

CYCLOTRON PRODUCED RADIOPHARMACEUTICALS***K. Kopic̄ka, M. Fišer, P. Hradilek, P. Hanč and O. Lebeda****Nuclear Physics Institute, Academy of Sciences of the Czech Republic**CZ-250 68, Řež, Czech Republic*

The cyclotron may be used as an important source of radionuclides. Some of those radionuclides may serve for the production of radiopharmaceuticals. The lecture deals with basic information relating to various aspects of those compounds. In comparison with the radionuclides / compounds used for non-medical purposes, the radiopharmaceuticals are subject to a broader scale of regulations, both from the safety and efficacy point of view; besides that there are both radioactive and medical aspects that must be taken into account for any radiopharmaceutical.

According to the regulations and in compliance with general rules of work with radioactivity, radiopharmaceuticals should only be prepared / manufactured under special conditions, using special areas and special equipment and applying special procedures (e.g. sterilisation, disinfection, aseptic work). Also, there are special procedures of cleaning and maintenance. Sometimes the requirements for the product-safety clash with those for the safety of the personnel; several examples of solution pertaining to those cases are given in the lecture.

In most cases, a radiopharmaceutical consists of a radionuclide and a non-radioactive part of the molecule (carrier). There are requirements both for the radionuclide (type of radiation, energy, half-time, radiation toxicity and so on) and for the carrier (type of compound, its affinity to special body organ target, toxicity, stability and so on). Various iodine isotopes (^{123}I , ^{124}I , ^{125}I , ^{131}I) and various iodine-labelled compounds may serve an example of a broad spectrum of radiopharmaceuticals along with examples of various labelling procedures. Special attempts should be taken in quality assurance and quality control of the products. In order to provide for a safe and time-limited distribution, special analytical methods had to be developed. The contribution deals with several examples of such methods and procedures. The application area of radiopharmaceuticals lies within the area of medical purposes; both diagnostic and therapeutic radiopharmaceuticals are known and used, however, the latter form a minor part of application. There are various ways of administration of radiopharmaceuticals but, apart from minor exceptions, most of the radiopharmaceuticals are administered parenterally. This part of the lecture deals with the conditions of distribution, delivery and administration of the radiopharmaceuticals – their indication and use; last but not least, several examples of the importance of logistics are given. In addition to the general information on radiopharmaceuticals, the most important cyclotron-produced radionuclides for the purpose of production of radiopharmaceuticals, along with their methods of manufacturing, are mentioned. The following aspects of the production are dealt: target technique, technology of radionuclide production, carrier labelling, special conditions of the production, analytical aspects and problems of a timely delivery. Special attention will be paid to a most prospective part of radiopharmaceuticals – PET products, their physical principle and logistic aspects.