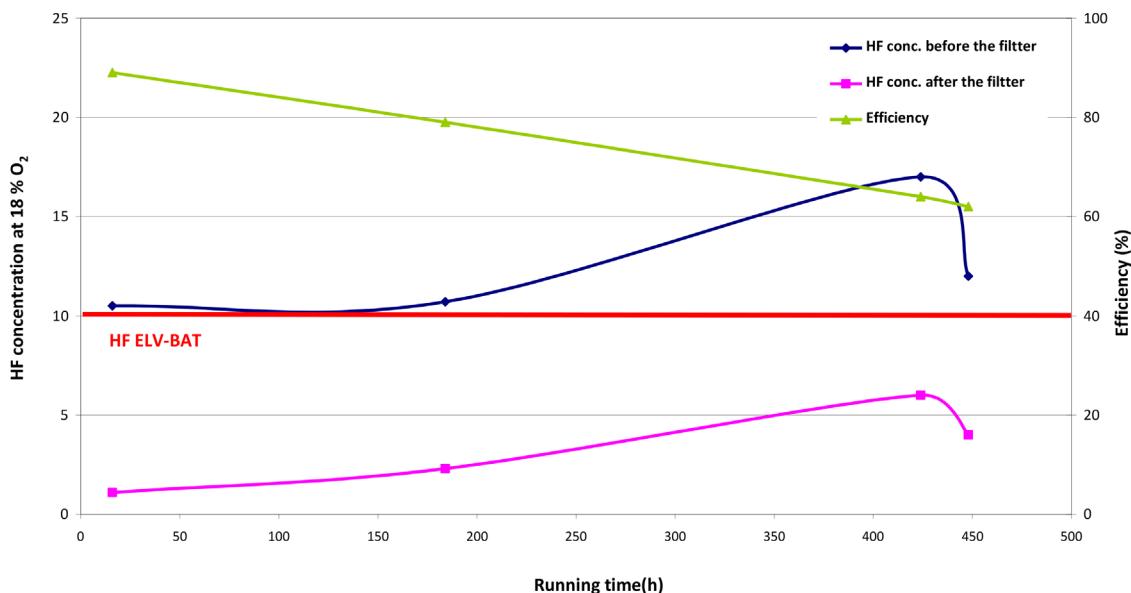


Figure 5. Evolution of HF concentration ( $\text{mg/m}_\text{N}^3$  expressed at 18%  $\text{O}_2$ ) and HF removal efficiency (%).

## 5. CONCLUSIONS

The following conclusions may be drawn from the results:

- The results obtained for the HF concentrations in the experimental measurements made after the treatment system, which ran for 24 days (592 hours), were below 10 mg/m<sup>3</sup>N3 at 18% O<sub>2</sub> in the stack, independently of the studied product (earthenware tile and porcelain tile).
- The efficiency of the system gradually decreased, probably because the reagent, which was in a static bed, gradually lost its adsorption capacity.
- Lower emission values than the ELV-BAT values<sup>1</sup> established for HF in the BREF for the ceramic industry were obtained, so that this technique could be a BAT candidate in the next review of the ceramic BREF.

(<sup>1</sup> Note: ELV-BAT is the abbreviations for the Emission Limit Value relating to the Best Available Technique, established by law for HF)

## 6. ACKNOWLEDGEMENTS

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<sup>1</sup> Note: ELV-BAT is the abbreviations for the Emission Limit Value relating to the Best Available Technique, established by law for HF.