

SMARTdress: Innovative pH-Responsive Dressings for Diabetic Wound Healing

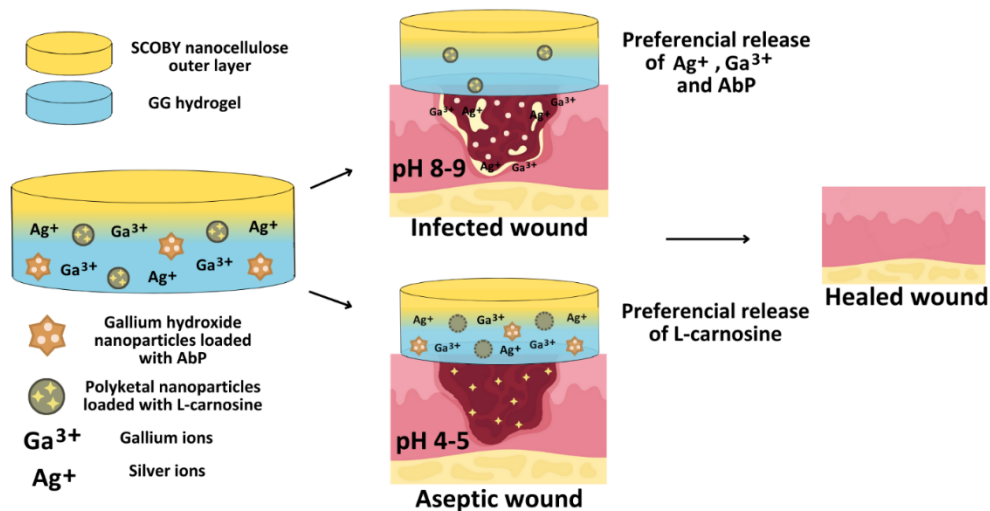
One of the biggest problems we face today are civilization diseases, like diabetes types 1 and 2. People with diabetes often suffer from nerve damage and poor blood flow in their legs and feet, which can lead to painful ulcers/sores. These wounds often get infected with harmful bacteria. Studies show that more than 40% of diabetic ulcers are permanently colonized with bacteria. Moreover, the presence of bacterial infections makes healing more challenging, which can worsen the situation. If these infected wounds are not treated correctly, they can increase the risk of losing a limb or developing sepsis.

The pH level can be used as a key indicator of how a wound is doing, so if it is infected with bacteria, or what the current healing status is. Normally, the fluid from chronic wounds is more alkaline, with a pH that can go as high as 9, which encourages pathogenic bacteria to grow. On the other hand, the pH of healthy skin or uninfected wounds is between 4.2 and 5.9. So, creating an effective treatment for diabetic ulcers is tricky because the condition of the wound can change. The focus on the healing process of the sores will not be effective as long as bacteria are still present. Meaning, that the ideal wound dressing needs to fight bacteria, but at the same time, we want to avoid using traditional antibiotics because they can lead to the development of antimicrobial resistance.

Knowing the background of the infected diabetic wounds, we plan to create a **SMART multicomponent wound dressing that will adjust the type of released substances to the condition of the wound based on its pH**. For example, if the sore is infected and has a higher pH of 8-9, the dressing will release more antibacterial agents. In contrast, if the sore is not infected and has a lower pH of 4-5, it will promote healing processes. This dressing will also absorb excess exudate and protect the wound from the external environment.

We suggest using a natural hydrogel made from gellan gum (GG) for the base of the wound dressing, topped with a layer of a special SCOBY nanocellulose membrane. The dressing will include silver and gallium ions, as well as certain antibacterial peptides, all entrapped in nanoparticles that break down at higher pH levels. Once the bacteria are gone and the wound comes back to an uninfected state, a substance called L-carnosine will be released to help with healing. We will again use pH-sensitive polymeric material capable of falling apart when the pH changes.

SMARTdress: pH-sensitive dressing



Our project focuses on creating a SMART wound dressing that can respond to the pH of a wound. This special dressing can automatically release helpful substances when necessary, which means that patients and caregivers will not need to constantly monitor or have extensive knowledge about the wound state. Additionally, it uses affordable and sustainable materials, making it an environmentally friendly option for the effective care of diabetic wounds.

We will accomplish this by working within a diverse team of experts in various fields like biomaterials, biomedical engineering, microbiology, cell culture, *in vivo* models, and the development of advanced therapy medicinal products. Our combined skills will help us work together efficiently to achieve the project goals.