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Development of a WD-XRF analysis method of minor and trace elements in liquid petroleum products

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Abstract

The developed methodology permits the analysis of minor and trace elements in liquid petroleum products, with varying oxygen content between 0 and 3.4 % and varying C/H ratio between 7 and 9, by wavelength-dispersive X-ray fluorescence (WD-XRF) spectrometry, necessary to determine the properties that indicate the function and performance of the product in service.

The proposed methodology allows the analysis of a set of elements: Al, Ba, Ca, Cr, Cu, Fe, Mg, Mn, Ni, P, Pb, S, Si, Ti, V and Zn, by WD-XRF in different materials in a huge range of concentrations, with high accuracy and in only 20 minutes. The method was fine-tuned by optimizing the measurement conditions and calculating the detection and quantification limits (1.4 $mg \cdot kg^{-1}$ for S and 0.5 $mg \cdot kg^{-1}$ for the rest of elements). The validation was carried out by using a series of reference materials and the uncertainty of the method was calculated according to the expression: $U = k \cdot \sqrt{u_{V_R}^2 + u_{V_L}^2 + u_{REPRO}^2}$, where u_{V_R} is the uncertainty of the certified value of the reference material, u_{V_L} is the uncertainty of the measurement of the reference material, u_{REPRO} is the uncertainty of the measurement of the sample, and *k* is a coverage factor.

Sulphur analysis was also performed by combustion and IR detection apart from WD-XRF and the results obtained by both techniques were compared. The matrix of the samples analyzed and the standards used was also analyzed by determining C, H, N and O.

Biography

Maria Fernanda Gazulla Barreda completed her PhD on Chemistry (Chemical Engineering) in 2005 from Jaime I University of Castellón (Spain). She is the head of the Area for the Analyses and Tests of the Instituto de Tecnología Cerámica (ITC), a research institute focused on spearheading technology innovation and design processes in the Spanish industry. She has published 65 papers in reputed journals, 2 books and 57 communications at conferences and symposia on different subjects. She has participated in more than 75 R&D and Technology and Consultancy conduced at ITC and given more than 30 conferences and courses about chemical characterization.