

PLASMA SURFACE MODIFICATION OF POSS-PCU NANOCOMPOSITE TO IMPROVE BLOOD COMPATIBILITY

M. Solouk¹⁾, H. Mirzadeh¹⁾ and A.M. Seifalian^{2, 3)}

¹⁾Polymer Engineering Department, Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran.

²⁾Centre for Nanotechnology & Regenerative Medicine, Division of Surgery & Interventional Science, University College London (UCL), London, U. K;

³⁾Royal Free Hampstead NHS Trust Hospital, London, U. K.

By considering the surface properties as a key factor in blood compatibility and biostability of a synthetic vessel, in the present study, the surface modification of a hybrid nanocomposite polyhedral oligomeric silsesquioxane (POSS) in to poly (carbonate-urea) urethane (PCU), POSS- PCU, was done.

Computer based modelling through response surface methodology (RSM) and central composite design (CCD) was used to optimise the processing conditions relating to plasma power output (30, 60 and 90 W), and (b) the duration of plasma exposure time (30, 75 and 120 sec) on the treatment process. It was found that optimal WCA (θ) for endothelial cells (EC) adhesion and retention which was reported 55° from supporting literature (equivalent to $\gamma_s = 51$ mN/m), was easily achievable using the following experimental conditions: (I) power output at 30 W for 75 sec, (II) 90 W for 40 sec, and (III) 90 W for 55 sec in O₂.

The effect of plasma treatment on the film of POSS- PCU was studied through water contact angle (WCA), surface energy, ATR-FTIR, SEM and AFM. A comparison between platelet adhesion, hemolysis ratio and EC adhesion and MTT assays for cell assessment to both plasma treated and untreated samples were done and evaluated.

This study showed that by developing a model, it is possible to investigate key experimental parameters to achieve reproducible and optimal wettability and surface energy (γ_s) values and hence modify the interfacial properties of biomaterials used in the design of vascular bypass grafts to enhance the endothelial cells (EC) response to biomaterials.

References

- [1] Desmet, T., Morent, R., Geyter, N. D., Leys, C., Schacht, E., Dubruel, P. *A Review, Biomacromolecules*, **10**, 2351 (2009)
- [2] J. Solouk, A., Cousins, B.G., Mirzadeh, H., Hashtjin, M.S., Najarian, S., Seifalian, A.M., *Biotech. Appl Biochem.*, in the press (2011)