ANQUE – ICCE – CIBIQ 2019
ANQUE-ICCE 3 3rd International Congress of Chemical Engineering
Santander, SPAIN June 19-21, 2019
EFCE Event No.757
"Building bridges in Chemical Engineering"
CIBIQ 1er Congreso Iberoamericano de Ingeniería Química
Santander, ESPAÑA Junio 19-21, 2019
ANQUE-ICCE 3 Student Conference
Santander, SPAIN June 17-18, 2019

Solid sampling determination of ZnO nanoparticles in eyeshadows by graphite furnace atomic absorption spectrometry

J.C. García-Mesa, P. Montoro Leal, E.I. Vereda Alonso, M.M. López Guerrero*, M.T. Siles Cordero, A. García de Torres, J.M. Cano Pavón

University of Málaga, Faculty of Sciences, Department of Analytical Chemistry, Malaga, Spain

*Corresponding mmlopez@uma.es

Abstract

The application of nanoparticles (NPs) in science and technology is a fast growing field. Therefore, reliable and straightforward analytical methods are required for their fast determination in different types of samples. In this work, a method that enables the determination of the average size of ZnO NPs, besides their concentration, discriminating them from ionic zinc, has been optimized. The method is based on solid sampling high-resolution continuum source electrothermal atomic absorption spectrometry (SS-HR-CS-GFAAS), and has been applied to determination and characterization of ZnO NPs in cosmetic samples.

Recently, graphite furnace atomic absorption spectrometry has been introduced as a new tool to determine the size of nanoparticles by evaluation of the following parameters: atomization delay (t_{ad}) and atomization rate (k_{at}). In this work both parameters (besides peak area) have been obtained from absorbance signals for a line of Zn with low sensitivity. Two multiple response surface designs have been used in order to optimize the adequate furnace program to achieve our aims. All the optimization experiments were performed using baby´s skin irritation protective cream. The optimized furnace program is shown in Table 1.

Table 1. Optimized furnace program

Step	Temperature (C)	Ramp (C/s)	Hold Time (s)
Drying	80	6	20
Drying	90	3	20
Drying	110	5	10
Pyrolysis	300	50	20
Atomize	1300	1500	3
Clean	2450	500	4

The size calibrations were performed against solid (powered) ZnO standards, from 50-nm to 500-nm sized nanoparticles. The correlation coefficients (R value) of the linear calibration were not worse than 0.9982. The optimized method was tested in other types of cosmetic samples such as eyeshadow samples with good results. The determination of the MNPs' size was validated by transmission electron microscopy (TEM) and the Zn concentration in the solid samples was validated by atomic fluorescence spectroscopy (AFS).

Acknowledgements (optional) [Garamond font, 10 points]
The authors would like to thank Plan propio "Proyecto Puente" de la Universidad de Málaga for financial support of this work.