DEVELOPMENT AND PRODUCTION OF $^{81}Rb/^{81m}Kr$ RADIONUCLIDE GENERATOR IN NPI

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The cyclotron produced ^{81}Rb ($T_{1/2}$ = 4.58 H) and its daughter ^{81m}Kr ($T_{1/2}$ = 13.3 s) constitute a radionuclide generator for nuclear medicine, being used as a common tool for ventilation and/or perfusion studies carried-out by the SPECT technique. The main advantages of this generator are good imagine properties and low radiation dose in tissue. A typical production method of ^{81}Rb employs irradiation of pressurized Kr gas on an accelerator. The radioactive product is gained by leaching the target chamber with water. The medical Rb/Kr generator is usually designed as a cartridge containing porous solid medium loaded by radioactive Rb compound. The cartridge is connected with a carrier-gas source in a shielded unit. At a nuclear medicine department, the radioactive Kr is then eluted and administered under controlled flow conditions.

Due to the short half-life of the parent ^{81}Rb, these systems are usually manufactured and distributed near the production area. Since there exists an actual call for Rb/Kr systems in CZ, it was decided to develop an appropriate target and generator assembly in NPI.

In the last year, our accelerator laboratory accomplished two new irradiation positions on the U-120M cyclotron facility. Both of them are located at the outer proton beams with the energy and intensity suitable for production of many medical radionuclides. At the same time a new clean laboratory complex was started to build up at the accelerator building. This area will be entirely intended for the production of radiopharmaceuticals. Our current results dealing with the development of the Rb/Kr generator are presented in this paper.

The Kr target is a tube drilled in a 'soft' aluminum alloy rod of checked purity. The interior of the tube is coated with a thin Ni layer and the chamber is cooled by water. The surface density of the target gas is 530 mg/cm^2 of Kr_{nat}, the starting pressure is 20 atm (NTP). Using this system, 0.5 Ci of ^{81}Rb (EOB) is produced in one 5-hour's session. The Rb isotopes produced in the target are solved in water containing Rb carrier and the radioactive solution is transported by a remote system to a small hot cell in the cyclotron area. All target operations are computer controlled. The chemical yield is over 85% of total ^{81}Rb. The final product is packed and transferred to the clean laboratory, where the generators are manufactured.

The generator consists of a supported strip of ion-exchange paper, which is placed into specially designed cartridge. After wetting the strip, the Rb radioactivity is loaded on the paper by slow passing of a portion of Rb solution followed by washing. The efficiency of the Rb retention is higher than 98%. The cartridge is then dried and the generator is packed. The entire production is carried out in clean hot cells, using precise PC operated dispensers. The NPI laboratories have made the design and set-up of all devices, including the target, transport systems, dispensers and software. The final generator assembly is carefully tested in accordance with the standard quality regulations. The following parameters are declared: 1. biocompatibility of the product, 2. radioactivity of ^{81m}Kr in the gaseous phase, 3. radio-chemical purity of the eluent and 4. tightness of the system. At present, the generator is going to be submitted to the authorities for the certification procedure.