Bioactive Particles to Remove Bilirubin in Hemodialysis Treatment

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Abstract.

The rate of mortality in dialyzed patients with hepatic failure is unacceptable high. Current treatments for bilirubin removal are expensive, complex and selective for other compounds apart from bilirubin. About one million of people dye annually from kidney failure and more than two million of patients are receiving some type of hemodialysis. For this reason, the necessity of a material to remove bilirubin in an effective and selective way is clearly justified.

The main objective of this work is the development of a polymeric particulate biomaterial able to remove unconjugated bilirubin from the blood of highly jaundiced patients. The particles must be fully biocompatible avoiding blood coagulation on top and selective enough for bilirubin leaving unaffected the rest of biochemical parameters of the person treated. The size of the particles has to be large enough to allow the easy circulation of the blood stream. The particles will be allocated into a cartridge connected on line with the hemodialysis system.

To achieve this aim polystyrene-co-methylmethacrylate (P(Sty-co-MMA)) and polystyrene-co-divynilbencene P(Sty-co-DVB) matrices were functionalized by means of the coaddition or final addition of Poly(ethylene glycol) methacrylate (PEGMA) or Glycidyl Methacrylate (GMA) to get the inmovilization of Bovine Serum Albumin (BSA). The ability of the different particle formulation to attach albumin has been measured and the influence of the particle composition on the amount and stability of the albumin immobilized was studied.

The efficiency of the synthesized particles removing bilirubin has been tested. In vitro experiments have demonstrated that particles can reduce the bilirubin concentration in blood below 2 mg/dL in less than two hours. Finally, several in vivo experiments have been carried out demonstrating that the particles reduce the level of bilirubin in blood from toxic to healthy values in less than one hour.