ANALYSIS OF FLUORINE COMPOUNDS IN CERAMIC INDUSTRY GASES

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1. MEASUREMENT OF FLUORINE CONCENTRATIONS IN GAS EMISSIONS

The present study addressed the effect of several variables on fluorine measurement in ceramic industry gas emissions to enable determining which variables need to be particularly watched, and to establish a simple method specifically adapted to the needs of the ceramic industry.

Different reference methods exist for determining fluorine compounds in gas emissions. They are all based on extraction by an appropriate probe of a known volume of gas, making the gas cross an absorption system that captures this element; the fluorine present is then determined in the capturing solution and its concentration in the gas stream is calculated.

Using these reference methods, the most critical factors in the sampling method were determined. These are: probe construction materials and temperature, absorption system, withdrawn gas volume flow rate, sampled gas volume and analysis technique.

Each of these variables was studied on a laboratory scale and at industrial facilities.

2. EXPERIMENTAL

2.1 VARIABLES STUDIED ON A LABORATORY SCALE

- Probe construction material: steel and Teflon
- Nature and concentration of the absorbing solution contained in the bubblers
- Sampled gas volume flow rate
- Total sampled gas volume

To conduct the laboratory-scale study an assembly was designed, which is schematically shown in Figure 1.

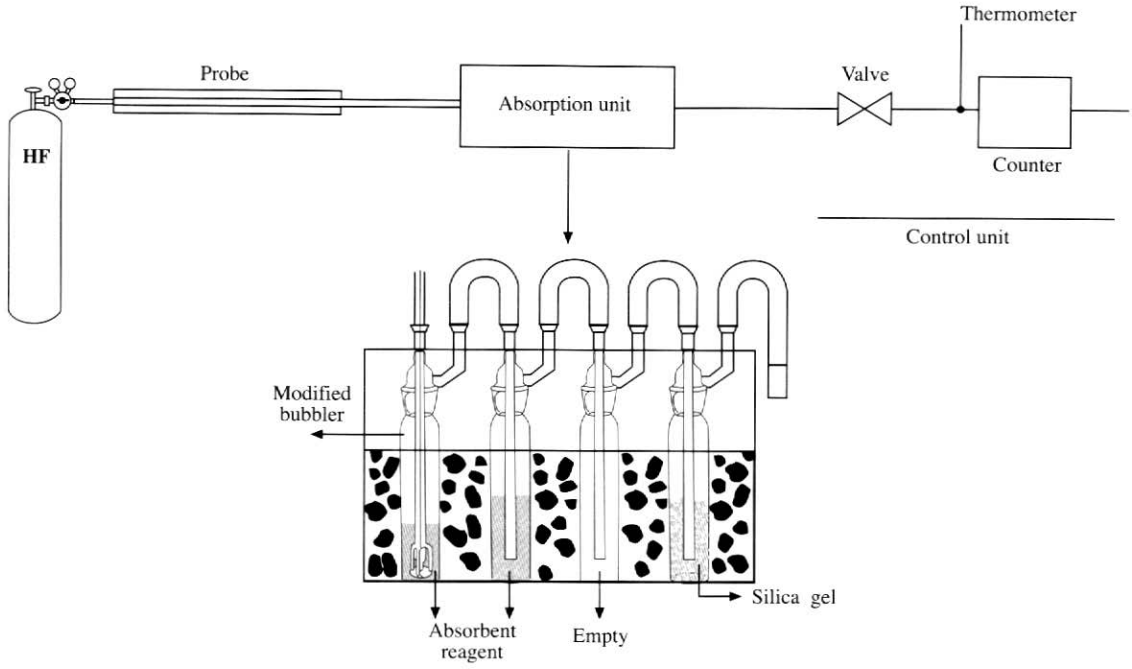

Figure 1. Schematic of the laboratory assembly used in the fluorine capturing study.

2.2 VARIABLES STUDIED ON AN INDUSTRIAL SCALE

- Sampling train material: steel, Teflon and titanium
- Volume flow rate of the gas to be withdrawn
- Importance of the circuit washing operation

3. RESULTS AND DISCUSSION

3. 1 LABORATORY-SCALE STUDY

- It was found that the **probe material** notably affected the final sampling result. Under the studied test conditions, the stainless steel of the probe was the material that essentially reacted with the fluorine present in the gas stream, yielding a result that was much lower than the actual value.

- In the study on the **nature and concentration of the reagent**, substantial variations were not observed in the results, so that the use of KOH is feasible as an alternative solution to sodium hydroxide for capturing HF, as is the use of solutions with variable concentrations of NaOH.

- The modification of the **gas withdrawal flow rate** had a negligible effect on the determination of the HF concentration (at least up to flow rates of 30 l/min). On the other hand, on modifying sample volume it was observed that the minimum sample volume needing to be withdrawn was about 150 litres.

3.2 INDUSTRIAL-SCALE STUDY

- The values obtained on an industrial scale were similar to the results found on a laboratory level. That is, the **gas withdrawal flow rate** in the studied range of values was not a significant factor, while the **type of materials** of the sampling train was a highly critical factor in the determination of fluorine compounds in kiln emissions.

- Another type of studied probe material was titanium, a material that enables sampling at high temperatures. It was found that this material did not react with fluorine like stainless steel.

- In the results found on an industrial level, the importance was noticed of the circuit washing operation, since the fluorine collected in this solution represented about 30% of the total fluorine.

4. REFERENCES

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