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Advanced wound care adhesives with new functional properties

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Wound healing is a dynamic process characterized by three overlapping cellular phases: inflammation, new tissue formation, and remodeling. Chronic wounds, which are often manifested in elderly and diabetic patients, result from anomalies in the cellular and molecular wound repair mechanism. Such wounds can lead to significant disability, amputation and increased mortality. The understanding of the normal wound healing mechanism and the consideration of the complexity of the wound environment, given by, e.g., hypoxia or bacterial infections, are crucial factors in order to develop an effective therapeutic approach. Systemic drug delivery systems, such as oral and intravenous delivery, are the most common routes for drug administration. Nevertheless, these routes are characterized by several significant drawbacks. For instance, systemic delivery requires an appropriate blood perfusion of the target tissue, often insufficient in chronic wounds, and carries with it a high risk for systemic toxicity, which can limit dosing and duration of the medical treatment. Therefore, localized drug delivery is a promising approach to improve bioavailability and maintenance of a therapeutic drug concentration, while minimizing systemic drug toxicity. Here, we propose a novel, skin-friendly, industrially relevant silicone/glycerol hybrid adhesive with new functional properties, including: improved moisture handling due to the incorporation of emulsified glycerol and dispersion of an antimicrobial agent by glycerol-embedding. This particular matrix paves the way for an innovative drug delivery system. Various parameters will be taken into account in order to develop a relevant adhesive, in particular glycerol content, glycerol domain size and adhesive thickness.

Figure 1: Glycerol domains incorporated in the silicone matrix characterized by optical microscope.

Recent Publications:

1. A J Whittam, Z N Maan, D Duscher, V W Wong, J A Barrera, M Januszyk, G C Gurtner (2016) Challenges and opportunities in drug delivery for wound healing. Adv. Wound Care. 5(2):79-88.
2. D Telgenhoff, B Shroot (2005) Cellular senescence mechanism in chronic wound healing. Cell Death Differ. 12(7):695-698.
3. M D Redelings, L E Lee, F Sorvillo (2005) Pressure ulcers: more lethal than we thought? Adv. Skin Wound Care. 18(7):367-372.
4. Y Zhang, H F Chan, K W Leong (2013) Advanced materials and processing for drug delivery: the past and the future. Adv. Drug Deliv. Rev. 65(1):104-120.
5. P Mazurek, S Hvilsted, A L Skov (2016) Green silicone elastomer obtained from a counterintuitively stable mixture of glycerol and PDMS. Polymer. 87:1-7.

Biography

Valeria Chiaula obtained the Laurea Magistrale in Pharmaceutical Chemistry and Drug Technology from La Sapienza, University of Rome, in July 2016. She started working in The Danish Polymer Centre, located in the Danmarks Tekniske Universitet (DTU), Lyngby, Denmark, in October 2016. After 4 months as Intern and 6 months as Research Assistant, she got the position of Industrial PhD in collaboration between the Danish Polymer Centre and Coloplast A/S,Wound & Skin Care.

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