Nitric oxide-releasing chitosan film for enhanced antibacterial and in vivo wound-healing efficacy

Jong Oh Kim\textsuperscript{a,1}, Jin-Ki Noh\textsuperscript{b,1}, Raj Kumar Thapa\textsuperscript{a}, Nurhasni Hasan\textsuperscript{b}, Moonjeong Choi\textsuperscript{b}, Jeong Hwan Kim\textsuperscript{a}, Joon-Hee Lee\textsuperscript{b}, Sae Kwang Ku\textsuperscript{c}, Jin-Wook Yoo\textsuperscript{b,*}

\textsuperscript{a} College of Pharmacy, Yeungnam University, Gyeongsan 712-749, South Korea
\textsuperscript{b} College of Pharmacy, Pusan National University, Busan 609-735, South Korea
\textsuperscript{c} College of Korean Medicine, Daegu Haany University, Gyeongsan 712-715, South Korea

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\textbf{ABSTRACT}

Nitric oxide (NO) is a promising therapeutic agent with antibacterial and wound-healing properties. However, the gaseous state and short half-life of NO necessitate a formulation that can control its storage and release. In this study, we developed NO-releasing films (CS/NO film) composed of chitosan (CS) and \textit{S}-nitrosoglutathione (GSNO) as a NO donor. Thermal analysis demonstrated molecular dispersion of GSNO in the films. In vitro release study revealed that NO release from CS/NO films followed Korsmeyer–Peppas model with Fickian diffusion kinetics. Moreover, the CS/NO film showed a stronger antibacterial activity against \textit{Pseudomonas aeruginosa} (Gram-negative) and \textit{Staphylococcus aureus} (Gram-positive) than the CS film. Further, the CS/NO film accelerated wound healing and epithelialization in a rat model of full-thickness wounds as compared to the CS film. Histopathological studies revealed that CS/NO films favorably enhanced the re-epithelialization and reconstruction of wounded skin. Therefore, our results suggest that CS/NO films could be a suitable formulation for treating full-thickness wounds.