INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The skin, also known as protective barrier, is the largest organ of our body that defends the body against external environment, pathogens and mechanical disturbances. Cutaneous wounds, often caused by trauma or wound chronicity, impose a great threat, because such wounds lose the ability of self-repair and may lead to substantial organ failure in the absence of surgical interventions. To tackle this pressing health problem, we developed pro-regenerative matrices using cost-effective approaches to bridge the gap between the need and the demand. Our research focusses on harnessing the regenerative properties of naturally available silk biomaterials to aid wound healing through various strategies. The thesis presents possible strategies to develop numerous types of silk-based constructs such as nanofibrous matrices, microporous scaffolds and hydrogels for wound-specific treatments. Considering the natural wound milieu, instructive biochemical cues were recapitulated in the developed matrices such as cell adhesive sites and growth factors using bioactive molecules or functionalized recombinant spider silk motifs. In addition, the wound dressing matrices were developed considering ideal physical properties like antibacterial properties, moisture retention properties, and suitable mechanical properties. Efficient skin substitute was also developed in the design of an *in situ* forming hydrogel that could be applied on the wounds *via* one-step grafting surgery. The promising outcomes of *in vitro* and *in vivo* studies highlights immense potential of developed silk matrices for the treatment of complex wounds like burn injuries and diabetic wounds. The facile techniques demonstrated in the thesis show huge potential in skin regeneration therapeutics and wound healing applications.