



New calixarene formulations for a quick uranium skin decontamination

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1- INTRODUCTION

In nuclear industry, uranium skin contamination is the 2nd highest contamination pathway through intact or wounded skin. At that time, no specific emergency treatment exists. A liquid topical formulation was recently developed: a nanoemulsion displaying calixarene molecules, known for their actinides chelation properties^{1, 2}.

2- OBJECTIVES

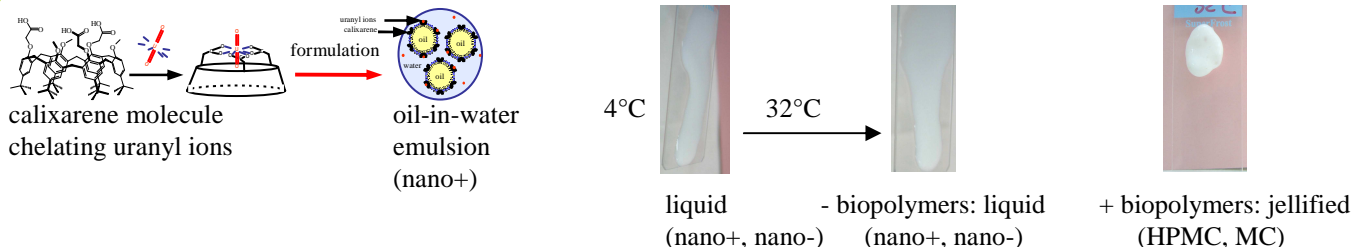
That liquid pharmaceutical formulation is not the best suitable galenic form for a topical delivery, so the objective of the study is to adapt the liquid formulation to a more efficient topical delivery system. We choose to modify the external phase of the nanoemulsion by jellifying the system as a function of the temperature

3- METHODS

Biopolymers, commonly used in cosmetics, like HydroxyPropylMethylcellulose (HPMC) and MethylCellulose (MC), in association with a poloxamer Pluronic F-127, were added to the initial liquid formulation. The formulations were tested by *ex-vivo* experiments: U transcutaneous diffusion kinetics were studied through pig ear skin explants as a function of the application of the different formulations (nano, HPMC, MC, ± calixarene), and uranyl ions were measured by ICP-MS.

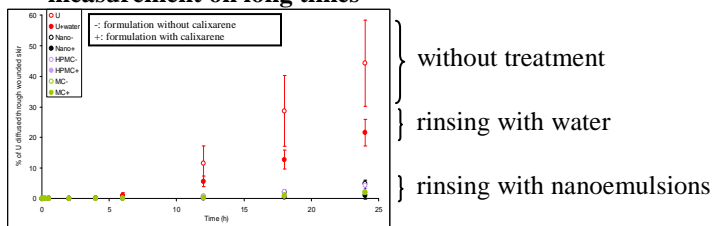
4- RESULTS

A- MODIFICATION OF THE NANOEMULSION: from a liquid to a jellified formulation as a function of T^{°C}



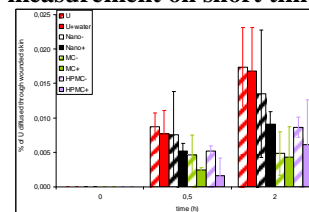
B- EX-VIVO EFFICIENCY EVALUATION

measurement on long times



- Efficiency of the nanoemulsions on U chelation
- Evidence of the interest of developing U chelating formulations

measurement on short times



- U diffusion < 30min => need to chelate U quickly
- Efficiency of the jellified formulations HPMC+ and MC+, 30min from contamination

5- DISCUSSION

Thanks to the addition of biopolymers, the new formulations jellify when they get in touch with the skin. They demonstrate their chelating action on U from the earliest times.

6- CONCLUSION

These results demonstrate the potential interest of these delivery systems for uranium skin decontamination in order to avoid an internal contamination.

References

- 1- Spagnol A., Bouvier-Capely C., Phan G., Rebière F., Fattal E. A new formulation containing calixarene molecules as an emergency treatment of uranium skin contamination. *Health Physics*, 99 (3), 430-434, 2010.
- 2- Spagnol A., Bouvier-Capely C., Phan G., Landon G., Tessier C., Suhard D., Rebière F., Agarande M., Fattal E. *Ex vivo* decrease in uranium diffusion through intact and excoriated pig ear skin by a calixarene nanoemulsion. *European Journal of Pharmaceutics and Biopharmaceutics*, 79, 258-267, 2011.