

Defence Seminar

Seminar Title	: Chitosan-based Bioactive Nanofibrous Hemostatic Agent for Emergency Care
Speaker	: Balaram Mishra (Rollno : 519bm6001)
Supervisor	: Mukesh Kumar Gupta
Venue	: Seminar Room, BM Department
Date and Time	: 15 Apr 2025 (10:00 AM)
Abstract	<p>: Bleeding causes ~5.8 million deaths globally half of the patients die if rapid hemostasis is not achieved. In India, road traffic injuries are a significant concern, which causes 40% of deaths due to hemorrhage, and there is a rise of 2.4% every year. Commercially available hemostatic agents require at least 1-2 minutes for blood clotting, and most are either difficult to apply, expensive, or produce exothermic reactions upon contact with blood to cause adverse reactions. Our study developed a novel self-assembly-based facile method to fabricate chitosan-casein/gelatin nanofibers through polyelectrolyte complex (PEC) formation for rapid hemostasis.</p> <p>Further, the nanofiber formation and characterization showed that electrostatic interaction between the charged amine and negatively charged phosphate, carboxyl groups could lead to < 50 nm diameter nanofibers at pH of 8.0±0.1 and 10 min sonication. Nanofibrous PECs were allowed to rapidly clot within 10 seconds in both <i>in vitro</i> and <i>in vivo</i> by promoting rapid blood absorption and platelet activation, which were nine-fold better than Celox®. The chitosan-casein PECs could also be developed as a microporous hemostatic sponge (CC30G) with a porosity of 73.00±4.74%, a pore diameter of 42.66±5.33 µm, and rapid water absorption capacity (1165±55%). The bioactivity of nanofibrous PECs could be improved by incorporating ZnO and AG-NPs (Nanoparticles) without compromising their hemostatic efficiency or biocompatibility. Further, nanofibrous PEC with nanoparticles had excellent bioactivity in promoting cellular/tissue metabolic enzymes involved in skin regeneration and could enhance platelet aggregation and activation and strong bactericidal activity.</p> <p>Taken together, chitosan-casein/gelatin nanofibrous PEC could rapidly clot the blood within 10 seconds under <i>in vitro</i> conditions by promoting platelet activation and aggregation, rapid absorption of plasma, and activation of the extrinsic coagulation pathway. It could also clot blood within 10 s in the rat femoral artery puncture model and within 25 s in the rabbit ear artery model. The PEC was bioactive, bactericidal, hemocompatible, biocompatible, non-toxic, non-immunogenic, and safe for animal models. The chitosan-based PECs could also be developed as hemostatic sponges for skin cuts and lacerations.</p>