The Emerging Value of Stable Freeze-Dried Kit Formulations for Fast Clinical Translation of Radiopharmaceuticals in Targeted Imaging and Therapy

Emilija Janevik-Ivanovska[1], Sanja Vranješ-Đurić[2], Paulina Apostolova[1], Katarina Davalieva[3], Petre Makreski[4], Icko Gjorgoski[4], Marija Arev[1], Drina Janković[2], Marija Mirković[2], Magdalena Radović[2], Darinka Gjorgieva Ackova[1], Katarina Smilkov[1], Hanife Rustemi Ahmeti[1], Nevena Mindizova[1], Aleksandar Dimovski[3], Adriano Duatti[5]

Presenter: Emilija Janevik-Ivanovska

[1]Goce Delcev University Stip, Faculty of Medical Sciences, Republic of North Macedonia
[2]Vinca Institute of Nuclear Sciences, National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Republic of Serbia
[3]Research Center for Genetic Engineering and Biotechnology "Georgi D Efremov", Macedonian Academy of Sciences and Arts, Republic of North Macedonia
[4]University St Cyril and Methodius Skopje, Faculty of Natural Sciences and Mathematics, Skopje, Republic of North Macedonia
[5]University of Ferrara, Department of Chemical and Pharmaceutical Sciences, Ferrara, Italy

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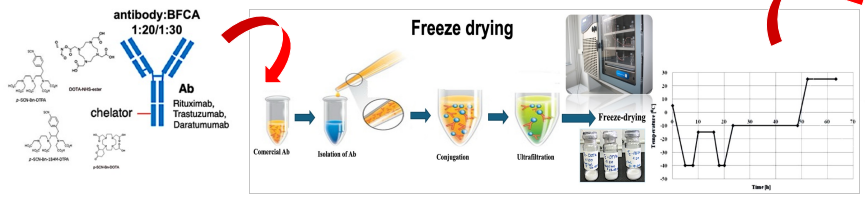
Background

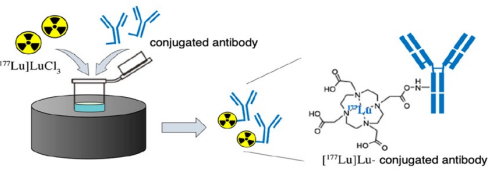
The development of targeted, molecular probe-based radiopharmaceuticals has significantly advanced personalized molecular imaging and therapy.
We present a validated freeze-drying technology for the formulation of ready-to-use kits containing protein/peptide-based radiopharmaceuticals, specifically conjugated antibodies labeled with Lu-177 using various bifunctional chelating agents.
This innovative approach integrates key components of radiopharmaceutical development—including chemical synthesis, radiolabeling, and preclinical validation, facilitating the successful clinical translation of these agents in nuclear medicine by enhancing their stability, usability, and cost-effectiveness.

Materials and methods

Immunoconjugation

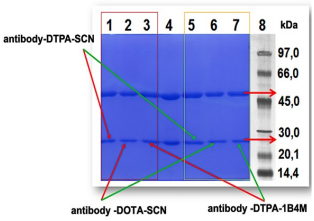


Radiolabeling

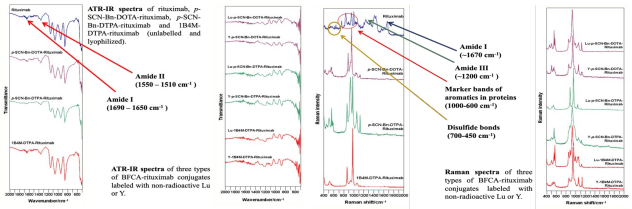


Results

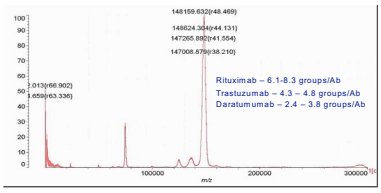
SDS-PAGE electrophoresis of immunoconjugates



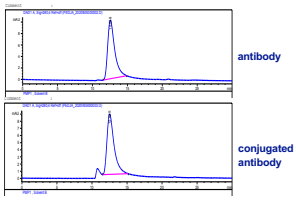
Vibrational spectroscopy techniques
Fourier Transform Infrared Spectroscopy (FTIR) and Raman Spectroscopy (RS)



Laser desorption / ionization using MALDI-TOF-MS

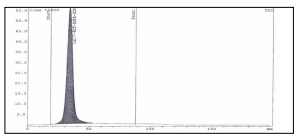


HPLC (SE chromatography / DAD detection)



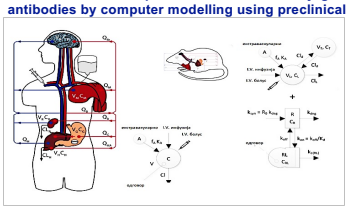
Radiolabeling with ^{177}Lu after reconstitution of freeze-dried kit formulation (370 555 MBq/1mg)

Radiochemical purity ITLC (ammonia acetate:metahol 1:1)



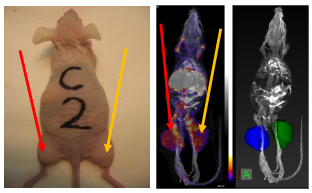
Yield (> 95%)

Prediction of human pharmacokinetics of conjugated monoclonal antibodies by computer modelling using preclinical data

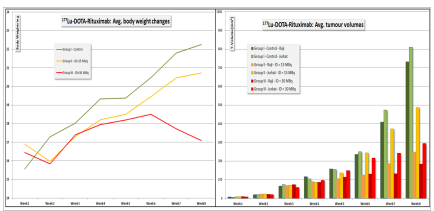


Maxsim2 - Real-time interactive computer simulation for testing pharmacokinetics and pharmacodynamics
Provided by Mats Jirstrand, Department of Systems and Data Analysis, Fraunhofer-Chalmers Centre, Gothenburg, **Sweden**

Animal studies

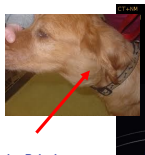


Double xenografts in Nude mice
specific vs non-specific uptake

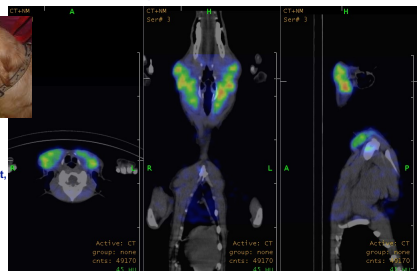


177Lu- DOTA-Rituximab tumour volumes - BWs

Patient – Dog with B limphoma



Dr. Lajos Balogh ,
Gamma-VET Ltd, Budapest, Hungary



Conclusion

Freeze-dried, ready-to-use kits for targeted molecular probe-based radiopharmaceuticals enhance availability, improve precision in molecular imaging, and help optimize therapeutic outcomes. Research involving veterinary cancer patients serves as a vital bridge between in vitro experiments and human clinical studies, supporting the One Health initiative. Collaboration between human and veterinary medicine accelerates the development of novel therapies, ultimately improving healthcare outcomes for both humans and animals.

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We thank the IAEA for funding the CRP project - Development of potential 177Lu radiopharmaceuticals: design, radiolabelling and nonclinical evaluation/F22078.