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PII: S0928-0987(17)30076-3
DOI: doi: 10.1016/j.ejps.2017.02.014
Reference: PHASCI 3912

To appear in: *European Journal of Pharmaceutical Sciences*

Received date: 24 August 2016
Revised date: 2 February 2017
Accepted date: 6 February 2017

Please cite this article as: María Teresa Páez González, Fernando Fumagalli, Carolina Gomes Benevenuto, Flavio da Silva Emery, Lorena Rigo Gaspar , Novel benzophenone-3 derivatives with promising potential as UV filters: Relationship between structure, photoprotective potential and phototoxicity. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Phasci(2017), doi: 10.1016/j.ejps.2017.02.014

Novel benzophenone-3 derivatives with promising potential as UV filters: relationship between structure, photoprotective potential and phototoxicity

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Abstract:

Benzophenone-3 (BP-3) is a UV filter with absorption at the UVB and UVA wavelengths which has not been extensively studied in experiments involving its absorbing effects and toxicity. We synthetized four BP-3 derivatives and characterized their photoprotective potential by UV absorption and photodegradation, their phototoxicity potential by 3T3 Neutral Red Uptake (3T3 NRU PT) and their photoreactivity by the reactive oxygen species (ROS) assay. The UV absorption, photodegradation, phototoxicity and photoreactivity of the four BP-3 derivatives (BP-3 carbonate, BP-3 carbazole, BP-3 phenylamine and BP-3 methoxy-phenylamine) were evaluated and compared to those of BP-3. Results showed that all derivatives were photostable, except BP-3 carbonate, which did not absorb in the UVA range. BP-3 phenylamine and BP-3 methoxy-phenylamine were considered non-phototoxic and weakly photoreactive in the ROS assay, while the carbazole derivative was considered phototoxic and non-photoreactive due to its rigid structure. The UV spectra of BP-3 carbonate, BP-3 phenylamine and BP-3 methoxy-phenylamine showed the influence of hydrogen bonding on their UV absorption. Based on these results, we concluded that BP-3 phenylamine and BP-3 methoxy-phenylamine could be promising UVA filters.

Keywords: UV filters, Photostability, Phototoxicity, Benzophenone-3.

1 INTRODUCTION

The risk associated with cumulative or excessive exposure to ultraviolet (UV) radiation emitted by the sun [UVB (290-320 nm) and UVA (320-400 nm)] has been well studied (Forestier, 2008; Kockler et al., 2012). UVA rays are considered as deleterious as