# Material Proposed for Treating Nuclear Waste Operates by Different, Destructive Mechanism

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The most important method for separating the chemical components of radioactive waste (for example, strontium-90) is liquid-liquid extraction. In liquid-liquid extraction, two liquids that do not dissolve in each other, like oil and water, are vigorously mixed and some of the radioactive materials dissolved in the water phase are selectively transferred (or extracted) into the oil phase. On the industrial scale, this "oil-like" liquid, called the diluent, is often flammable, volatile, or toxic. Because of the environmental difficulties inherent in handling or disposing of these diluents, a new class of chemicals called room-temperature ionic liquids has attracted much attention as a possible replacement for conventional diluents. We have used X-ray absorption fine structure measurements at the Advanced Photon Source BESSRC-CAT beamline to study the chemical form of the strontium compounds that are extracted from water into a conventional diluent (octanol) or into a room-temperature ionic liquid. Although the room-temperature ionic liquid extracts much more strontium than octanol does, the price for this efficiency is high. Strontium is efficiently extracted into the room-temperature ionic liquid because, unlike conventional diluents, the extracted strontium compounds are positively charged and they replace the positively charged part of the room-temperature ionic liquid. While this helps the extraction, it eventually destroys the ionic liquid. Consequently, despite their many desirable properties, room-temperature ionic liquids may not be able to replace less environmentally friendly conventional diluents in the treatment of radioactive waste. We are continuing to study the liquid-liquid extraction properties of room-temperature ionic liquids to see if this is a general property of room-temperature ionic liquids, or if particular molecules can circumvent this limitation.