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BERGAMOT PROCESSING WASTE PRODUCTS AS POTENTIAL EXCIPIENT FOR THE DESIGN OF LIPID NANOPARTICLES INTENDED FOR TRANSDERMAL DELIVERY

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Riassunto

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Nowadays, the recovery and valorization of waste as novel materials in the pharmaceutical and cosmetic field are attractive. In this light, bergamot peels, derived from the food industry, are used to obtain essential oils, flavonoids, pectin, and ascorbic acid. The remaining waste can be an economically source of other high-value components, such as waxes, the use of which has not yet been thoroughly investigated. This work explores the possibility of using bergamot wax (BW) as potential excipients for the preparation of lipid nanocarriers, such as solid lipid nanoparticles (SLN) and nanostructured lipid carriers (NLC), for topical administration. Ibuprofen (IB), an anti- inflammatory drug widely used in commercial topical products, was chosen as model molecule. Wax was extracted from bergamot peels by using Soxhlet Apparatus and characterized by GC/MS and DSC. SLN (BW 100%) and NLC (BW/isopropylmiristate 80/20 w/w) were obtained by hot melt homogenization**.** IB was loaded in 1:3 drug:lipid ratio. The in vitro skin permeation pattern (porcine skin) of IB-SLN and IB-NLC was compared to: I) IB solution (70/30 water/PEG400) at the same concentration (IB-0.3); II) IB saturated solution (IB-1); III) a commercial product containing 10% IB (10%-Gel); IV) placebo SLN (coAdmSLN) or NLC (coAdmNLC) added to the same control formulations. Furthermore, the possible interactions with stratum corneum were deepened by FTIR spectroscopy. GC/MS data showed a prevalence of C_{14}-C_{18} fatty acids in BW after transesterification (saturated/ unsaturated fatty acids 2.5/1). SLN and NLC had a mean diameter of ~ 200 nm and the encapsulation efficiency was in the 43-53% range. Both SLN and NLC significantly enhanced the IB flux through the skin (Figure 1, Panel A) with SLN being more effective than NLC. Interestingly, lipid nanoparticles resulted effective also in co-administration, suggesting that they work as skin penetration enhancers rather than drug carriers. This behavior was found to be dose dependent and might be ascribed to the high content of unsaturated fatty acids. Coherently the addition of SLN to a 10%-Gel formulation led to an amelioration of the IB flux. The obtained data highlighted the potentialities of BW as skin penetration enhancer and therefore as novel excipient for cutaneous preparation.

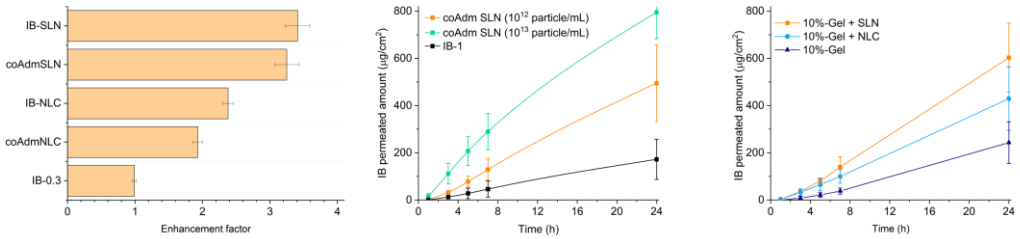

Figure 1. Summary of the in vitro permeation tests. *Panel A* reports the enhancement factor (flux of each formulation divided by the flux of the control solution) of tested formulations containing 0.3% IB; *Panel B* highlights the influence of placebo SLN concentration on IB skin permeation pattern. *Panel C* shows effect of the addition of NLC or SLN to the commercial formula.

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