

Development of Total Organic Carbon Instrument – Reactor and Process Design for Analyzing Large Amounts of Solid Samples

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Abstract— In this study, effective reactor and process design was developed for solid module of Total Organic Carbon (TOC) instruments that utilizes high temperature combustion (HTC). A working prototype was developed according to the design parameters of; large amount of solid sample loading, complete combustion of the carbonaceous species to CO₂, preventing the atmospheric air to enter the combustion system during sample loading, automatic adjustment of process conditions (flow rates and temperatures) according to the carbon content of the sample and automatic sample loading. Experiments were carried out on developed prototype in order to test the foregoing design parameters. Combustion products were analyzed with a Mass Spectrometer (MS) and a Non-Dispersive Infrared (NDIR) analyzer. According to the results of the experiments it was verified that, it is possible to load solid samples between a few milligrams up to 10 grams and sample loading can be done automatically. During sample loading detectors did not detect any CO₂ signal higher than that of in the TOC grade air. Depending on the sample loading combustions last between 2 to 12 minutes. Regardless of the high and low carbon content of the samples, the RSD of the results remained under 2% for 10 to 50000 µg carbon loading. According to the results of the performance tests it can be said that the developed instrument can be used with main TOC units using static pressure or flow through detectors.

Key Words: Total Organic Carbon (TOC), Solids Module, High Temperature Combustion (HTC)