New cosmetic formulations based on N-Prolyl Palmitoyl Tripeptide-56 Acetate and Bakuchiol Complex with anti-aging properties

Ana Simona BARNA1, Claudia MAXIM1, Adriana TRIFAN2, Delia TURCOV2, Alexandra Cristina BLAGA1 and Daniela SUȚEU1

1“Gheorghe Asachi” Technical University of Iasi, Faculty of Chemical Engineering and Environmental Protection, Iași, România
2University of Medicine and Pharmacy “Grigore T. Popa”, Faculty of Pharmacy, Department of Pharmacognosy, Iași, Romania

INTRODUCTION

The objective of this study was to evaluate the biological potential of a pharmaceutical O/W emulsions containing a synergic biologically active complex based on a plant-derived meroterpenic phenol, bakuchiol (BAK) [1- (4-hydroxyphenyl)-3,7-dimethyl-3-vinyl-1,6-octadiene] and a peptidic as a n-proyl palmitoyl tripeptide-56 acetate (TPA), in order to highlight the optimal concentration and combination in the formulation, in terms of antioxidant activity.

The objective of this study was to evaluate the biological potential of a pharmaceutical O/W emulsions containing a synergic biologically active complex based on a plant-derived meroterpenic phenol, bakuchiol (BAK) [1- (4-hydroxyphenyl)-3,7-dimethyl-3-vinyl-1,6-octadiene] and a peptide as a n-proyl palmitoyl tripeptide-56 acetate (TPA), in order to highlight the optimal concentration and combination in the formulation, in terms of antioxidant property. Bakuchiol is a active substance found in the species Psoralea corylifolia which exhibits antioxidant and antibacterial activity and it is an alternative to the retinoids. The n-proyl palmitoyl tripeptide-56 acetate is a small peptide which has been reported to stimulate the production of elastin, fibronectin, glucosaminoglycan and collagen.

O/W emulsions were prepared using a non-ionic, non-ethoxylated emulsification system that is composed of hydrolyzed wheat protein oilovyl, cetearyl alcohol, glyceryl oleate, glyceryl stearate, able to build-up anisotropic lamellar phases O/W from vegetable oils, by means of totally natural ingredients. As a dispersed phase, we use a mix of vegetable oil like Phuknetia volubilis, Ribes nigrum, and Triticum vulgare and as a a continuous phase Lavandula latifolia hydroxid.

There were formulated three emulsions with different concentrations in active complex (0.5% BAK + 0.5% TPA, 1% BAK + 1% TPA, 1% BAK + 2% TPA).

METHODS

Determination of total phenolic content

The total phenolic content was determined following previously described methods (Grochowski et al., 2017; Trifan et al., 2021). Briefly, 50 µL of sample were mixed with 100 µL Folin-Ciocalteu reagent and vigorously mixed. After 3 min, 75 µL of 1% Na2CO3 solution were added and the mixture was incubated for 2 h at room temperature in the dark. Then, the absorbance was read at 760 nm and the total phenolic content was expressed as micromgrams of gallic acid equivalents (µg GAE/mL).

Determination of antioxidant activity

DPPH and ABTS assays were used to evaluate the antioxidant activity of the the active complex (BAK /TPA)

6.2-diphenyl-1-picrylhydrazyl radical scavenging assay

The assay was performed following a previously described method (Grochowski et al., 2017), with slight modifications. Thus, 50 µL of sample was added to 150 µL of 2,2-diphenyl-1-picrylhydrazyl (DPPH) 0.048% methanol solution. After 30 min incubation at room temperature in the dark, the absorbance was read at 517 nm. DPPH radical scavenging activity was expressed as milligrams of Trolox equivalents (mg TE/mL).

2,2′-azino-bis(3-ethylbenzthiazoline) 6-sulfonic acid radical scavenging assay

The assay was performed following a previously described method (Grochowski et al., 2017), with minor changes. ABTS*+ was generated by mixing 7 mM 2,2′-azino-bis(3-ethylbenzthiazoline) 6-sulfonic acid (ABTS) solution with 2.45 mM potassium persulphate (1:1, v/v). The mixture was allowed to stand for 12-16 min in the dark at room temperature. In the beginning of the assay, ABTS solution was diluted with methanol to reach an absorbance of 0.700 ± 0.02 at 734 nm. Then, 30 µL sample was added to 200 µL ABTS solution and vigorously mixed. After 30 min incubation at room temperature, the absorbance was read at 734 nm. The ABTS radical scavenging activity was expressed as milligrams of Trolox equivalents (mg TE/mL).

RESULTS

Sample | TPC (µg GAE/mL) | DPPH (mg TE/mL) | ABTS (mg TE/mL)
--- | --- | --- | ---
0.5% Bak + 0.5% TPA | 0.035 ± 0.002 | 1.06 ± 0.01 | 3.61 ± 0.02
1% Bak + 1% TPA | 0.043 ± 0.004 | 1.28 ± 0.01 | 3.62 ± 0.01
1% Bak + 2% TPA | 0.046 ± 0.007 | 1.30 ± 0.01 | 3.61 ± 0.02
1% Bak | 0.069 ± 0.005 | 1.35 ± 0.01 | 3.61 ± 0.01
2% TPA | 0.017 ± 0.003 | 0.03 ± 0.00 | 0.10 ± 0.02

Data are presented as mean ± standard deviation (SD) of three determinations. Abbreviations: ABTS - 2,2′-azino-bis(3-ethylbenzothiazoline) 6-sulfonic acid; Bak – bakuchiol [1- (4-hydroxyphenyl)-3,7-dimethyl-3-vinyl-1,6-octadiene]; DPPH - 1,1-diphenyl-2-picrylhydrazyl; TE - trolox equivalent; TPA - total phenolic content.

CONCLUSION

The results suggested that the biologically active complex showed good antioxidant activity. This research confirmed that the proportions used for preparing emulsions with BAK and TPA are suitable for topical use due to their antioxidant effect and to the potential utilization in antiaging therapy.

Microbiological evaluation indicates that the total number of viable aerobic mesophilic microorganisms does not exceed 103 cfu/g or 103 cfu/ml of product. Pseudomonas aeruginosa, Staphylococcus aureus and Candida albicans were not detected in the emulsions.

Optical microscopy indicates that the samples are stable, no creaming, flocculation or sedimentation phenomena are observed. The addition of cosmetic actives after emulsion production does not change the emulsion structure.

It can be concluded that the designed emulsions presented physico-chemical properties adequate for cosmetic skin care product formulations.