

PROTEIN ADSORPTION ONTO N-CONTAINING HEMA COPOLYMERSR. Sariri¹ & A. Ghanadzadeh²¹*Department of Biology, Gilan University, Rasht, Iran*²*Department of Chemistry, Gilan University, Rasht, Iran*

INTRODUCTION: The use of hydroxyethyl methacrylate (HEMA) as a biomaterial is associated with a number of particular problems, the most important of which is its biocompatibility. A biomaterial with low biocompatibility will be rejected by the biological site. This will be manifested in many ways depending on the environment in which the biomaterial is used. In this research attempt was made to improve HEMA biocompatibility by use varying quantity of a charged co-monomer. Adsorption of protein onto biomaterial is the most important biological response to it. Once adsorbed, the protein is very difficult to be removed and the first protein layer serves as a favorable medium for consequent adsorption of other protein layers, lipids and different inorganic ions such as calcium.

METHODS: HEMA was copolymerized with different amounts of N-vinyl imidazole (NVI) and N-(30sulfopropyl)-N-methacryloxyethyl-N,N dimethyl ammonium betaine (SPE) in order to study the effect of these co-monomers on protein adsorption onto HEMA. 1% ethylene glycol dimethacrylate (EGDM) was used as cross-linking agent. The equilibrium water content (EWC) of the co-polymers was between 35 to 70%. The co-polymers were shaped into 1-cm disks of 0.1 cm depth. The transparent disks were spoiled in 0.5 mg/ml lysozyme solution at room temperature for 24 hours and the protein adsorbed was measured by UV spectrophotometer at 280 nm. The disks were rinsed with distilled water once and mounted directly into the UV cell and their absorption was measured against a blank of the same polymer type and size.

RESULTS: The chemical structures of N-containing co-monomers used for polymerization with HEMA show the presence of a quaternary nitrogen (positively charged). The results of lysozyme adsorption onto both copolymers are compared with pure hema in Table I.

Table 1. The quantity of lysozyme adsorbed onto HEMA copolymers.

Monomer Wt (%)	Comparative surface charge	Lysozyme (mg/cm ²)
ITC (0.0)	-	0.066
NVI (1.0)	+	0.038
NVI (3.0)	++	0.022
NVI (5.0)	++	0.023
SPE (1.0)	++	0.018
SPE (3.0)	+++	0.010
SPE (5.0)	+++	0.012

DISCUSSION & CONCLUSIONS: Lysozyme is a positively charged protein with a small size which is easily adsorbed to HEMA with methacrylic acid (MAA) impurities. Incorporation of NVI and SPE with positive charges reduces the negative charge on HEMA surface and introduces some positive charge. As a result, adsorption of positively charged protein, lysozyme, is reduced. It is also shown that the higher percentages of these co-monomers have a higher positive effect on enhancing the HEMA biocompatibility. It can be suggested from these results that the biocompatibility of HEMA in terms of protein adsorption can be increased by choosing an appropriate monomer in a known amount to be copolymerized with HEMA. Choosing the co-monomer is important in order to control the effect of MAA which is always present as impurity in HEMA.

REFERENCES: ¹ J. Fitton (1993) *Cells, Surfaces and Adhesion*, Ph.D. thesis, Aston University. ² W. Norde, J. Lyklema (1990) *J Colloid Interface Sci.* 2:3, 183-188. ³ R. Sariri (1995), Acidic and Basic Impurities in HEMA, 19th. Annual Clinical Conference, British Contact Lens Association.

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