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A New Way for Separation of 99mTc from Cyclotron Irradiated 100Mo Foil

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99mTc is at present, without any doubt, the most extensively used radiotracer in nuclear medicine imaging [1]. Usually, the operation period of research reactors used for the production of 99Mo is about 40-50 years. Most reactors used in the preparation 99Mo have already reached this age, or will reach in the near future. There is a growing interest in exploring cyclotron production of 99mTc using 100Mo(p,2n)99mTc reaction, a method first proposed by Beaver and Hupf nearly 40 years ago [2]. There is a real necessity to develop separation technologies suitable for use in novel modes of 99mTc production. Separation of technetium from irradiated molybdenum may be carried out using either "wet"or "dry"chemical processes. "Wet"separation techniques require dissolving of the metallic target under oxidative conditions and then separation of pertechnetate can be achieved using one of many strategies, e.g. liquid–liquid extraction [3], ion-exchange chromatography [4], aqueous biphasic extraction chromatography using ABEC resin [5] and electrochemistry [6].
The aim of our studies is to investigate the possibility of separating microquantities pertechnetate from macroquantities molybdate anions. These studies have been carried out using a natural molybdenum powder. Molybdenum forms heteropolyacids such as ammonium molybdenum phosphate (AMP) precipitating as a characteristic yellow solid. In the first step metallic molybdenum target is dissolved in 3,5 M HNO3. Next, triammonium phosphate is added and Mo is precipitated from the solution according to the reaction:
(NH4)3PO4 *3H2O + 12MoO42- + 24H+ (NH4)3P(Mo3O10)4⊠ + 5H2O
We have optimized four parameters of the process: NH4NO3 and (NH4)3PO4•3H2O concentrations, temperature and the time of precipitation. From performed studies it can be concluded that the proposed process is promising and allows fast separation of macroamounts of Mo from the solution without co-precipitation of 99mTc. After optimization of the precipitation conditions, the lowest concentration of MoO42- was only 0.37 mg ml-1. The final solution may be required additional purification by separation of 99mTcO4- by ABEC resin, extraction by HDEHP or by nano-ZrO2.

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