Modification of Plastics with Chitosan

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Research Experiences for Undergraduates

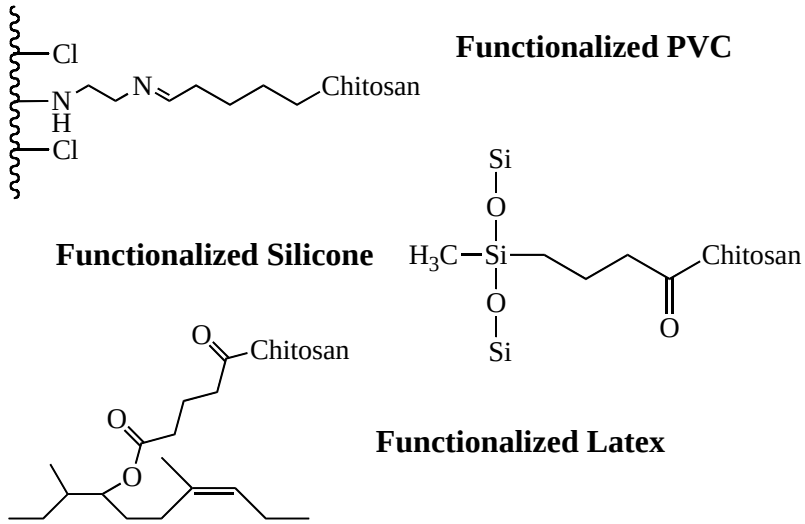
Even in the modern hospital, the threat of infection is never far. The surface of polymers such as silicone, latex, and polyvinyl chloride, which find extensive use in the medical industry, are often the breeding ground for potentially fatal infections. To prevent this, coatings have been develop to prevent bacteria from growing on the surface. Chitosan, a derivative of the natural biopolymer chitin, has shown both good biocompatibility and high levels of antibacterial activity.

Undergraduate student Kyle Zarzana (Harvey Mudd '07) worked on efforts to modify the surfaces of all three types of plastics in order to covalently bind a layer of chitosan to the surface.

The PVC was reacted with ethylene diamine to introduce amine groups to the surface[1]. Glutaraldehyde, which reacts with amine groups, was added to react first with the amine groups on the surface and then the amine groups present in chitosan.

Acrylic acid was UV-grafted to the surface of the silicone[2]. Coupling agents were then added to the solution to facilitate the binding of chitosan to the acrylic acid.

The latex was modified by reacting the plastic with glutaric acid, which added to the double bond[3]. The unreacted carboxylic acid group was then reacted with chitosan.



1. Balakrishnan, B, et al. Biomaterials 26 (2005) 3495–3502.
2. Hu, Shuwen, et al. Analytical Chemistry, Vol. 74, No. 16, August 15, 2002.
3. Peterson, Paul E and Eddie V. P. Tao. Journal of Organic Chemistry Vol 29, Issue 8, 1964, 2323-2325.