Feasibility Study for Tracing of Source Area of the Groundwater NO_3-N Pollution in Basin Using CFCs of River Water and Groundwater

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Chlorofluorocarbons CFC-12, CFC-11, CFC-113, which are primarily of anthropogenic origin, are often used to young groundwater dating. However, CFCs concentrations are extremely over record (EOR) in 40 % in sampling points of the well waters in Matsumoto basin as well as in other agricultural basin. The concentration of CFCs in EOR is also likely to increase with NO_3-N. Supposing CFCs with NO_3-N enrich along groundwater flow path, the source area of NO_3-N pollution can be identified by tracing the relationship between CFCs, NO_3-N and the location. In order to identify the source of NO_3-N in agricultural basin, we carried out feasibility study using CFCs. We measured the CFCs and SF_6 concentrations of river water at 19 points of three rivers, groundwater at 21 wells and air at 19 points along rivers in the Matsumoto basin. The CFCs' concentrations of river waters exponentially increase with distance and elapsed time in the direction from upstream to downstream up to air values of CFCs' concentrations, being close to average atmospheric CFCs' concentrations of north hemisphere. It is natural that the gradual increases of CFCs concentrations in rivers with distance and elapsed time reflects the process of gaining equilibrium between water and air. Moreover, CFCs' concentrations of river water at beginning point of mountain stream will correspond to the CFCs of spring, in our understanding. The NO_3-N of river waters decreases with distance and elapsed time in the direction from upstream, surrounding vegetable fields, to downstream, indicating dilution due to river water. On the contrary, the CFCs' concentrations of groundwater increase with NO_3-N from upstream, surrounding vegetable fields, to downstream along groundwater flow path, suggests CFCs with NO_3-N enrich in the groundwater. The relationship between CFCs and NO_3-N of river water and groundwater along groundwater flow paths is plotted around a same line, indicating that the source area of NO_3-N pollution of groundwater is identified to be vegetable fields.

Keywords: groundwater, Chlorofluorocarbons, nitric acid, groundwater pollution

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