Sample preparation is a key aspect in conducting quantitative analysis by micro x-ray fluorescence (MXRF). Liquid samples are often prepared as a dried residue, but are likely to have heterogeneous elemental distribution when deposited on a microliter scale. The use of picoliter dried residues is a reliable means of preparing liquids, but is not well suited to all types of samples, such as those containing particulate. Microfluidic sample preparation is an alternative to the dried residue approach that permits direct analysis of liquid samples with minimal handling. Here, recent efforts in the development and evaluation of microfluidic devices designed for actinide determination in spent fuel will be described, and analytical results compared to those of the dried residue approach. High resolution x-ray (hiRX) detection limits <1 µg/mL have been shown using disposable microfluidic devices containing <5 µL of sample. Advantages and limitations of this new approach will be compared with those of more conventional preparation techniques.

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