

Green Gels for Topical Delivery Prepared from Orange Peels: Investigation of the Rheology Behavior and Antimicrobial and Antioxidant Activities

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Abstract

Recycling of fruit wastes such as orange peels into a low-cost, nontoxic, sustainable, and eco-friendly product is an optimal approach nowadays that can ultimately reduce waste. Pectin is a natural polymer that is extracted from citrus peels. It is widely utilized as gelling agent, stabilizer, thickener, emulsifier, and rheology modifier. The aim of this study was to develop green gels from pectin extracted from orange peels as a carrier for topical preparations. The extracted pectin was characterized in terms of Yield%, degree of esterification, equivalent weight, methoxyl content, galacturonic acid content, and FTIR. In addition, the ethanolic orange peels extract was prepared and compared with pectin hydrogels. Hydrogels were prepared using different pectin concentrations and then crosslinked with various CaCl_2 concentrations. Pectin hydrogels exhibited pseudoplastic behavior, viscoelastic and bioadhesive properties, and antioxidant activity. Whereas pectin hydrogels did not show any wound healing or antimicrobial activities. Whereas the ethanolic orange peels extract revealed remarkably enhanced wound healing, antimicrobial activity against the Gram-positive

bacteria *Staphylococcus aureus*, and antioxidant activities. Therefore, pectin hydrogel could be considered a potential carrier for topical delivery systems.

Keywords: Extract, green hydrogel, orange peels, pectin, rheology modifier.