A novel approach of WD-XRF for the analysis of fluorine content in soil with suggested correction factors for Fe/Mn interference

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In our previous study, the wavelength dispersive X-ray fluorescence specrometry (WD-XRF) was assessed to be feasible for the analysis of fluorine conetent in soil [1]. However, the limit of dection (LOD) value of 1-to-1 (w/w) pre-treatment method was still too high (812 mg-F/kg-soild) compared with other methods. Therefore, the existing pre-treatment method was modified to reduce the LOD value.

The soil was mixed with a polyvinyl alcohol at 9-to-1 weight ratio to 4 g of total specimen and then pressurized 20 tons over 20 seconds. The LOD value of 9-to-1 (w/w) pre-treatment method was reduced by about 38 times from existing method to 21.3 mg-F/kg-soild of modified method. This LOD value was comparable to that of other methods for determination of soil fluorine concentrations (Table 1).

Analytical instrument	Pre-treatment method	LOD (mg/kg)	Ref.
Selective ion electrode	Alkali fusion	3	[2]
Selective ion electrode	Pyrohydrolysis	20	[3]
WD-XRF	1-to-1 pellet	812	[1]
WD-XRF	9-to-1 pellet	21.3	This study

Table 1: Comparison of several methods.

In WD-WRF analysis, fluorine intensity measured at Bragg angle of 43.174° was affected by other elements having similar Bragg angle, such as Fe and Mn. Therefore, the intensity was corrected by calibration of F intensity with different Fe/Mn contents in soil sample. The sample specimen containing 0, 10, 20, and 50% of Fe_2O_3 and 0, 2.5, 5, and 10% of MnO_2 were prepared to calculate the correction factor (CF).

Acknowledgement
This study received support from the Geo-Advanced Innovative Action (GAIA) project of the Korea Environmental Industry & Technology Institute (KEITI).

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