Advanced Wound Care Adhesives with New Functional Properties

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### Introduction

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. 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 active compounds 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.

### Background

**Wound Healing: 4 Cellular Phases**

- **Hemostasis**
  - Blood vessel damage
  - Formation of platelet plug
- **Inflammation**
  - Phagocytes phagocytose debris
  - Leukocyte migration
  - Inflammatory cells
- **Proliferation**
  - Epithelial cells migrate over wound site
  - Mesoangioblastic cells migrate
  - Fibroblasts
- **Remodeling**
  - Collagen deposition and matrix remodeling

**Chronic Wound Healing Process**

- Bacterial infection
- Hyperproliferation epidermis: stalled re-epithelialization
- Persistent inflammation

**Focus: Appropriate Dressing for Appropriate Wound Environment**

- Improvement in water retention
- Improvement in bacteria
- Absorbs exudate excess
- Maintains appropriate humidity in the wound

### Development of Novel, Skin-Friendly Glycerol-Silicone Hybrid Adhesive

**Silicone Adhesives – Gentle Skin Adhesion Properties**

- Improved moisture handling
- Incorporation of emulsified glycerol
- Release of active compounds
- Glycerol-incorporation of active compounds
- Beneficial skin care effects
- Glycerol

**Experimental Work and Results**

**Release of Active Compounds: G20_SA and G40_SA Profiles**

**Figure:** Glycerol domains incorporated in the silicone matrix characterized by optical microscopy. The emulsions were investigated with respect to the stability during 60 min. Complete curing is known to occur after this time at room temperature and the systems can be assumed to be immobilized with no further changes expected. Specifically, we studied changes in size of the glycerol domains over this time period. Pictures refer to a) t = 0 and b) t = 60 min after the formation of the emulsions. The relative average glycerol domain sizes are shown. The results presented in Figure highlighted the stability of glycerol domains size over 60 min, since no changes were observed.

### References


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