Data driven analysis for a prediction method of arsenic adsorption to soils

*Kota Kurosawa[1], Kengo Nakamura[1], Takeshi Komai[1]

1. Tohoku University

Arsenic is a trace element that is toxic to plants, animals and humans. Arsenic moved to the surface of the earth via ground water can cause skin diseases. Thus it is important to predict the amount of arsenic in soil. However, it is too difficult to describe the absorbed amount of arsenic in soils because in the surface in soil it occurs as and that forms two types of complexes (inner-sphere complex and outer sphere complex), which we can't distinguish. We used regression analysis as a new predictive method for arsenic adsorption. Arsenic adsorption tests were conducted using nine type soils and applying Freundlich isotherm. At the same time, we measured the 13 characteristic values of soils (pH, EC and the content of Na, Mg, Al, Si, P, S, K, Ca, Ti, Mn and Fe). Finally, simple and multiple regression analysis were used as a method of data driven analysis. The simple regression was applied to relate all parameters to Freundlich constant and exponent. In multiple regression, we calculated all combination from measured 13 parameters. They were also applied to relate Freundlich constant and exponent are associated. The best model expression was selected from calculated 91 formulas by using the coefficient of determination and Student's t-test., which proves the effectiveness of regression coefficients. The best model formula, which showed 95% reproducibility, consisted of the EC value, and Ti and Al content. This indicates that arsenic adsorption by soils is mainly arsenic competing with salts, and the occurrence of titanium iron and an Al-bearing mineral. We showed the availability of data driven analysis for predicting arsenic adsorption.

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