



# Sprayable biogenic Ag-collagen nanocomposites with potent antibacterial and antibiofilm activity for *Acinetobacter baumannii* infected wound healing under hyperglycemic condition

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## ABSTRACT

Owing to their susceptibility to infection by drug-resistant bacteria, refractory wounds pose a formidable risk to the well-being of patients with diabetes and other immune-compromised conditions, and their management poses significant economic distress to the healthcare system, particularly in low and middle-income countries. Therefore, deployable interventions for rapid and effective management of such wounds are needed. In the present study, we report the processing of sprayable biogenic Ag-collagen nanocomposites (Ag-Col NCs) with cogent antibacterial and healing activity in *Acinetobacter baumannii* infected wounds under hyperglycemic conditions. Silver nanoparticles (Ag NPs) has been synthesized by using the plant extract of *Urginea indica* (*U. indica*), which was further used for the processing of Ag-Col NCs. Synthesized NCs were found to have notable broad spectrum antibacterial activity against clinically significant strains (*Acinetobacter baumannii*, *Staphylococcus aureus* and Methicillin-resistant *Staphylococcus aureus*) and appreciable biocompatibility towards RAW 264.7 and 3 T3 mouse fibroblast cell lines. The sprayable NC system was found to promote the wound healing activity in mouse model (Balb/c) not only in normal but also in hyperglycemic conditions. Our experimental findings suggest the potential of the Ag-Col NC spray in chronic wound management and an exploitable option in both clinical and personalized settings.

## 1. Introduction

Skin, the largest organ in the body is composed of an intricate network of three layers, epidermis, dermis, and hypodermis, and provides a physical barrier between the environment and the organism [1]. The coherence of healthy skin plays a critical role in maintaining the physiological homeostasis of the human body and thereby, protects against any detriment caused by mechanical stress or strain, infections, fluid imbalance, and thermal dysregulation [2]. Due to its unique positioning, skin is perpetually challenged by a wide variety of external factors and therefore, susceptible to trauma or wound. Presently,

cutaneous wounds are considered one of the formidable challenges in medical care, with  $\approx 300$  million chronic and  $\approx 100$  million traumatic wound patients globally, and they put a momentous burden on the healthcare systems, specifically in low and middle-income countries [3,4]. Additionally, with the rise in the global population of immuno-compromised patients with type-II diabetics and peripheral vascular disease, the incidences of complicated chronic wounds may surge drastically [5]. Wound healing usually involves complex intra and intercellular mechanisms that depend on an intricate interplay between a number of highly regulated factors (such as multiple cell populations and extracellular bioactive molecules as soluble mediators) to work in

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