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52Mn (t1/2 = 5.59 d, β+ = 29.6%, Eβave = 0.24 MeV) shows promise in positron emission tomography (PET) and in dual-modality manganese-enhanced magnetic resonance imaging (MEMRI) applications including neural tractography, stem cell tracking, and biological toxicity studies. The extension to bioconjugate application requires high specific activity 52Mn in a state suitable for macromolecule labeling. To that end a 52Mn production, purification, and labeling system is presented, and its applicability in preclinical, macromolecule PET is shown using the conjugate 52Mn-DOTA-TRC105. 52Mn is produced by 60 µA, 16 MeV proton irradiation of natural chromium metal pressed into a silver disc support. Radiochemical separation proceeds by strong anion exchange chromatography of the dissolved Cr target, employing a semi-organic mobile phase, 97:3 (v:v) ethanol: HCl (11M, aqueous). The method is 62 ± 14% efficient (n=7) in 52Mn recovery, leading to a separation factor from Cr of (1.6 ± 1.0) x10^6 (n = 4), and an average effective specific activity of 0.8 GBq/μmol (n = 4) in titration against DOTA. 52Mn-DOTA-TRC105 conjugation and labeling demonstrate the potential for chelation applications. In vivo images acquired using PET/CT in mice bearing 4T1 xenograft tumors are presented. Peak tumor uptake is 18.7 ± 2.7 %ID/g at 24 hours post injection and ex vivo 52Mn biodistribution validates the in vivo PET data. Free 52Mn2+(as chloride or acetate) is used as a control in additional mice to evaluate the non-targeted biodistribution in the tumor model.