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Fabrication of herbal scaffold for bone tissue engineering using *Eucomis autumnalis* plant extract

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In spite of the frequent use of different biomaterials as a substrate for seeded cells and for supports of the formation of new matrix deposition, little or no work has been done in incorporating medicinal plants extracts with anti-inflammatory and osteoinductive capacity in scaffold fabrication, hence, our focus on a novel herbal scaffold incorporating medicinal plant *Eucomis autumnalis* extract with natural biopolymers, alginate and chitosan by lyophilization technique. The prepared composite scaffolds with plant extract were further characterized using X-ray diffraction analysis (XRD), Scanning Electron Microscope (SEM) and Fourier Transform Infrared Spectroscopy (FTIR).Our data showed that the formed scaffold is an ideal scaffold. Toxicity, compatibility, differentiation capacity, alkaline phosphate performance, SEM, inflammatory activity using Cyclooxygenase enzyme (COX-1, COX-2) activity of the fabricated scaffold were investigated on porcine derived adipose stem cells (pASCs). The XRD and Ft-IR tests different peaks indicated clear presence of CaCO3, HPO4 and H2O compounds. The 3-(4,5-dimethythiazol2-yl)-2,5-diphenyl tetrazolium bromide (MTT) assay in cells showed the herbal scaffold to be non-toxic, increasing proliferation with cell viability more than scaffolds without herbal extract, swelling ratio for water uptake showed higher in scaffolds incorporated with the plant extract. The herbal scaffolds were found to selectively inhibit COX-2 expression in cells. The physiochemical and biological properties of the herbal scaffold showed osteo-inductive support to pASCs. *E. autumnalis* extract in scaffolds may provide safe and cost effective alternative treatment for bone fracture and regeneration, reducing the long hospitalization of patients with bone defects and other bone therapeutics.

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Antibody engineering to develop next generation monoclonal antibody therapeutics

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Recombinant therapeutic antibodies constitute the largest share of global Pharmaceutical market; occupy the dominant position of pipeline drugs in disease segments like, oncology and rheumatoid arthritis. Therapeutic antibodies which lack the core fucose oligosaccharide moiety exhibit improved antibody-dependent cellular cytotoxicity (ADCC) response and thereby attain higher efficacy, compared to fucosylated molecules. Genetically engineered mammalian cell line (CHO) platform with impaired fucose biosynthetic pathway were used to express non-fucosylated antibody. Our results suggest complete abrogation of antibody fucosylation and corresponding improvement of ADCC profiles. We have developed Afucosylated AntiHer2 Antibody through this platform which revealed more than 15 folds improvement in ADCC compared to Trastuzumab drug. The fucose knock out CHO expression system will be used to produce multiple next generation antibody therapeutics, especially the Immuno-Onco checkpoint targets. We have developed unique antibody display libraries for discovery and development of new antibody drug molecules. These libraries span over human naive and synthetic molecules developed through rational designing strategies to identify and characterize best in class antibodies. Unique rational designing approach incorporates criteria like thermostability, antigenicity and specificity during antibody library development. Zumutor's libraries are uniquely positioned, naive antibody gene sequences from Indian sub populations an unexplored resource in this space, integrating rational designing during synthetic library design addressing manufacturability of potential leads, combined phage and yeast display technology that generates lead molecules in both ScFv and Fab formats translation to successful products. This strategy allows discovery of superior antibody molecules with higher affinity and better manufacturability.

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