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A novel approach to measure elemental concentrations in cation exchange resins using XRF-scanning technique, and its potential in water pollution studies

Jyh-Jaan Huang (1), Sheng-Chi Lin (2), Ludvig Löwemark (1), Ya-Hsuan Liou (1), Queenie Chang (1), Tsun-Kuo Chang (2), Kuo-Yen Wei (1), and Ian W. Croudace (3)

(1) Department of Geosciences, National Taiwan University, Taipei, Taiwan (huang.jyhjaan@gmail.com)., (2) Department of bioenvironmental Systems Engineering, National Taiwan University, Taipei, Taiwan., (3) Ocean and Earth Science, University of Southampton, National Oceanography Centre, European Way, Southampton, U.K.

X-ray fluorescence (XRF) core-scanning is a fast, and convenient technique to assess elemental variations for a wide variety of research topics. However, the XRF scanning counts are often considered a semi-quantitative measurement due to possible absorption or scattering caused by down core variability in physical properties. To overcome this problem and extend the applications of XRF-scanning to water pollution studies, we propose to use cation exchange resin (IR-120) as an “elemental carrier”, and to analyze the resins using the Itrax-XRF core scanner. The use of resin minimizes the matrix effects during the measurements, and can be employed in the field in great numbers due to its low price. Therefore, the fast, and non-destructive XRF-scanning technique can provide a quick and economical method to analyze environmental pollution via absorption in the resin.

Five standard resin samples were scanned by the Itrax-XRF core scanner at different exposure times (1 s, 5 s, 15 s, 30 s, 100 s) to allow the comparisons of scanning counts with the absolute concentrations. The regression lines and correlation coefficients of elements that are generally used in pollution studies (Ca, Ti, Cr, Ni, Cu, Zn, and Pb) were examined for the different exposure times.

The result shows that within the test range (from few ppm to thousands ppm), the correlation coefficients are all higher than 0.97, even at the shortest exposure time (1 s). Therefore, we propose to use this method in the field to monitor for example sewage disposal events. The low price of resin, and fast, multi elements and precise XRF-scanning technique provide a viable, cost- and time-effective approach that allows large sample numbers to be processed. In this way, the properties and sources of wastewater pollution can be traced for the purpose of environmental monitoring and environmental forensics.