Review paper
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FACTORIAL DESIGN AS A TOOL FOR THE ASSESSMENT OF MATRIX INTERFERENCE

Edlira Baraj[1], Kledi Xhaxhiu[2], Rajmonda Totoni[1], Luis Felipe Hax Niencheski[3], Besnik Baraj[2*]

[1]Department of Chemistry, Faculty of Mathematical Engineering and Physical Engineering, Politechnic University of Tirana, S. Delvina nn, 1001 Tirana, Albania
[2]Department of Chemistry, Faculty of Natural Sciences, Tirana University, Boulevard Zogu I nn, 1001 Tirana, Albania
[3]Departament of Chemistry, Federal University of Rio Grande, Avenue Italia nn, Rio Grande - RS, Brazil

[*]e-mail: barajbesnik@gmail.com

Abstract

During the analysis of the biological, geological, brines and seawater samples, the matrix can have a significant effect on the quality of the obtained results. Due to matrix effect, the reduction or enhancement of the instrument signal is observed, causing severe interferences, likely occurring both types of proportional and constant systematic errors. While factorial design is used in order to optimize technological processes, methodology, yield of different chemicals, rarely is found used in analytical chemistry for the assessment of matrix interferences. Normally, the study of interference is performed by univariate method, which is not economic and do not take into account the interaction between factors. Our experience has shown that factorial design is a very useful tool to point out the influence of constituents of the matrix on the instrumental signal of the solutes. The assessing of the effects of Cu, Cd and exposure period on metallothionein production in gills of mussel by this technique has been studied as well. In this work are shown applications of factorial design on study of matrix interferences in seawater, brines and soil samples. The aim of this research was to underline the philosophy of assessing effects of matrix constituents, which helps to get accuracy results.

The techniques used for lithium determinations in brines samples were atomic absorption spectroscopy (emission mode). In brines major constituents of matrix are Na, K, Ca and Sr. In soil, in which Al and Fe are abundantly found, the determination of fluoride by ion selective electrode (ISE) was applied. The ratio of the constituents of the prepared samples have been according the concentrations found in natural samples. Previously, some hundreds natural samples of underground brines, in contact with oil from Albanian oilfield, have been analyzed for trace metals by AAS. The regression coefficients found in the models demonstrated a significant interference of Fe, with an even more pronounced interference for Al during ISE determination of fluoride. While for lithium determination by AAS, Na and Ca showed significant interferences. Following the application of standard addition method is found the source type of systematic error, constant or proportional.

From the factorial design plans, applied for hard matrix samples, it is concluded, that the regression coefficients found in the models, demonstrated significant interferences of studied factors, including their interaction terms. Clearly factorial design has shown significant advantages over classical method of studying interferences. Therefore, we strongly recommend it in the analysis of complicated samples.

Key words*: Factorial design, Matrix interference, AAS, Ion selective electrode.*