

## Uranium purification by partition methods



<b>Laboratory / Team</b>	Institute of Nuclear Physics, Orsay (IPNO) – physics and radiochemistry of nuclear energy - Back-end of the Nuclear Fuel Cycle and Spallation Physics Team (PACS) <a href="http://ipnwww.in2p3.fr/Physique-et-Radiochimie-de-l-energie-Nucleaire">http://ipnwww.in2p3.fr/Physique-et-Radiochimie-de-l-energie-Nucleaire</a>
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<b>Main topics</b>	Radiochemistry
<b>Objectives/context</b>	Natural uranium consists of the isotopes $^{234}\text{U}$ (0.005%), $^{235}\text{U}$ (0.72%) and $^{238}\text{U}$ (99.275 %) that are $\alpha$ emitters of half-life $2.46 \cdot 10^5$ years, $7.13 \cdot 10^8$ years and $4.47 \cdot 10^9$ years, respectively. But the main dose rate of $\text{U}_{\text{nat}}$ comes from its daughters that accumulate in uranium tailings and stocks of yellow cake. To limit the dose rate in uranium processing facilities, some radioactive daughters must be eliminated. Uranium purification can be carried out by partition methods like solvent extraction or chromatography, techniques that are widely used in radiochemistry.
<b>Equipment / resources / tools / software used</b>	Glove box or fume hood, gamma and alpha spectrometry, PERALS
<b>Level / Duration / Period</b>	L3, M1 or M2 / 2 to 5 months / training period October 2018 – July 2019
<b>Number of trainees</b>	Possible pairing / Certificate of fitness to work under ionizing radiation mandatory
<b>Course description / main tasks</b>	
<p>The affinity of some radionuclides (RNs) in acidic media towards solid support (ion exchange resin, silica) will be characterized. For that purpose, solutions containing the radionuclides at tracer scale will be contacted with the solid phase. After centrifugation, the RNs concentration will be determined by PERALS (photon electron rejecting <math>\alpha</math> liquid scintillation) for uranium and gamma spectrometry (<math>^{227}\text{Th}</math>, <math>^{223}\text{Ra}</math>, <math>^{211}\text{Bi}</math>...). The student will carry out the following tasks:</p> <ul style="list-style-type: none"> <li>– preparation and characterization of acidic media and RNs solutions</li> <li>– sorption experiments</li> <li>– determination of RNs concentration in aqueous phase by PERALS or <math>\gamma</math></li> <li>– determination of the distribution coefficients <math>K_d</math></li> <li>– analysis of experimental data (<math>K_d</math> variations as function of acid concentration, ratio mass of solid support/solution, type of acid)</li> <li>– writing report</li> <li>– presentation of the results within the team</li> </ul>	
<b>Skills acquired on completion of the course</b>	
<ul style="list-style-type: none"> <li>• Ion exchange and extraction chromatography: principle and implementation</li> <li>• Determination of separation factors</li> <li>• Gamma spectrometry, PERALS: principle and implementation</li> <li>• Knowledge of regulations associated with work in a controlled area</li> </ul>	