

Rapid estimation of trace organophosphonate used as a scale inhibitor in aqueous systems by reactive pyrolysis-gas chromatography/mass spectrometry

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ABSTRACT: The determination of trace organophosphonates which is used in cooling towers as a scale inhibitor usually involves extraction and/or concentration of the target components prior to analysis. The extracts are analyzed using chromatographic or spectroscopic methods. This methodology is not only cumbersome but also results in poor data quality. This work presents a novel approach for the rapid and sensitive determination of trace amounts of an organophosphonate: 1-hydroxyethylidene-1,1-diphosphonic acid (HEDP) in aqueous solution. This method is based upon reactive pyrolysis-GC/MS in the presence of tetramethyl ammonium hydroxide (TMAH). Approximately 10 μ L of the aqueous sample containing a trace amount of HEDP and 1 μ L of 25 % a methanol TMAH solution was placed in the sample cup. The cup was then dropped into the furnace which was at 350°C. The heat initiated the hydrolysis of the organophosphonate followed by the methylation of the hydrolysates. Trimethylphosphate (TMP) was detected by GC/MS. The level of TMP is related to the level of the phosphonate, HEDP in the aqueous sample. Using an external standard calibration curve, it was possible to make a rapid estimation of mg/L levels of organophosphate.