Simultaneous optimization of percutaneous delivery and adhesion for ketoprofen poultice

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Abstract

Topical poultices of ketoprofen were prepared using deionized water, propylene glycol (X1), and glycerin (X2) as the vehicle in combination with hydrophilic matrix materials, including gelatin (X3) and sodium polyacrylate. A mixture design was utilized to evaluate the influence of these constituents (X1-X3) on the adhesion of the poultice and the percutaneous penetration of ketoprofen from poultices. The adhesion of the poultice was measured based on the L-Peel test method using a Tensile and Compression Testing Machine. Percutaneous delivery was conducted using nude mouse skin as the barrier. The poultice containing the highest weight fraction of gelatin demonstrated the highest value of peak stress, whereas the poultice containing 0% weight fraction of gelatin showed the smallest value among all formulations. This indicates that gelatin was the main factor determining the adhesion of the poultice. However, the interactive influence of propylene glycol with gelatin on the adhesion of the poultice cannot be ignored. On the contrary, the formulation having the maximal penetration rate was determined to be the vehicle with 0% weight fraction of gelatin and the highest percent weight fraction of glycerin. This indicates that the presence of glycerin in the poultice was able to increase the flux of ketoprofen to some extent. Quantification of individual's effect based on this mixture design resulted in a polynomial equation: Peak stress=0.033X1+0.016X2+0.12X3, flux=1.90X1+4.70X2-6.65X3. Finally, an optimized formulation with acceptable adhesion and a flux comparable to two commercial products was developed in this study.