RESEARCH ARTICLE

Oxybenzone Entrapped in Mesoporous Silicate MCM-41

Valeria Ambrogi • Loredana Latterini • Fabio Marmottini • Maria Cristina Tiralti • Maurizio Ricci

Published online: 16 August 2013 © Springer Science+Business Media New York 2013

Abstract

Purpose Oxybenzone is an organic ultraviolet absorbent commonly used as photoprotection agent in cosmetic formulations. Unfortunately, it shows safety problems because of its potential systemic absorption and skin photosensibilization. Thus, a new particulate carrier is proposed with the aim of solving these problems.

Methods Oxybenzone (OXY) was loaded into the mesopores of the silicate MCM-41 and the obtained particulate carrier (MCM-41-OXY) was mixed with melt tristearin or stearyl alcohol with the aim of plugging the MCM-41 mesopores and thus entrapped OXY inside the pores. These particles were characterized and incorporated in an emulgel. OXY release from these formulations was evaluated in vitro and was compared with those from emulgels containing free OXY and unplugged MCM-41-OXY. The photoprotection range of the hybrid materials was also investigated through spectrophotometric measurements.

Results As concerns with UV absorption properties, it can be observed that the spectrum of the neat compound appears broader than those recorded for lipid/silicate particles and MCM-41-OXY, but MCM-41-OXY with tristearin presents a higher absorption intensity in UVA, UVB, and UVC regions, maintaining thus excellent photoprotection effects. Besides this aspect, the pore occlusion by means of the lipid ingredients offers a proper obstacle to sunscreen release, thus

L. Latterini

CEMIN-Dipartimento di Chimica, Università di Perugia, Via Elce di Sotto 8, 06123 Perugia, Italy

F. Marmottini

Dipartimento di Ingegneria Civile ed Ambientale, Via G. Duranti 93, Perugia, Italy

preventing the contact between the sunscreen and the skin and consequently both systemic absorption and cutaneous adverse reactions.

Conclusions The new lipid/MCM-41 particles appear to be promising candidates to formulate sunscreen preparations.

Keywords Ordered mesoporous silicate · Ultraviolet absorbent · Sunscreen release · Photoprotection

Introduction

It is well-known that UV sun exposure is the cause of very detrimental effects on skin both acute and chronic such as sunburn, photocarcinogenesis, photoimmunosuppression, and photoaging [1]. Thus many strategies of photoprotection have been adopted and among them the use of sunscreens remains the most widespread protection strategy. Sunscreen products contain both organic and inorganic molecules that can absorb, reflect, or scatter UV rays [2]. Two main problems associated to the use of organic sunscreens are their potential photode-gradation with the formation of photosensitizing compounds and the risk of systemic absorption.

Oxybenzone (OXY) belongs to the class of aromatic ketones known as benzophenones. It provides a broad-spectrum UV coverage [1] and for many years has been one of the most used filter. In fact in 2003 it was present as an ingredient of 60 % of sunscreen products manufactured in the USA. Despite established photoprotective effects, a number of important issues have been arisen about the use of OXY in sunscreen formulations. Benzophenones are considered the most allergenic agents of current FDA-approved sunscreens and OXY has the highest incidence of contact and photocontact dermatitis of all sunscreens [3]. Another important problem of OXY use is its systemic absorption profile and its potential as endocrine disruptor. OXY is systematically adsorbed [4, 5] and accumulates primarily in the liver, kidney, and spleen. It is

V. Ambrogi (🖂) · M. C. Tiralti · M. Ricci

Dipartimento di Chimica e Tecnologia del Farmaco, Università degli Studi di Perugia, Via del Liceo 1, Perugia 06123, Italy e-mail: valeria.ambrogi@unipg.it