

(54) Title of the invention : Smart Hydrogel Wound Dressing with Mathematical Drug Release Control Model

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(31) Priority Document No	:NA	(72)Name of Inventor : 1)Dr. Nirmala Rajkumar
(32) Priority Date	:NA	2)Dr. Nidhi Tiwari
(33) Name of priority country	:NA	3)Dr. Aparna T
(86) International Application No	:	4)Dr. Rajan Singh
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(87) International Publication No	: NA	6)Dr. S. Subhashini
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(57) Abstract :

The present invention relates to a smart hydrogel wound dressing integrated with a mathematical drug release control model for improved wound treatment and controlled drug delivery. The invention belongs to the field of biomedical materials and advanced wound care systems. The proposed dressing utilizes a biocompatible hydrogel matrix capable of absorbing wound exudate and maintaining a moist environment that supports faster tissue regeneration and healing. Therapeutic agents such as antibiotics, antimicrobial agents, or anti-inflammatory drugs are incorporated into the hydrogel network to provide localized treatment at the wound site. The hydrogel matrix gradually releases the embedded drug when it comes into contact with wound fluids. A mathematical drug release control model based on diffusion kinetics is integrated into the system to predict and regulate the rate of drug release from the hydrogel matrix. The model considers factors such as drug concentration, hydrogel swelling behavior, and time to ensure sustained and controlled delivery of therapeutic agents. The invention improves the efficiency of wound treatment by maintaining consistent drug concentration at the wound site, reducing infection risk, and minimizing the need for frequent dressing changes. The proposed smart hydrogel wound dressing provides a reliable, biocompatible, and effective solution for treating chronic wounds, burns, surgical wounds, and diabetic ulcers, thereby enhancing overall patient care and wound healing outcomes.

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