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Grapefruit Oil and Cobalt Nitrate-Loaded Polyurethane Hybrid Nanofibrous Scaffold for Biomedical Applications

Mohan Prasath Mani[1], *Ahmad Athif Mohd Faudzi*[2,3], *Shahrol Mohamaddan*[4], *Ahmad Fauzi Ismail*[5], *Rajasekar Rathanasamy*[6], *Manikandan Ayyar*[7] *and Saravana Kumar Jaganathan*[2,3,8]*

[1]School of Biomedical Engineering and Health Sciences, Faculty of Engineering, Universiti Teknologi Malaysia, Skudai, Malaysia, [2]Centre for Artificial Intelligence and Robotics, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia, [3]School of Electrical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia, [4]Department of Bioscience and Engineering, College of Systems Engineering and Science, Shibaura Institute of Technology, Saitama, Japan, [5]Advanced Membrane Technology Research Centre (AMTEC), School of Chemical and Energy Engineering, Universiti Teknologi Malaysia, Skudai, Malaysia, [6]Department of Mechanical Engineering, Kongu Engineering College, Erode, India, [7]Department of Chemistry, Bharath Institute of Higher Education and Research (BIHER), Chennai, India, [8]Department of Engineering, Faculty of Science and Engineering, University of Hull, Hull, United Kingdom

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***Correspondence:**
Saravana Kumar Jaganathan
s.k.jaganathan@hull.ac.uk

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The goal of this work is to fabricate a new composite based on polyurethane (PU), grapefruit (GP) oil, and cobalt nitrate [$Co(NO_3)_2$] using an electrospinning technique. Morphology results revealed the reduction in the fiber diameter of the composites compared to pristine PU control. The interaction of PU with GP and $Co(NO_3)_2$ was confirmed by hydrogen bond formation evident in infrared analysis. The fabricated PU/GP composites depicted a more hydrophobic behavior, while PU/GP/$Co(NO_3)_2$ showed a hydrophilic behavior than the pristine PU. Atomic force micrographs (AFM) revealed that the developed composites showed a decrease in the surface roughness (R_a) compared to PU. The addition of GP and $Co(NO_3)_2$ improved the mechanical strength of the pristine PU. The blood compatibility assays concluded not only the increase in blood clotting levels but also the less toxic nature of the fabricated composites compared to the pristine PU. Hence, the newly designed composites possessing outstanding physicochemical and biological properties may be used as a potential candidate for scaffolding in tissue engineering applications.

Keywords: PU, Co(NO3)2, grapefruit oil, electrospun scaffold, tissue engineering

INTRODUCTION

Tissue engineering is an emerging technique used for the recovering of the lost functions of the human tissue. This technique utilizes a natural/synthetic structure named "scaffold," which plays a key role in remodeling the damaged human tissue. The scaffold was combined with cell binding sites and growth factors in order to mimic the native extra cellular matrix (ECM) structure of the human tissue to support the cell proliferation, migration, and differentiation (Teixeira et al., 2020). The important characteristics of an ideal scaffold are its non-toxic, non-allergenic, biocompatible, and biodegradable nature (Zennifer et al., 2021). Recently, a scaffold based on a nanofibrous material was widely investigated in tissue engineering applications.