A comparison of labeling characteristics of manual, lyophilized-kit, and automated synthesis methods for Lutetium-177 PSMA Radiopharmaceuticals

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Introduction:

Since its introduction, labor-intensive methods have been heavily relied on to synthesize Lutetium-177 using peptides such as DOTA-TATE and now PSMA. A manual method of synthesis is also notorious for the introduction of batch-to-batch variances. In line with current Good Manufacturing Principles (GMP) as well as Good Radiopharmaceutical Practice (GRPP), more systems are making a move from manual synthesis methods of Lutetium-177 with peptides to more automated or Lyophilized sterile-based synthesis methods. These alternative methods, when validated, can streamline processes and open possibilities of upscaling synthesis runs on a grand scale. These also solve several GMP non-conformances introduced by manual labelling by increasing process reliability and rigid conformance to the quality parameters set out for Lutetium-177 peptide synthesis.

Methods:

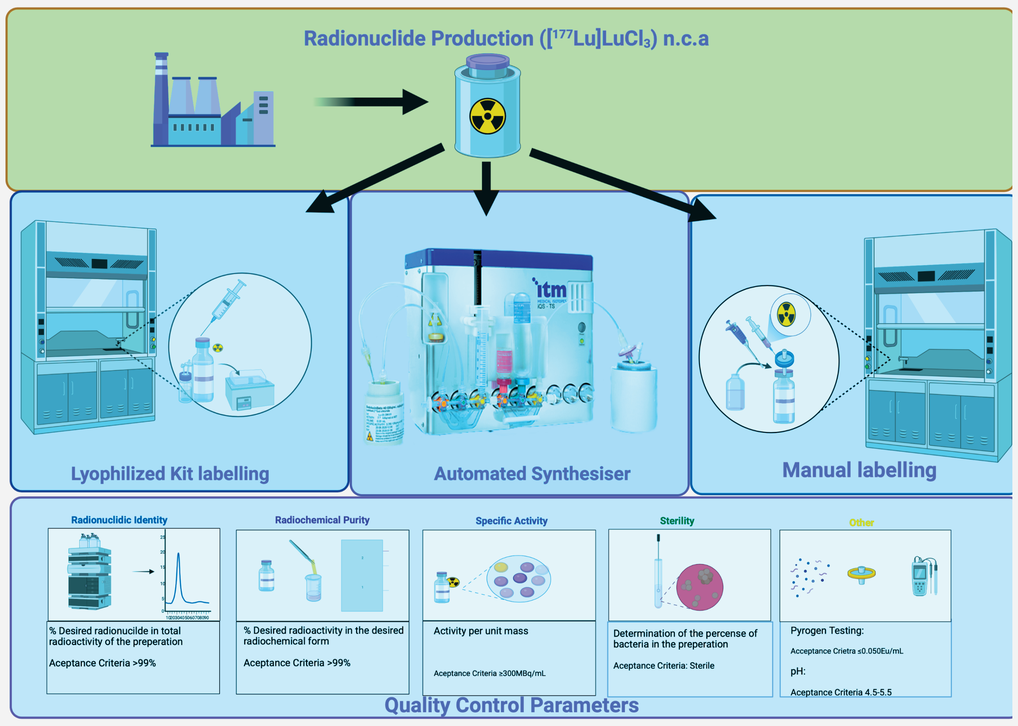

Figure 1: Radiolabeling methods investigated

Results:

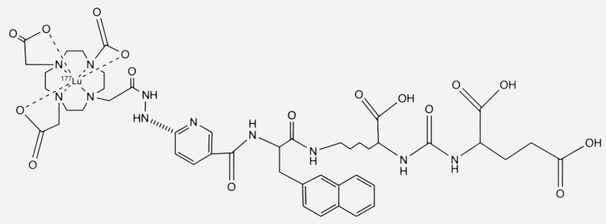

Figure 2: Radiolabled Lutetium-177 DOTA-iPSMA

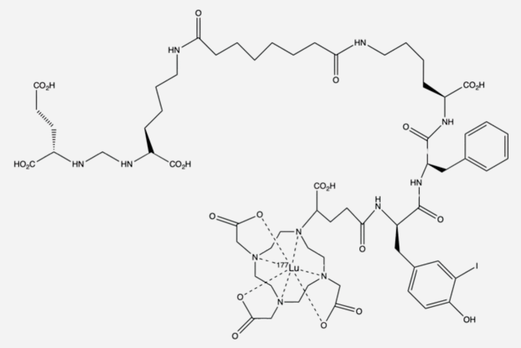

Figure 3: Radiolabeled Lutetium-177 PSMA I&T

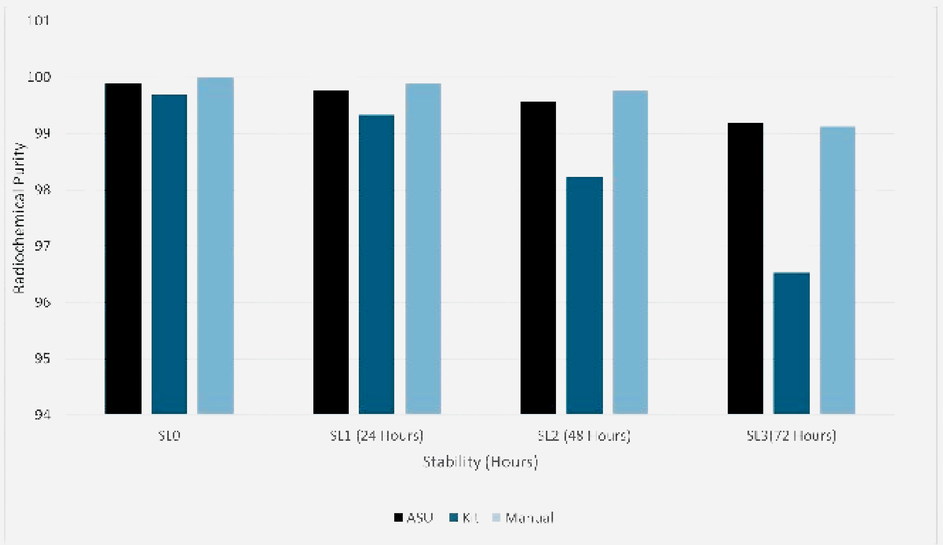

Figure 4: Radiochemical purity of different Lutetium-177 PSMA peptides (I&T and DOTA-iPSMA) over 72 hours

Method	ASU	Manual	Lyophilized Kit
Whole-body exposure (μSv/hr)	1,32	8,42	6,42
Extremity Exposure (mSv)	0,2	0,88	0,79
Operator time (min)	30min	45min	45min

Table 1: Radiation safety data for Lutetium-177 Radiolabeling methods

Conclusion:

Lutetium-177 radiolabeling with PSMA molecules such as PSMA-I&T as well as DOTA-iPSMA has proven to be robust and reliable when performed using a validated method. Labeling characteristics of the PSMA molecules evaluated have successfully met the required criteria for safety and quality as required of radiopharmaceuticals. The stability profile of the radiolabeled doses has shown that stability of Lutetium-177 PSMA is up to 3 days. Lyophilized Kits when compared to manual labelling and automatic synthesis, have shown to be more a cost-effective method, while still providing the same level of quality and safety as the other two methods. Each method has proven to be robust and reliable. The selection of an ideal method for any facility is therefore dependent on the resources available in that facility, as guided by IAEA operational levels.

References:

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