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Improvement of cutaneous delivery of methylene blue by liquid crystals

Maria Teresa Junqueira Garcia^{a*}, Thalita Pedralino Gonçalves^a, Éricka São Félix Martins^a, Tereza Silva Martins^a, Márcia Carvalho de Abreu Fantini^b, Paulo Roberto Regazi Minarini^a, Sandra Costa Fernandez^c, Giovanna Cassone Salata^c, Luciana Biagini Lopes^c

^aInstituto de Ciências Ambientais Químicas e Farmacêuticas, Universidade Federal de São Paulo, Rua: São Nicolau 210, Diadema/SP, Brazil.

^bInstituto de Física, Universidade de São Paulo, Rua do Matão 1371, São Paulo/SP, Brazil

^cInstituto de Ciências Biomédicas, Universidade de São Paulo, Av. Prof. Lineu Prestes 1524, São Paulo/SP, Brazil.

*Corresponding author: Universidade Federal de São Paulo, Campus Diadema, Rua: São Nicolau 210, CEP: 09913-030, Diadema, São Paulo. E-mail: mtjgarcia@unifesp.br

Abstract

The purpose of this study was to evaluate the effect of composition and characteristics of liquid crystalline phases (LCPs) on cutaneous delivery of methylene blue (MB). LCPs were obtained by mixing Brij97[®] with water at various ratios; Brij97[®]:water at 8:2 (F8:2), 7:3 (F7:3), and 6:4 (F6:4) were selected, and MB was incorporated at 0.1%. F8:2 and F7:3 exhibited textures and small angle X-ray scattering (SAXS) patterns corresponding to lamellar phase, whereas F6:4 displayed characteristics of hexagonal phase. All three LCPs were stable for 9 months, and exhibited thixotropic pseudoplastic behavior. Increasing water content increased viscosity. All three LCPs released less (3.2- to 6.6-fold) MB than control gel (3.0% hydroxyethylcellulose (HEC) + 0.1% MB), demonstrating their ability to sustain release. Despite the lower release, all LCPs improved skin retention of MB at 6 h post-application (1.3- to 2.1-fold) compared to the control gel. Among the LCPs, F8:2-mediated skin retention of MB was more pronounced, followed by F7:3. Consistent with the increased penetration, transepidermal water loss (TEWL) also increased after treatment with the LCPs (2.0-2.8 fold), which suggests their influence on skin barrier. Irritation studies by Hen's Egg Test – Chorioallantoic Membrane (HET-CAM) suggest that F7:3 and F6:4 may be better tolerated by the skin than F8:2.

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