

Modeling transportation of noxious trace elements in rivers by means of colloidal iron interaction

HAI, Chi^{1*} ; NAKAYA, Shinji¹ ; ISHIKAWA, Mistunori¹ ; KUJIOKA, Tomoko¹ ; MASUDA, Harue²

¹Shinshu University, ²Osaka City University

Toxic elements in water systems can expose crops to dangerous levels of contamination through irrigation and soil pollution. Therefore, it is of vital importance to ascertain the dynamic state of noxious trace element as they are carried by soil colloids via river systems. However, the behavior of toxic elements varies depending on their current state. Possible states consist of the colloidal state, in which the element is attracted to some colloids by sorption, or water-soluble state where the element exists as an ion or a complex ion.

The study focuses on two rivers with headwaters in volcanic rock areas near Mt. Asama and Mt. Yatsugatake in Saku, Nagano. The concentrations of both major elements and trace elements are measured before and after filtration. By comparing the concentrations before and after filtration, the current state (water-soluble or colloid) of the toxic elements (Arsenic, Cadmium, Cesium and Lead) in river may be determined. From correlations between the various elements, the parameter that explains the effect of the concentration and transportation of toxic trace elements can be elucidated.

As a result, 1) The current state of toxic trace elements in Mt. Asama area is: Arsenic (water-soluble state), Cadmium (colloidal state), Cesium (water-soluble state), and Lead (colloidal state). The state of toxic trace elements in Mt. Yatsugatake area is: Arsenic (water-soluble state), Cadmium (colloidal state), Cesium (colloidal state), and Lead (colloidal state). 2) When the current state of trace elements is colloidal state, the parameter which explains the effect of the concentration and transportation of toxic trace elements is sorption by Fe-Al-Ti colloid. When the current state of trace elements is water-soluble state, the parameter is pH. 3) The model of transportation of noxious trace elements by means of colloidal iron interaction is formed. The model has two types. Type 1: In Y-river in Mt. Yatsugatake area which does not contain much iron, toxic trace elements are attracted to Fe-colloid by sorption. Type 2: In A-river in Mt. Asama area which largely contains colloidal iron, toxic trace elements are also attracted to Fe-colloid by sorption. However, there are some colloidal irons without toxic trace elements.

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