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Suture Biomaterials Development from Natural Fibers: Muga Silk (Antheraea assama) and Ramie (Boehmeria nivea)

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Abstract : The quest for developing an ideal suture material prompted our interest to develop a novel suture with advantageous characteristics to market available ones. We developed novel suture biomaterial from muga silk (Antheraea assama) and ramie (Boehmeria nivea) plant fiber. Field emission scanning electron microscopy (FE-SEM), energy-dispersive X-ray spectroscopy (EDX), attenuated total reflection fourier transform infrared spectroscopy (ATR-FTIR) and thermo gravimetric analysis (TGA) results revealed the physicochemical properties of the fibers which supports the suitability of fibers for suture fabrication. Tensile properties of the prepared sutures were comparable with market available sutures and it found to be biocompatible towards human erythrocytes and nontoxic to mammalian cells. The prepared sutures completely healed the superficial deep wound incisions within seven days in adult male wister rats leaving no rash and scar. Histopathology studies supports the wound healing ability of sutures, as rapid synthesis of collagen, connective tissue and other skin adnexal structures were observed within seven days of surgery. Further muga suture surface modified by exposing the suture to oxygen plasma which resulted in formation of nanotopography on suture surface. Broad spectrum antibiotic amoxicillin was functionalized on the suture surface to prepare an advanced antimicrobial muga suture. Surface hydrophilicity induced by oxygen plasma results in an increase in drug-impregnation efficiency of modified muga suture by 16.7%. In vitro drug release profiles showed continuous and prolonged release of amoxicillin from suture up to 336 hours. The advanced muga suture proves to be effective against growth inhibition of Staphylococcus aureus and Escherichia coli, whereas normal muga suture offers no antibacterial activity against both types of bacteria. In vivo histopathology studies and colony-forming unit count data revealed accelerated wound healing activity of advanced suture over normal one through rapid synthesis and proliferation of collagen, hair follicle and connective tissues.

Keywords : sutures, biomaterials, silk, Ramie
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