Investigation of the Effect of Chromolaena Odorata Extract and its Formulations on HDFa Cells in Terms of Skin Photoaging

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INTRODUCTION

Skin aging is a complex multifactorial mechanism involving physical and biological changes in the skin. Photoaging is one of the major subgroups of skin aging. Low amount of high energetic UVB is enough to trigger deleterious effect to the skin through the generation of reactive oxygen species (ROS) and secretion of Matrix Metalloproteinase-1 (MMP-1). MMP-1 are zinc-containing endopeptidases secreted by keratinocytes and dernal fibroblast and mediate the degradation of collagen. Phospholipids have several applications in drug delivery systems such as enhancing the bioavailability of poorly soluble drugs and improving or altering the release and permeation of drugs. Chromolaena odorata (CO) has been shown to possess anticancer, anti-inflammatory, antimicrobial, and antioxidant properties. Its phytochemical components are alkaloids, flavonoids, flavanone, essential oils, phenolics, saponins, tannins and terpenoids. For that reason, it has the potential to be incorporated into a cosmeceutical formulation for the amelioration of skin aging conditions.

METHODOLOGY

Four types of formulations including liposomes, transfersomes, ethosomes and lecithin organogels (LO) were formulated and characterized for particle size, zeta potential and pH.

The effect of CO extract and the formulations against UVB irradiation-induced photoaging in human dermal fibroblasts (HDFs) was investigated by determining cell viability, total soluble collagen, MMP-1 level and ROS accumulation.

Cell viability was determined using MTS assay. Total soluble collagen level was measured in fibroblasts culture using Sircol™ soluble collagen assay. MMP-1 level was measured using ELISA Kit. Finally, the accumulation of ROS was determined using 2',7'-dichlorofluorescein diacetate (DCFDA).

RESULTS

The pH of all the formulations was found to be around the skin pH. The ZP of all the formulations showed negative charge and confirmed the stability of the vesicles in terms of sufficient charge and mobility to inhibit aggregation. The mean particle size of the prepared CO loaded formulations was in the range between 281.77 to 456.47 nm.

Table 1: Characterization of the prepared empty and loaded formulations, pH, ZP, size and PDI.

<table>
<thead>
<tr>
<th>Formulation</th>
<th>pH (± SD)</th>
<th>ZP (± SD)</th>
<th>Vessicles size (nm)</th>
<th>PDI (± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO loaded liposomes</td>
<td>7.38 ± 0.04</td>
<td>-88.7 ± 8.70</td>
<td>281.77 ± 6.33</td>
<td>0.44 ± 0.03</td>
</tr>
<tr>
<td>Empty liposomes</td>
<td>7.43 ± 0.06</td>
<td>-82.8 ± 0.36</td>
<td>208.37 ± 1.40</td>
<td>0.27 ± 0.00</td>
</tr>
<tr>
<td>CO loaded transfersomes</td>
<td>7.17 ± 0.15</td>
<td>-55.23 ± 3.27</td>
<td>456.47 ± 21.42</td>
<td>0.43 ± 0.03</td>
</tr>
<tr>
<td>Empty transfersomes</td>
<td>7.23 ± 0.06</td>
<td>-66.1 ± 2.38</td>
<td>362.17 ± 3.65</td>
<td>0.52 ± 0.05</td>
</tr>
<tr>
<td>CO loaded ethosomes</td>
<td>6.48 ± 0.04</td>
<td>-61.47 ± 1.71</td>
<td>349.93 ± 15.80</td>
<td>0.36 ± 0.04</td>
</tr>
<tr>
<td>Empty ethosomes</td>
<td>7.10 ± 0.10</td>
<td>-80.17 ± 1.63</td>
<td>297.07 ± 5.18</td>
<td>0.47 ± 0.01</td>
</tr>
<tr>
<td>CO loaded LO</td>
<td>7.31 ± 0.03</td>
<td>-27.07 ± 0.86</td>
<td>360.27 ± 12.76</td>
<td>0.29 ± 0.01</td>
</tr>
<tr>
<td>Empty LO</td>
<td>6.47 ± 0.06</td>
<td>-24.63 ± 0.12</td>
<td>353.97 ± 12.27</td>
<td>0.44 ± 0.03</td>
</tr>
</tbody>
</table>

Notes: Each value is expressed as mean ± standard deviation (n=6). Abbreviations: ZP, Zeta potential; PDI, Polydispersity index.

CONCLUSION

- None of the treatments showed significant increase or decrease in the soluble collagen without UVB exposure.
- In order to find the effect of UVB radiation towards HDFa cells, the cells were exposed to 50 min of the radiation, and the effect of UVB on the cells were assessed when pre-treated with the CO incorporated formulations.

Figure 1: Viability of HDFa cells after treatment with CO extract and formulations. (Mean ± SD, n=6).

Figure 2: Viability of HDFa cells treated with CO extract and formulations followed by exposure to UVB. (Mean ± SD, n=6).

Figure 3: Collagen level in HDFa cells treated with CO extract and formulations followed by exposure to UVB. (Mean ± SD, n=6).

Figure 4: MMP-1 level in HDFa cells treated with CO extract and formulations followed by exposure to UVB. (Mean ± SD, n=6).

Figure 5: ROS level in HDFa cells treated with CO extract and formulations followed by exposure to UVB. (Mean ± SD, n=6).

REFERENCES