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# PRODUCTION OF HIGH SPECIFIC ACTIVITY Y-86 USING ELECTROCHEMICAL SEPARATION

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**Purpose:** Yttrium-90 is one of the most widely used radionuclides for targeted radiotherapy. However, Y-90 only emits β-particles making accurate dosimetry difficult. Availability of the positron-emitting Y-86 would allow for biodistribution determination and dosimetry calculation on an individual patient basis with PET. The aim of this study is to produce high purityY-86 in an efficient, cost-effective manner for routine use and supply. **Methods:** Y-86 was produced via the $^{86}Sr(p,n)^{86}Y$ nuclear reaction. 50 mg of enriched $SrCO_3$ was irradiated under a 2 μA beam current for <3 hr. The target was dissolved in 2.8M $HNO_3$ acid bath. The dissolved solution was transferred to electrochemical cell. The solution was diluted with water, and 1ml of 0.5M NH4NO3 electrolyte was added. The pH of the solution was adjusted to 2.5-3. The solution was electrolyzed at 1200 mA (40 min) using the two Pt plate-electrodes. A second electrolysis (150 mA for 20 min) was performed in fresh 3 mM $HNO_3$ using one Pt plate and the Pt wire as electrodes. The Y-86 was collected from the Pt wire using 2.8M $HNO_3$/EtOH. After evaporation, Y-86 was reconstituted in 100μl of 0.1 M HCl. Specific activity was determined via titration of $^{86}Y(OAc)_3$ with DOTA. **Results:** Average yields of 2.2 mCi/μA · h were achieved which were 58% of theoretical. The major radioisotopic contaminants at EOB were identified to be $^{86m}Y$, $^{87}Y$, and $^{88}Y$. Over 95% of the Y-86 was adsorbed on the Pt plate during the first electrolysis, with >97% being re-collected on the Pt wire after the second. **Conclusion:** Y-86 was produced in good yield using a small amount of recyclable $SrCO_3$. The electrochemical cell with three Pt electrodes significantly accelerated the electrodeposition speed of Y-86. High pure Y-86 was reconstituted in a final small volume and DOTA was labeled successfully with purified Y-86.

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# Comparison of in vivo Distribution of Estrogen Receptor β Selective [F-$^{18}$]FEDPN in α/βERKO Mice with [F-18]FES

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**Purpose:** Estrogen receptor β (ERβ) could be a factor that determines the level of estrogen action in certain estrogen target tissues. ERβ is found in breast cancer, and its levels relative to ERα decline with disease progression. Thus, the independent quantification of ERα and ERβ levels in breast cancer by imaging might be predictive of responses to different hormone therapies. **Methods:** The hydroxy group of (2R,3S)-2,3-bis(4-benzyloxyphenyl)-5-hydroxy-pentanenitrile was converted to the fluorine compound using DAST and the benzyl groups were removed by hydrogenation to give FEDPN. For the 18F labeling 5-tosyl-(2R,3S)-2,3-bis (4-methoxyethoxymethyl-phenyl)-pentanenitrile was prepared. This substrate and $^{18}F$ were heated 35 sec using a microwave. Following deprotection (3M HCl) and HPLC purification, the 18F labeled FEDPN was isolated. Biodistribution studies were carried out using immature female Sprague-Dawley rats and ERα- and ERβ-knockout mice. **Results:** The synthesized FEDPN has an 8.3-fold absolute affinity preference for ERβ. [$^{18}$F]Fluoride-labeled FEDPN was prepared from a toluenesulfonate precursor, which provided [$^{18}$F]FEDPN with a specific activity greater than 3100 Ci/mmol after HPLC purification. Biodistribution studies revealed specific uptake of [$^{18}$F]FEDPN in the uterus and ovaries. Experiments using ERα- and ERβ-knockout mice demonstrated the expected ERα-subtype dependence in the tissue uptake of [$^{18}$F]FES, which has a 6.3-fold preference for ERα. The tissue uptake of [18F]FEDPN in the ER knockout mice showed some evidence of mediation by ERβ, but the levels of specific uptake of this agent were relatively modest. **Conclusion:** Based on our results, imaging of ERα can be done effectively with [$^{18}$F]FES, but imaging of ERβ will likely require agents with more optimized ERβ binding affinity and selectivity than [$^{18}$F]FEDNP..