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# Physically crosslinked-sacran hydrogel films for wound dressing application

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ABSTRACT

The thin hydrogel films consisting of water-swollen polymer networks can potentially be applied for biomedical fields. Recently, natural polysaccharides have great attentions to be developed as wound healing and protection. In the present study, we newly prepared and characterized a physically crosslinked-hydrogel film composed of a novel megamolecular polysaccharide sacran for wound dressing application. We successfully fabricated a physically crosslinked-sacran hydrogel film by a solvent-casting method. The thickness of a sacran hydrogel film was lower than that of a sodium alginate (Na-alginate) film. Importantly, the swollen ratio of a sacran hydrogel film in water at 24 h was 19-fold, compared to initial weight. Meanwhile, a Na-alginate hydrogel film was completely broken apart after rehydration. Moreover, a sacran hydrogel film did not show any cytotoxicity on NIH3T3 cells, a murine fibroblast cell line. The *in vivo* skin hydration study revealed that a sacran hydrogel film significantly increased the moisture content on hairless mice skin and considerably improved wound healing ability, compared to control (non-treated), probably due to not only the moisturing effect but also the anti-inflammatory effect of sacran. These results suggest that sacran has the potential properties as a basic biomaterial in a hydrogel film for wound dressing application.



## 1. Introduction

The thin hydrogel films consisting of water-swollen polymer networks have attracted a lot of attentions in the last few decades because of excellent properties like stimuli-responsive behavior, macroporous structure, and molecularly imprinted polymers [1–3]. Additionally, it can potentially be used in several biomedical applications, outstandingly in wound dressing application [4,5]. Wound dressings are essential in wound healing therapy due to the moisturing effect to avoid not only tissue dehydration but also cell death in regeneration during repairing of dermal and epidermal tissues [6–8].

In general, the ideal properties of wound dressing materials must be biocompatible, non-irritating, non-toxic and suitable mechanical properties as well as the moisturing ability for skin [9]. Furthermore, wound dressing materials need various properties, depending on the type of wound [10]. For instance, in open wound, the dressing materials having more porous structures and swelling abilities are promising. Meanwhile, in closed wound, the durable dressing materials are important [11].

Many hydrogel films are prepared by chemical or physical crosslinking method to obtain the ideal hydrogel film properties. A highly elastic and durable polyvinyl alcohol (PVA) hydrogel films were successfully fabricated by a chemical crosslinking method using potassium persulphate as a crosslinker [12]. The similar properties also appeared in pullulan/polyvinyl alcohol (PVA) blend films which were prepared by casting the polymer solution in dimethyl sulfoxide and using glyoxal as chemical crosslinkers [13]. However, organic solvents and crosslinkers are potentially hazardous to the body [14]. Meanwhile, the physical crosslinking does not require the addition of hazardous chemical crosslinkers. The hydrogel films prepared physically with sodium alginate (Na-alginate) as a matrix agent and propylene glycol as a plasticizer were successfully developed by Aktar et al. [15]. Moreover, the addition of propylene glycol in hydrogel films composed of pectin improved

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