POLYISOCYANOPEPTIDE HYDROGELS AS EFFECTIVE TISSUE ENGINEERING SCAFFOLDS

Anna Kargaard[a], Rueben Pfukwa[a], Bert Klumperman[a], Alan Rowan[b]

[a]Stellenbosch University, Department of Chemistry and Polymer Science, Private Bag X1, Matieland 7602, South Africa
E-mail bklump@sun.ac.za.
[b]Institute for Molecules and Materials, Radboud University Nijmegen Heyendaalseweg 135, 6525 AJ, Nijmegen (The Netherlands)

ABSTRACT

The extracellular matrix (ECM) provides the perfect environment for cells, with regard to mechanical strength, delivery of nutrients, facilitation of cell-to-cell communication, and more. The most challenging aspects of tissue engineering, the artificial construction of living tissue and organs, is to find a scaffold that is able to create an environment that mimics that of the ECM. In the search of such a scaffold, polyisocyanopeptide hydrogels, functionalised with oligo(ethylene glycol) side chains, have found to be the closest synthetic mimic of the ECM.[1] They mimic, in almost in every way, the microenvironment of the cells. The aim of the study was to establish if the polyisocyanopeptides, decorated with Cys-Ile-Lys-Val-Ala-Val (CIKVAV) and cyclo(Arg-Gly-Asp-D-Phe-Cys (cyclo(RGDfC) epitopes, can be used as scaffolds in the promotion of neurite outgrowth in neuronal progenitor cells.

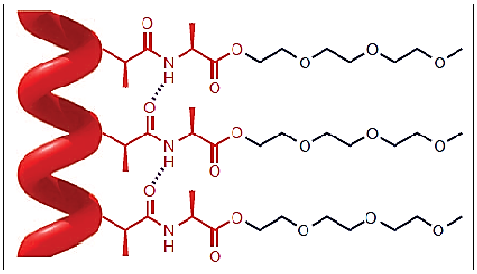

Fig. 1: A schematic representation of polyisocyanopeptide hydrogels grafted with oligo(ethylene glycol) side chains.

Ni(II)-catalysed copolymerization was used in order to prepare polyisocyanopeptides with partial, pendant azide functionality.[2] This was then used as a reactive handle to introduce the epitopes, which both carried a strained alkyne functionality. The polymers were fully characterized by FT-IR, SEC, AF4, CD and UV-vis analysis. The functionalised polymers were found to be non-cytotoxic. Preliminary data regarding the scaffolding ability of the hydrogels was obtained after seeding the polymers with neuronal GT1-7 progenitor cells.

Acknowledgement: We would like to acknowledge the National Research Foundation, Stellenbosch University and Radboud University for funding.

References

[1]Kouwer, P. H. J.; Koepf, M.; Le Sage, V. A. A.; Jaspers, M.; van Buul, A. M.; Eksteen-Akeroyd, Z. H.; Woltinge, T.; Schwartz, E.; Kitto, H. J.; Hoogenboom, R.; Picken, S. J.; Nolte, R. J. M.; Mendes, E.; Rowan, A. E. *Nature* **2013**, *493*, 651
[2] Mandal, S.; Eksteen-Akeroyd, Z. H.; Jacobs, M. J.; Hammink, R.; Koepf, M.; Lambeck, A. J. A.; van Hest, J. C. M.; Wilson, C. J.; Blank, K.; Figdor, C. G.; Rowan, A. E. Chemical Science **2013**, 4, 4168