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Designing and application of biomaterials based cross-linked hybrid hydrogels

Anujit Ghosal, Shivani Tiwari and **Jaydeep Bhattacharya**
Jawaharlal Nehru University, India

Statement of Problem: Polymeric hydrogels are three dimensional (3D) interpenetrating (IPN) polymeric materials with high affinity and ability to hold water or molecular species within. Hybrid hydrogels can be considered as an advance material due to synergistic cocktail of organic and inorganic components. However, only an optimum concentration of the individual components can result in a stable, bio-compatible and cell sustaining hybrid hydrogel. Chitosan is a well-known biopolymer however, stiffness in the free standing dry films or high toughness in 3D structures results in brittle nature of the matrix. So, here we report the effect of secondary bio-polymers (Guar gum, PVA and glycerol) and inorganic nano-filler (Graphite) on the physico mechanical, physicochemical and bio-compatibility properties of the hybrid hydrogels.

Methodology & Theoretical Orientation: Longer chain length has the ability to increase the flexibility of the resulting hydrogel matrix in one hand, whereas, it also decreases the stability of 3D structure. So, along with co-polymeric mixture addition of graphite would certainly enhance the stability and intactness of the 3D structure. Additionally, dispersion of graphite also improves the cell adhesion and cell proliferation in the 3D hybrid hydrogel matrix. A set of hydrogels were designed with varying concentration of components over fixed and optimum concentration of graphite nanostructure. Optimum concentration of graphite was defined by the parameters such as cell adhesion, viability, proliferation of human embryonic kidney (HEK-293) cell line and A549, adeno carcinomic human alveolar basal epithelial cells, along with the swelling ability of the resulting hydrogels.

Findings: The ten times improvement in physico mechanical, chemical and swelling properties with higher cell adhesion efficiency of the hybrid materials projects their potential in the fields of advance materials for 3D cell culturing and tissue engineering.

anujitghosal@gmail.com