Characterization, in vitro release and permeation studies of nicotine transdermal patches prepared from deproteinized natural rubber latex blends

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A B S T R A C T

The nicotine transdermal patches (NTPs) are available used for smoking cessation; however, they still should be developed for high efficacy and low cost. In this study, deproteinized natural rubber latex (DNRL) blended with hydroxypropylmethyl cellulose (HPMC) and dibutylphthalate (DBP) were used as matrix membrane for nicotine (NCT) delivery. Several techniques, i.e., FT-IR, XRD, DSC, and SEM were used to characterize the compatibility of each ingredient in the blended patches. A backing layer was used to protect NCT from volatilization. Five different types of backing layer were evaluated for their effects on in vitro release and skin permeation of NCT from the formulated matrix membranes. The backing layer with highest moisture vapor transmission rate (MVTR) and lowest oxygen transmission (OT) supposed to give higher NCT release and skin permeation due to increasing of skin hydration and its occlusive effect. The kinetic of in vitro release and permeation was demonstrated the monophasic slow release pattern which confirmed by first order and zero order kinetics, respectively. Therefore, the backing layer could be appropriated and used conveniently in the preparation of NTPs.

Keywords: Deproteinized natural rubber latex; Hydroxypropylmethyl cellulose; Nicotine transdermal patches; Transdermal drug delivery; Backing layer

1. Introduction

Transdermal drug delivery systems (TDDSs) are effectively alternative systems to deliver the drugs with small molecules into systemic blood circulation via the skin (Barry, 2001; Ghafourian et al., 2010). They provide several advantages over the conventional drug therapy including avoid first-pass biotransformation and metabolism, minimize absorption and metabolism variations, possibly to attain sustained and constant drug levels, increase drug bioavailability and efficacy, provide good patient compliance, and enable fast drug delivery termination by removing the systems (Davidson et al., 2008; Li Wan Po, 1993; Wang et al., 2002; Wokovich et al., 2006). Mainly, TDDSs consist of release liner, adhesive layer and backing layer. Backing layer is chosen for appearance, flexibility and need for occlusion such as polyester, polyethylene and polyolein. In addition, the backing additives protect the leaching out and diffusion of excipients, drug out of the patches (Lei et al., 2010). An overemphasis on the chemical resistance often may lead to stiffness and high occlusivity to moisture vapor and air, which cause the TDDSs to lift and possibly irritate the skin during long-term wear (Wokovich et al., 2006). The color of the backing layer may be a clear and colorless, flesh-colored or metalized. In addition, the backing layer can be categorized into two types, i.e., an occlusive backing, that does not allow air or steam to pass through and a non-occlusive backing, that...