ABSTRACT

The thesis highlights the implications of nano-biotechnological approaches for fabrication of soft and hard tissue biomaterials. Ideal biomaterials should possess anti-microbial property, proteolytic stability and vascularizability for its acceptability in the host. The thesis describes the fabrication of multifunctional biomaterials using collagen/gelatin as natural biopolymer reinforced with nutraceuticals and biodegradable metals. The cumulative therapeutic efficacy of nutraceuticals and metal nanoparticles added in therapeutic and biomechanical properties to the scaffolds that resulted in better tissue regeneration. The thesis is distributed into 8 chapters. Chapter 1 elaborates Tissue engineering and its therapeutic significance. The methodologies and instruments used in this study are described in Chapter 2. Chapter 3 outlines the fabrication of collagen aerogels reinforced with wheatgrass nutraceutical for soft tissue regeneration. Additionally, the effect of biodegradable manganese on wheatgrass collagen aerogels towards wound healing is also described in this chapter.

The role of curcumin as a cross-linker of collagen fibrils is detailed in Chapter 4 and the results suggested that curcumin in the aerogels spatio-temporally inhibited MMP activity and induced angiogenesis with controlled anti-proteolytic activity. Fabrication of nanofibrous scaffolds for tissue regenerative applications in a core-shell manner for controlled release of curcumin from gelatin core are presented in Chapter 5. Chapter 6 and 7 describes the application of glycoproteins form plant mucilage’s for the development of biomaterials in soft and hard tissue engineering. The experimental results obtained from the thesis provide cues for the

development of nutraceutical/biodegradable metal based therapeutic biomaterials for soft and hard tissue engineering applicationsthat can overcome many setbacks associated with commercially available biomaterials.