

## DETERMINING THE THERMODYNAMICS OF EXTRACTION OF AMERICIUM AND CURIUM BY HDEHP FROM NITRATE SOLUTION

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### *Abstract*

With the energy difference associated with a successful metal ion separation in a solvent extraction process being relatively small, paying careful attention to the thermodynamic properties of such systems ( $\Delta G^\circ$ ,  $\Delta H^\circ$  and  $\Delta S^\circ$ ) assists in providing an insight into the driving forces behind the partitioning process. While utilizing van't Hoff analysis from radiotracer studies give a reasonable approximation of how the metal ion will behave in a separations system, they do not give absolute values. Those types of experiments require a direct measurement of the reaction under study. Americium and curium are two of the key actinides that are targeted for separation in the TALSPEAK process, but the chemical interactions of these elements with the ligands that facilitate this process (lactic acid, DTPA, and di-2-ethyl hexyl phosphoric acid HDEHP) are not well defined. To that end, the study on the direct measurement of the heat of extraction of americium and curium by HDEHP has been highlighted as an area that could expand this field of research. By studying the thermochemistry of Am and Cm extraction from nitrate media by HDEHP using a calorimetric approach and van't Hoff analysis, we have begun to further expand our thermodynamic understanding of this liquid-liquid extraction system. The results from the two methodologies used for the determination of the  $\Delta H$  extraction will be compared and the challenges of thermochemical evaluation of liquid-liquid distributions will be summarized.