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Formation of Medical Radioisotopes 111In in Photonuclear Reactions

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The possibility of the photonuclear production of radioisotope 111In is discussed. The 111In radionuclide is among those that are used most frequently in diagnostics since it is a short lived (T1/2 = 2.8 day) gamma emitter (Eγ = 171.3, 245.4 keV). Moreover, this radioisotope is used in Auger therapy.
Enriched tin targets 112Sn were irradiated at the linear electron accelerator of Alikhanian National Science Laboratory (Yerevan) at the energy of 55 MeV and the average current of 1 μA. The yields of products formed in the target were measured by the gamma-activation method. The activity induced in the targets was measured with the aid of a high-purity germanium (HPGe) detector.
The bremsstrahlung photon flux is formed when electrons pass through the target converter. The protons flux was monitored by natCu thin foil (thickness of 50 μm) via 65Cu(γ, n)64Cu and 63Cu(γ, 2n)61Cu reactions. Radioactive nuclei formed in the target during the irradiation were identified by their half-lives and the energies of characteristic gamma lines. The yield Y(Eγmax) of a photonuclear reaction (γ,x) characterized by a threshold Eth and a cross section σ(Eγ) is the convolution of the cross sections and the effective photon energy spectrum W(Eγ max,Eγ).
The yield of the reactions 112Sn(γ,x)111In, 112Sn(γ,n)111Sn, 112Sn(γ,2n)110Sn, 112Sn(γ,3n)109Sn, 112Sn(γ,pn)110mIn, 112Sn(γ,pn)110gIn, 112Sn(γ,p2n)109In have been measured. The experimental data in question were compared with their theoretical counterparts calculated on the basis of the TALYS 1.95 code.
The yield of 111In ensures the production of samples without a carrier that have a high activity and which do not contain admixtures of long-lived indium isotopes.

Author: BAKHSHIYAN, Tiruhi (Institute of Applied Problems of Physics of the National Academy of Sciences of the Republic of Armenia IAPP NAS RA)

Co-author: HOVHANNISYAN, Gohar (Yerevan State University)

Presenter: BAKHSHIYAN, Tiruhi (Institute of Applied Problems of Physics of the National Academy of Sciences of the Republic of Armenia IAPP NAS RA)

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