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Electrospun polymer nanocomposite scaffolds containing metal oxide nanoparticles for diabetic wound healing

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Robin Augustine, Noorunnisa Khanama, Hany Elsayed Mareib, Sabu Thomasc, Ala-Eddin Al Moustafad, Anwarul Hasana a College of Engineering, Qatar university Doha, Qatar bBiomedical Research Centre, Qatar university Doha, Qatar cInternational and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam – 686 560, Kerala, India. dCollege of Medicine, Qatar university Doha, Qatar Abstract It is very important to treat diabetic foot injuries at early stage since even minor wounds can turn into serious foot ulcers which can lead to the amputation of the entire foot if not treated early. The management of diabetic foot ulcers requires the use of appropriate wound dressings to provide a moist wound environment and protect from infection. Large number of polymeric materials has been tried for wound coverage applications with many successful outcomes, but the search for an ideal wound dressing material which can enhance diabetic wound healing is still continuing. Poly(3-hydroxybutyrate-co-3-hydroxyvalerate), commonly known as PHBV has got a lot of attention in biomedical applications due to its biocompatibility and biodegradability Electrospinning is a robust technique that can produce highly porous membranes composed of nano or submicron fibers from polymer solutions. Formation of active blood vessel network through an implanted wound dressing is one of the most important issues in the treatment of diabetic wounds. Ability of metal oxide nanostructures to promote angiogenesis and wound healing is already established. Thus, in the present work, electrospun PHBV wound dressings containing metal oxide nanoparticles were fabricated and characterized. Our results demonstrated that metal oxide nanoparticles in the wound dressings enhanced human cell adhesion and

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their migration. Further, angiogenic property of the membranes was enhanced as evident from chicken chorioallantoic membrane assay and leads to the enhancement of diabetic wound healing. Present study strongly suggest the potential application of metal oxide nanoparticles incorporated PHBV scaffolds in promoting angiogenesis and their effective use in diabetic wound healing.