

## Radioactive Reactions with Fulvic and Humic Substances

**According to Szalay, radioactive elements react with humic substances and require only a brief time until equilibrium is reached.**

F.W. Pauli stated that the solubility, migration, and accumulation of uranium are influenced by humic and fulvic acids. The fuel discharged from the light water reactors is contaminated with substantial Szalay, A. (1958). *The significance of humus in the geochemical enrichment of uranium. Proceedings of the 2nd International conference on the Peaceful Uses of Atomic energy*, 2, 182-186. (London: Pergamon) amounts of plutonium and uranium. These ions react with humic compounds at a much more rapid rate than do copper, nickel, lead, or cadmium ions.<sup>117</sup> Pillai and Mathew agreed that it would not be unrealistic to presume that the geochemical behavior of plutonium and uranium is influenced by humic substances. They reported the presence of plutonium in purified organic material extracted from coastal sediments and indicated the possibility of the accumulation of plutonium on organic surfaces because the concentration of plutonium increased over time. As they confirmed that the organic matter solubilized the plutonium, they discovered that the addition of organic matter inhibited the hydrolysis and precipitation of the added plutonium. It was further reported that this scenario duplicates the action with uranium and other radioactive elements.<sup>118</sup> Rashid stated that nuclear reactor wastes contain unused uranium, the basic fuel, and long-lived fission product nuclides and actinides, including plutonium, strontium-90, zirconium-95, iodine-129, cesium-137 and cesium 135, all in abundance. Activated metals such as cobalt-60, iron-59, and manganese-54 also are present in reactor waste. He states that the basic reactions of these materials with humic substances are parallel to those of other transition and trace metals.<sup>119</sup>

*“Radioactive elements have an affinity for humic and fulvic acids. They form organo-metal complexes of different adsorptive stability and solubility. Uranium and plutonium are influenced by humic substances as are other polluting metals, each being solubilized and absorbed, thereby annihilating the specific radioactivity.”<sup>120</sup>*

117 Pauli, F.W. (1975). *Heavy metal humates and their behavior against hydrogen sulfide. Soil Science*, 119, 98-105.

118 Pillai, K.C., & Mathew, E. (1976). *Plutonium in the aquatic environment: Its behavior, distribution and significance. In Transuranium nuclides in the environment* (pp. 25-45). Proceeding of the Symposium, International Atomic Energy Agency, Vienna.

119 Rashid, M.A. (1985). *Geochemistry of Marine Humic Substances*. New York: Springer-Verlag.

120 W.R. Jackson PhD. (1993) *Humic, Fulvic, and Microbial Balance: Organic Soil Conditioning* (pp. 762-763).