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Carbon nanomaterials for biomedical applications: Properties and advantages

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Carbon nanomaterials namely graphene, graphite and carbon nanotubes are widely explored in electronics, aerospace and other areas by virtue of the exceptional mechanical strength, conductivity, light weight. Nowadays, applications are extended towards biomedical fields by utilizing some of the properties. The nanomaterials have shown increase in the mechanical strength of the implants and conductivity including antibacterial and antioxidant properties. Exploring the same features, our lab has utilized the nanomaterials for various applications in medical implants namely wound dressings, ocular implant and biosensors.

Novel nanofibrous wound dressing is developed utilizing graphene oxide (GO). GO has reported for its antibacterial properties and by utilizing the property a nanomaterial loaded nanofibers were fabricated. GO has added the antimicrobial property apart from enhanced porosity and strength to the fibers for better cell proliferation and handling. In another application, we have incorporated graphite in synthetic polymer to develop core-skirt design as an artificial corneal implant (Keratoprosthesis, KPro). The marketed KPro are either utilizing patient corneal endothelial cells or Poly hydroxyl ethylmethacrylate (PHEMA). All marketed KPro has a common problem of less tissue integration and suture strength. To improve the feature we have added graphite in the skirt design to enhance the roughness for better cell adhesion and strength. The results of in-vitro and cell line studies have shown comparatively porous nature of skirt region and also the evaluated suturing strength were in comparison with reported values. We are also exploring the application of Carbon Nanotubes in biosensors to enhance the sensitivity. The unique properties of carbon nanomaterials specifically, antimicrobial, mechanical and conducting nature can be explored for many biomedical applications.

Key words: Wound dressing, ocular implants, Nanofibrous Stent coating

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