Maria Gabriela Cuyar

Major: Chemical Engineering
University: Polytechnic University of Puerto Rico
Faculty Mentor: Dr. Silvia Jurisson
Mentor Department: Chemistry
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Comparison of different methods for removing metals from resins for applications to radiochemical seperations

Maria Gabriela Cuyar, Hendrik Engelbrecht, Cathy Cutler and Silvia Jurisson

Metallic contamination has been a problem for many years in the environmental field. Soil, water and air have been polluted by many different trace metals that finally affect humans by consumption of natural products, liquids and simple respiration, and have the potential of producing some toxicity in the body, leading to different illnesses such as cancer. On the other hand medical and scientific studies have found many metals such as the radiolanthanides and M(3+) metals, to be useful for therapeutic purposes, including cancer treatment, and targeting specific organs in the human body by the use of radioactive isotopes. The overall goal of this project was to compare the different techniques for cleaning various resins being used in the production of radiolanthanides at MURR. This was done to determine what metals and in what quantities these metals were removed by each method. Resins are known to contain extraneous metals such as copper, zinc, calcium and iron, which can leach out of the resin and contaminate the sample of interest resulting in low radiolabeling yields. The methods examined were different acid washes of various molarities and the use of different ligand systems (chelators) to determine which method would remove the most metals without affecting the resolving power of the resins. A variety of resins that are being investigated for performing separations, extractions and clean up of radiolanthanides of interest for radiotherapy were examined. Radiolanthanides are being developed and bound to biomolecular targeting agents to treat and provide palliative care for a variety of cancers. The purity of these radiolanthanides are essential as impurities in the original target material can result in unwanted impurities that can lead to environmental waste issues and dose concerns to workers and patients. In addition, since the chelates that attach these radiolanthanides to the targeting molecule are nonselective and will bind all +3 and many +2 metals, this would lead to low radiolabeling yields and therefore result in a lower dose being delivered to the target organ. The radiopharmaceutical developed by means of this procedure is one that selectively targets only a certain receptor and effectively irradiates only the tumor without affecting the surrounding organs. Thus is a non-invasive treatment that is better tolerated by the patients, as compared to other treatment methods such as chemotherapy, radiation treatments and surgery. The resins were washed and the eluents analyzed by ICP-MS (Inductively Coupled Plasma Mass Spectrometry). This technique determines the amount of metals present in the eluents collected from each wash. The elements expected to be found in these samples are the common metals found in the environment, like iron, calcium, aluminum, zinc, chromium, copper, nickel, etc. Furthermore, by performing simple radiolabeling studies with Lutetium-177 and 1,4,7,10-tetraazaciclododecane-1,4,7,10-tetraacetic acid (DOTA), a ligand commonly used to bind radiolanthanides, the washes were compared. The percentage labeled complex was compared to evaluate which method resulted in the best extraction of unwanted metals.