Abstract:

Blood-contacting medical devices play an important role within healthcare and are required to be biocompatible, hemocompatible and resistant to microbial colonization. Here we describe a high throughput screen for copolymers with these specific properties. A series of weakly amphiphilic monomers are combinatorially polymerized with acrylate glycol monomers of varying chain lengths to create a library of 645 multi-functional candidate materials containing multiple chemical moieties that impart anti-biofilm, hemo- and immuno-compatible properties. These materials are screened in over 15,000 individual biological assays, targeting two bacterial species, one Gram negative (Pseudomonas aeruginosa) and one Gram positive (Staphylococcus aureus) commonly associated with central venous catheter infections, using 5 different measures of hemocompatibility and 6 measures of immunocompatibility. Selected copolymers reduce platelet activation, platelet loss and leukocyte activation compared with the standard comparator PTFE as well as reducing bacterial biofilm formation in vitro by more than 82% compared with silicone. Poly(isobornyl acrylate-co-triethylene glycol methacrylate) (75:25) is identified as the optimal material across all these measures reducing P. aeruginosa biofilm formation by up to 86% in vivo in a murine foreign body infection model compared with uncoated silicone.

Reference: