P1. POSTERS: METHODOLOGY, THERAPY

P1-1
DEVELOPMENT OF SOLID TARGET AND PURIFICATION FOR THE PRODUCTION OF SCANDIUM-44

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INTRODUCTION: Scandium-44 (^{44}Sc) is a promising radionuclide that has favorable half-life ($t_{1/2}$ = 3,97 h) and decay characteristics ($E\beta^+_{av}$ = 632 keV) for PET imaging. Currently, natural calcium or enriched calcium carbonate-graphite powder mixture is used as target material to produce ^{44}Sc. Our goal was to develop a solid target and compare two novel separation method to obtain ^{44}Sc in cyclotron from the proton irradiation of natural calcium target.
METHODS: The irradiated calcium target was dissolved in 3 molar hydrochloric acid and purified with syringe filter or ion exchange resin (DGA). Filter purification: 400 μL crude ^{44}Sc solution was mixed with 800 μL 3%-ammonia solution to adjust the pH to > 10. Thereafter the entire solution was passed through 0.22 μm filter to trap ^{44}Sc in colloidal form. To wash out the impurities, 5 mL water was passed through the filter. ^{44}Sc was eluted with 0.1 molar HCl. DGA purification: the crude ^{44}Sc solution was loaded onto the DGA column. To remove the impurities, 3 molar HCl and 1 molar HNO_3 was passed through the column. ^{44}Sc was eluted with 0.1 molar HCl. The labeling efficiency of ^{44}Sc was tested with different concentration of DOTA solution and NODAGA-AMBA peptide.
RESULTS: In case of filter purification 30.9 MBq activity was loaded onto the filter. The trapped activity was 29.5 MBq and 29.3 MBq remained after the washing. Eluted activity was 25.5 MBq in 0.1 M HCl. The labeling test was < 95% by 1 micro molar DOTA solution but the yield was only 17.5% using NODAGA-AMBA peptide. In case of DGA purification 115 MBq activity was loaded onto the filter. The trapped activity was 114 MBq and 109 MBq remained after the washing. Eluted activity was 89.3 MBq in 0.1 M HCl. The labeling efficiency was < 98% by 1 micro molar DOTA solution and the yield was 85% using NODAGA-AMBA peptide.
CONCLUSION: ^{44}Sc was successfully produced and purified for peptide labeling. In our next step, we are planning to use enriched calcium carbonate that is necessary to produce isotopically pure ^{44}Sc and allowing its use for clinical PET imaging.

P1-2
OPTIMIZATION OF C-11 LABELED METHYL-IODIDE PRODUCTION

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INTRODUCTION: 11C labelled tracer molecules are often used in PET examination. In most cases the labeling procedure is methylation with [11C]methyl-iodide reagent. We applied the Tracer Maker synthesis panel developed by Peter Larsen to produce [11C]MeI and [11C] Me-Triflate in order to synthesize [11C] isotope labeled radiotracers. Our objective was to optimize parameters of synthesis panel.
METHODS: We produced [11C]MeI by the gas phase method using the Tracer Maker synthetsizer. [11C]CO2 generated in the target was reacted with H2 at 360 °C in the presence of Ni catalyst. The resulting [11C]CH4 was separated from the waste gases by freezing at –190°C on Hayesep adsorbent. Upon heating the Hayesep the [11C]CH4 was released at –10°C and directed to the recirculating circuit containing an iodine column where methane reacted with the sublimated iodine vapours at 720°C. The formed [11C]MeI was adsorbed on Hayesep again, and released by heating to 200°C.
The operational parameters of the module were systematically varied in order to find those, which are influencing the yield. The pressure drop in the system was minimized using a multi stage leak-check program. We determined the decay corrected radioactivity produced in the cyclotron with 44 μA beam current and 2 minute irradiation time. The activity of the produced [11C]MeI with the same parameters was compared to this value. We varied the time of the regeneration of the adsorbents, the flow rate of the target gas, the temperature of the iodine and the high temperature furnace and the flow rate of the recirculation circuit. in order to study the dependence of the yield on these parameters.
RESULTS: The activity of the [11C]CO2 produced by the cyclotron was 12 GBq in our measurements. The initial yields of the system with default settings were 36 ± 3%. With the increase of temperature of the iodine oven only 2% increase was achieved. We observed no change in yield by increasing the flow rate of the recirculation circuit and the temperature of the high temp. oven. Optimization of the target gas flow, increase of the regeneration time, achieving appropriate starting temperature and minimizing pressure drops of each stages of the process resulted in a 52 ± 2% [11C]MeI yield. The radiochemical purity was more than 98%.
CONCLUSION: Based on our measurements, the critical part of the synthesis process was found to be the adsorption of the [11C]CO2 on the molecular sieve. The other parameters showed only minor effect on the yield.

P1-3
QUALITY CONTROL OF RENOSCINT-MAG3: COMPARISON OF RADIOCHEMICAL QUICK TESTS AND PHARMACOPEIAL RADIO-HPLC METHOD

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INTRODUCTION: A growing demand arises by clinical users for easy-to-handle, rapid tests for quality control of radiopharmaceuticals after labelling. In our experiments we compared easy-to-handle, quick tests to pharmacopeial radiochemical purity method.
METHODS: Renoscint-MAG3 (Medi-Radiopharma) preparations were labelled with ^{99m}Tc isotope in the maximal activity concentration according to the manufacturer's instructions. Thin layer chromatography (TLC) and solid phase extraction (SPE) methods were performed and compared to pharmacopeial radio-HPLC method (PhEur). Ethyl acetate: butanone or water: acetonitrile mobile phase were applied on TLC layers (ITLC-SG or GMCP-SA or Whatman 3 mm). Evaluation of developed layers were done by using miniGita TLC scanner (Raytest). SPE was performed on SepPak C18 cartridge (Waters) with hydrochloric acid, phosphate buffer and ethanol as eluents. The activity of the factions were measured with dose calibrator (Isomed 2010). The reference method was performed using Agilent 1200 HPLC system with Gabi flow through radiodetector (Raytest).
RESULTS: The solid phase extraction showed 0.6 to 1.3% lower radiochemical purity (RCP) results than those of radio-HPLC method. The amount of hydrophilic impurities correlated well as measured by using the two methods (SPE and HPLC). Difference of RCP results came from the amount of lipophilic impurities. The amount of hydrophilic impurities separated on instant thin layers (ITLC-SG, -SA) were similar to those of HPLC reference method. Evaluated the two type of layers the ITLC-SG method gave a more efficient separation and approached better the results of the reference method (difference +0.3–0.9% compared to the HPLC method). Reduced hydrolyzed technetium colloids were not detected on the Whatman 3 mm layer.
CONCLUSION: Improving the efficiency of the elution of ^{99m}Tc-mertiatid (MAG3) fraction might optimize the separation. Using ITLC-SG layer in ethyl acetate: methyl ethyl ketone mobile phase for determination of hydrophilic impurities is more accurate and efficient than using GMCP-SA layer. All the quick tests (TLC and SPE) resulted in radiochemical purity results that meet the requirements of the pharmacopeia and the SmPC. All the investigated quality control quick tests are suitable for rapid quality checking of Renoscint-MAG3 after labelling at clinical site as compared to reference pharmacopeial radio-HPLC method.
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P1-4
EFFECT OF STORAGE IN DISPOSABLE POLYETHYLENE/POLYPROPYLENE SYRINGE ON THE QUALITY OF NANOSCAN RADIOPHARMACEUTICAL

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INTRODUCTION: Effect of storage in disposable polyethylene/polypropylene (PE/PP) syringe was studied on the quality of Nanoscan 500 micrograms radiopharmaceutical in order to support economical clinical radiopharmaceutical usage.
METHODS: Samples (n = 5) were taken from ^{99m}Tc-isotope labelled Nanoscan radiopharmaceutical (Medi-Radiopharma) into disposable PE/PP syringes (B.Braun) and stored for 10 hours at room temperature. The quality control of radiopharmaceutical in syringe was evaluated by using thin-layer chromatography (TLC), particle size distribution (dynamic light scattering, DLS) according to pharmacopeia and SmPC of the manufacturer. Measurements were done in every 2 hours after labelling until 10 hours. TLC method was performed on ITLC-SG layer in methyl-ethyl-ketone and saline 0.9%. Developed TLC layers were evaluated by using miniGita TLC scanner (Raytest), colloidal size distribution by using Zetasizer ZS (Malvern). Syringe retention was also measured with dose calibrator (Isomed 2010). Standard bioassay was executed in Wistar rats administered Nanoscan radiopharmaceutical, which has been stored in disposable syringes. Whole-body mapping was performed by using Nucline gammacamera (Mediso), organ activities were measured with 2480 Wizard2 automated gamma counter (Perkin Elmer).
RESULTS: Chromatography for unbound, free pertechnetate showed no impurity neither in case of samples from ampoules nor samples from syringes at any time points. TLC for non-colloidal, soluble species resulted in no difference between samples from glass vial and PE/PP syringes at any time points, and all the results (0.0–0.4%) met requirements of the pharmacopeia and the SmPC. Mean colloidal size (15.5–16.0 nm) and polydispersity (PdI = 0.33–0.44) measured with DLS method showed no changing tendency in the investigated time interval. No change was observed in syringe retentions (8.3 ± 0.5%) during the storage up to 10 hours. No difference was found in biological distribution of Nanoscan radiopharmaceutical stored in disposable PE/PP syringes compared to the distribution of radiopharmaceutical stored in its glass ampoule when bioassay were performed in rats. There was no result from any of the applied methods which differed between samples stored in its own glass ampoule and in disposable PE/PP syringes in the investigated 10-hour time period.
CONCLUSION: Storage in disposable PE/PP syringes had no influence on the quality of Nanoscan product, consequently radiopharmaceutical stored in PE/PP syringe passed pharmacopeial requirements up to 10 hours.
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