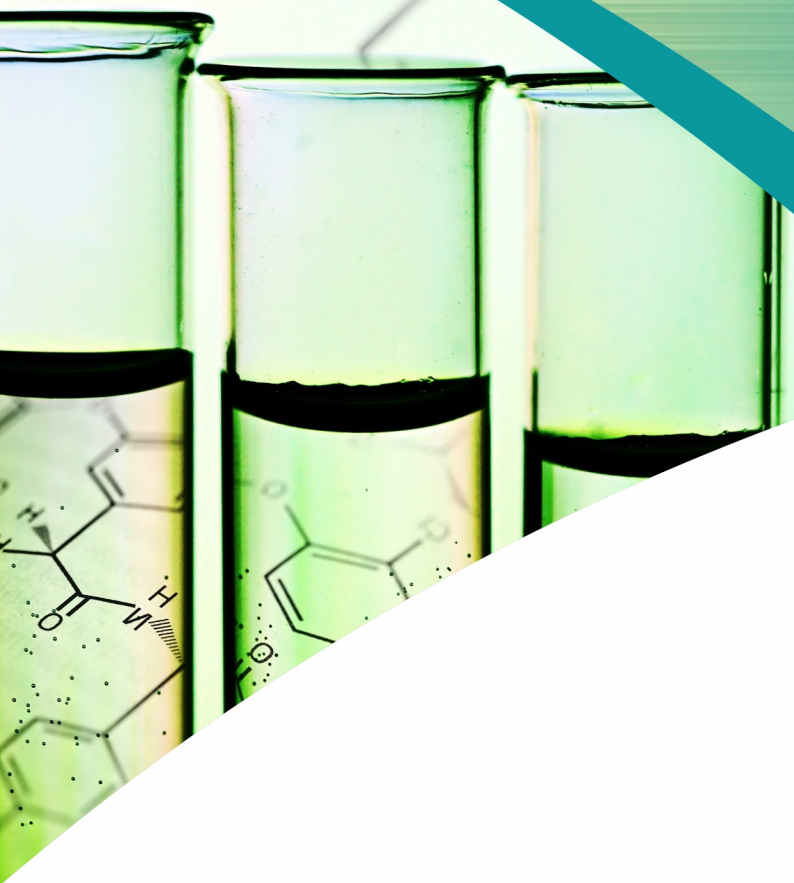


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# A Hydrogel Based Herbal Formulation Using Novel Combination for Wound Healing

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## ABSTRACT

**Background and Aim:** Wound healing is the dynamic process that takes place by regeneration or repair of broken tissue. Rhubarb and borax is commonly used worldwide for good antiseptic, antifungal and antiviral properties. The aim of the present study is to develop a chitosan based herbal formulation using rhubarb and borax for wound healing.

**Methods:** Borax and rhubarb loaded chitosan nanoparticles were prepared by ionic cross-linking process with sodium lauryl sulphate. A Box-Behnken statistical design was employed to study the effect of independent variables, polymer concentration ( $X_1$ ), cross-linker concentration ( $X_2$ ) and drug concentration ( $X_3$ ) on dependent variables, average particle size, zeta potential, percent entrapment and % drug release. The optimum nanoparticles were then loaded into hydrogel. Wound healing effects of developed formulation was studied on excision wound models on rats.

**Results:** Average particle size and zeta potential of chitosan nanoparticles varied from 93-2225 nm and +30.82 to -16.08 mV respectively, depending upon the polymer, cross-linker, and drug concentration. % entrapment and drug release was also found to be affected by concentration of independent variables. By point prediction tool of design expert, the optimum values of polymer concentration (0.0595%-0.07%), cross-linker concentration (0.460%-0.5425%) and drug concentration (0.7%-1%) were obtained with 85.0% to 108.67% experimental validity for different responses with -8.67% to +14.99% prediction errors. On the basis of particle size, zeta potential and % entrapment, Formulation $C_4$  (0.0595% chitosan, 0.535% cross-linker and drug 1%) was selected among different checkpoint formulation and proceeds for further studies. Hydrogel was developed using combination of polyvinylpyrrolidone and carboxymethyl cellulose. Wound healing activity showed significant % wound contraction for hydrogel based formulation when compared with control and standard.

**Conclusion:** The formulation successfully optimized using DESIGN EXPERT showed significant wound healing activity when tested on rats.



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