UNIVERSITI TEKNOLOGI MARA

SKIN HISTOLOGY OF MICROWAVE MODIFIED SKIN FOR TRANSDERMAL DRUG DELIVERY

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ABSTRACT

The effect of microwave on rat skin histology for the application in transdermal drug delivery was examined. Four types of pectin (P) films and gels were prepared by dissolving the pectin powder with or without oleic acid (OA) in deionised water under continuous stirring at 25 ± 1°C for 15 h. The skin was treated with microwave from the direction of epidermis using high power (80w) for 15, 30 and 45s. Subsequently, the treated skin applied with pectin films or gels were subjected to the staining method by Harris Haematoxylin-Eosin (H&E) and Oil Red O (ORO) Stain Kit for histological examination. Analysis using the attenuated total reflectance Fourier transform infrared spectroscopy demonstrated that there was no significant difference between the chemical structure of the untreated skin and skin treated by microwave for 15, 30 and 45s. No significant change was noticed in the case of microwave treated skin applied with P and P + OA films. Nevertheless, general observation demonstrated a higher cumulative OA concentration at the immediate surroundings of sebaceous glands in skin treated with microwave and applied with P + OA gel regardless of the irradiation time. The treatment of skin using microwave facilitated the penetration of OA from the pectin gel through the disordered lipid structure of stratum corneum. The freely soluble pectin in gel could probably aid the penetration of OA in comparison to the solid pectin film with entangled chains. Microwave was able to facilitate the penetration of oleic acid from pectin gel through the impermeable skin barrier without causing skin damage.

CHAPTER 1

INTRODUCTION

1.1 Research background

Transdermal drug delivery is a type of dosage forms that provide a continuous infusion of drug across the skin (Ebert et al., 1987; Friend et al., 1988; Chien et al., 1988; Hadgraft & Lane et al., 2006). The natures of skin provide a diffusion-resistant to enable any substances to diffuse through the skin (Andrews, Jeong, & Prausnitz et al., 2012). Thus, the use of a carrier or an enhancer is required to increase the drug transfer across the skin membrane (Durrheim et al., 1980; Barry et al., 1987). Transdermal delivery also avoids the first-pass metabolism of a drug by gastrointestinal or hepatic enzymes, thereby increasing bioavailability. Besides that, drug patches may also make administration of treatment easier in severe patients, such as children or adults with behavioral or psychiatric problems such as Alzheimer's disease (Ale, Lachapelle, & Maibach et al., 2009). In addition, it can improve patient adherence to treatment much easier by providing a visual reminder that the medication has been taken by the patient previously (Andrews et al., 2012; Guy et al., 2010). These types of dosage form imply a topical drug application on skin and to achieve a systemic pharmacological effect of the drug (Grewal et al., 2000).

In order to reach the bloodstream, a drug must first pass through the hydrophobic outer layer of the skin, known as the stratum corneum, then through the more lipophobic epidermal and dermal layers to reach the capillaries (Andrews et al.,2012). A drug may also enter the bloodstream via the sweat ducts, hair follicles,