

嘉南藥理科技大學專題研究計畫成果報告

比較 DEET 及 PLA 應用於化粧品經皮吸收儀器設計的探討

計畫類別：個別型計畫 整合型計畫

計畫編號：CNCS9510

執行期間：95 年 1 月 1 日至 95 年 12 月 31 日

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執行單位：化粧品應用與管理系

中華民國 95 年 02 月 28 日

一、摘要：

中文

經皮吸收是化粧品必然相關的途徑，為設計相關的儀器，必須採用高分子薄膜，以取代人的皮膚，方為便利可行。

本研究以 *potentio stat* 之 *square wave method* 探討 DEET 及 PLA，其條件為活化能 $=5.4\pm 0.7\text{kcal/mol}$ ，及 $R\leq 100\text{k}\Omega\text{cm}^2$ 。於流動系統測試之結果。經以電化學及 HPLC，針對 AA2G 進行經皮吸收，電化學以 CV Scan 定 AA2G 之還原電位 -0.3V 為，HPLC 的滯留時間 1.99 分，收集測試流體中濃度變化，進一步求其經皮吸收與流速的相關方程式。

英文

Permeating through skin is the only path way of Cosmetics when they were applied on the skin. A convenience instrument must be designed for understanding what's going on the Cosmetics had been applied on human skin. Here we replace human skin with polymer membranes DEET that the activity energy is $5.4\pm 0.7\text{kcal/mol}$ and R is small than $100\text{k}\Omega\text{cm}^2$. In this project AA2G was chose to study by CV Scan and HPLC method. The Reduction Voltametry of AA2G is -0.3V , and the retention time is 1.99 minutes in reverse phase C18 column by the mobile phase which is the ratio 1:1 with water and methanol. They were measured under different flow rates in the diffusion cell to gain the penetration concentrations of AA2G through DEET membrane during a period from starting to ending about 30 minutes. The data were collected and we further deduce them to be a useful function describing the mechanism of Skin penetration.

二、前言：

由於目前的經皮吸收研究，基本上多數研發團隊多以動物，如鼠、豬等，或人的皮膚進行經皮吸收的探討，其中當然以人的皮膚為最佳。但是，無論是鼠、豬或人的皮膚，於使用時效均受到若干限制，例如人的皮膚只能保存於 -20°C ，且不得超過兩週，因為其來源有限，不易取得。本實驗係為使經皮吸收研究薄膜之取得如同儀器的零件一般容易，而以高分子薄膜 DEET 取而代之，於擴散裝置。並以電化學及 HPLC，針對 AA2G 進行經皮吸收測試。

三、材料與方法：

1. 購買高分子薄膜 DEET 及 AA2G。
2. 以 potentiostat 之 CV Scan 及 HPLC 測定之。
3. 高分子薄膜分別於流動系統，以 CV Scan 及 HPLC 監測。
6. deduce 其經皮吸收與流速的相關方程式。

四、結果與討論：

由於過去的文獻知，濕潤的皮膚之導電度十分良好，於流動系統，如附件一，於 $\text{pH}=7.4$ 之水溶液下，以 square wave method 測定之，得

$$(i) = \Delta E/R \cdot e^{-t/RC} \quad \Rightarrow \ln i = -(RC)^{-1}(-t + \ln \Delta E/R)$$

顯示 $\ln i$ 與 $1/RC$ 成反比， $(-t + \ln \Delta E/R)$ 為活化能 $=5.4 \pm 0.7 \text{ kcal/mol}$ ，而 $R \leq 100 \text{ k}\Omega\text{cm}^2$ ，顯然皮膚與 lipid layer 比較有易導電的途徑存在。

本研究欲測試高分子薄膜 DEET 經皮吸收趨勢，以電化學 CV Scan 定 AA2G 之還原電位 -0.3V 為，HPLC 的滯留時間 1.99 分。得到十分快速的濃度變化，將經計算，求其經皮吸收與流速的相關方程式，以為進一步之儀器設計的基礎。

五、參考文獻：

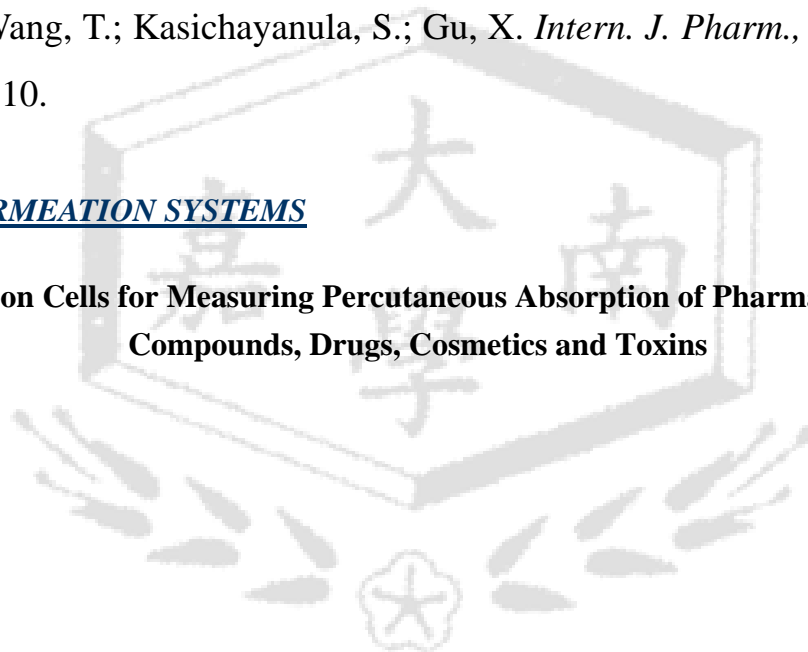
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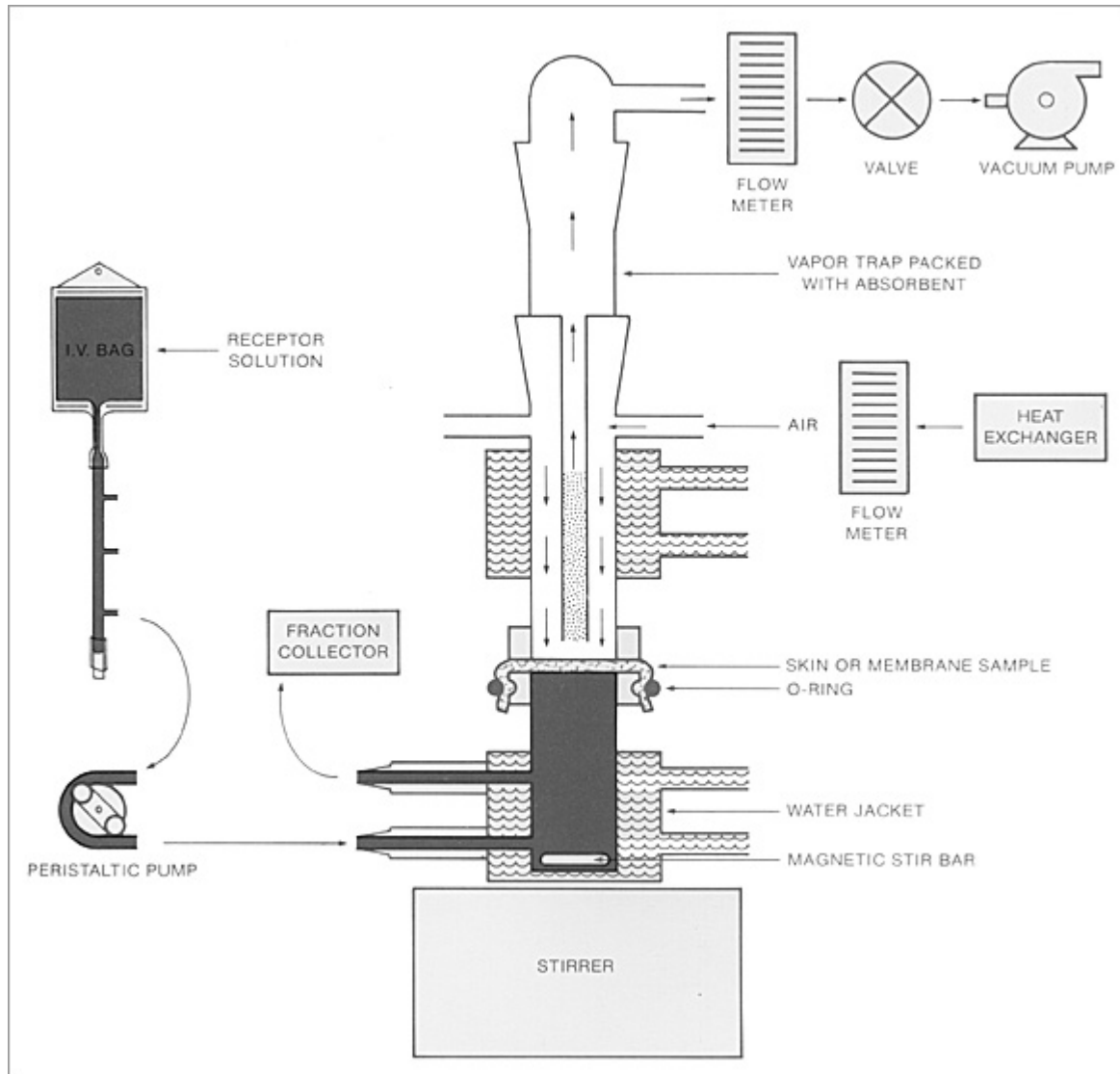
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附件一

SKIN PERMEATION SYSTEMS

**Diffusion Cells for Measuring Percutaneous Absorption of Pharmaceutical
Compounds, Drugs, Cosmetics and Toxins**





The above diagram shows how a typical penetration/evaporation system is set up. A sample of the membrane or excised skin is placed over the penetration cell, dermal side down, and is held in place with an o-ring. After the topical preparation is applied to the surface of the skin or membrane, an evaporation cell is clamped over it.

To measure penetration through the skin or membrane, a receptor solution is pumped from an i.v. bag through a manifold and into the receptor compartment of the penetration cell where it bathes the underside of the skin or membrane (the dermal side of the skin). The receptor solution then exits to a fraction collector where the appearance of the compound(s) of interest in the fractionated outflow gives a measure of percutaneous absorption over time.

Diffusion cells are used to measure the penetration of cosmetics, toxins and drugs into and through the skin or membrane. Evaporation cells are used to measure the

evaporation of these substances from the skin, a measurement that also affects penetration and can answer the question of how much of a topical preparation simply stays on or in the skin. Penetration and evaporation values obtained with diffusion cells can approximate the values obtained using *in vivo* methods such as tape-stripping, urinalysis/radioassay, and punch biopsy.

We have worked closely with local universities and research facilities to develop our line of glass diffusion cells for *in vitro* skin studies. In addition to the Skin Permeation Systems, we also manufacture the RCR Low Flow Cell as well as custom designed cells. For more information on custom designed cells, please see.

Skin Permeation Systems and Diffusion Cells				
	System 1-6	System 3-6 *	System 5-6	RCR
Model	LG-1083-C-6	LG-1084-CS	LG-1088-IC	LG-RCR-9290
		LG-1084-CM		
		LG-1084-CL		
Type	Evaporation/ Penetration	Penetration	Iontophoresis	Low Flow
Evaporation cell diameter	1.1cm			
Penetration cell exposure	1cm	1cm ² , 3.1cm ² , 5cm ²	2.5cm	0.8cm ²
Receptor Volume (Approx.)	3.2ml	3ml, 4.5ml, 5.5ml	4.5 ml	0.3ml
No. of cells	6	6	6	

Our Skin Permeation Systems are available as complete systems which include: **one** Variomag™ stirrer, **one** LGA Stand (holds six cells), **six** cells, tops, clamps, Spin Bars™, PTFE connectors, **four** three-outlet manifolds, and **one** six outlet I.V. bag manifold. Cells, parts and accessories can be ordered separately. The RCR Low Flow cells are available individually only.