Abstract

Hypertension is one of the most common diseases among human population. In 2009–2010, for example, 23.1% of adult Americans had prehypertension, while an additional 29.5% had hypertension. Potassium is the most abundant cation in intracellular fluid, and it has been long considered as a potential curative source for hypertension and associated cardiovascular diseases. Maintaining the proper distribution of potassium across the cell membrane is critical for normal cell function, as abnormal levels of serum potassium exacerbate myocardia, chronic kidney disease (CKD), and can even lead to higher mortality. Potassium is often measured in serum, plasma, or urine using selective electrodes. These measurements are not accurate markers of total body potassium. In addition, these biomarkers cannot be used to determine the bio-kinetics of potassium in the body. In-vivo neutron activation analysis (IVNAA) is a unique and powerful technique for elemental analysis in human body which has potential to quantify potassium and monitor potassium kinetics. It uses a low energy neutron source to stimulate the production of characteristic gamma rays from a sample. The resulting gamma rays are detected and analyzed to identify and quantify the elements within the sample. Our lab developed a prototype DD neutron generator based IVNAA system for metal quantification. In this project, we aim to design and construct a system with even higher sensitivity and lower radiation dose, which would be a reliable, quick, and accurate way to measure potassium and monitor potassium kinetics.