

Formulation of folic acid in niosomes for mature skin care

Iwona Zyglińska¹, Monika Pasikowska-Piwko¹, Renata Dębowska¹, Joanna Markiewicz², Krzysztof Cal³, Katarzyna Rogiewicz^{1,2}, Irena Eris^{1,2}

1. Dr Irena Eris S.A., Centre for Science and Research, Piaseczno, Poland
2. Dr Irena Eris S.A. Technology and Implementation Division, Piaseczno, Poland
3. Laboratory of Molecule Engineering, Gdansk, Poland

Introduction

Folic acid is well known vitamin, promoting growth of skin cells by providing necessary material for DNA and RNA renewal. Due to its activity it's an excellent ingredient in anti-aging cosmetics.

The aim of this study was to investigate whether folic acid enclosed in special delivery system - niosomes exhibits better penetration abilities through stratum corneum than pure folic acid. We also checked anti-aging effect of niosomes with folic acid *in vivo*.

Materials and Methods

Ex vivo penetration measurement

- Niosomes (with 0.5% folic acid) and pure folic acid (0.5%) were applied to a StatM membrane for 3 hrs in the Franck chamber. Amount and depth of folic acid penetration was analysed by microscope visualisation of dissected membrane.

In vivo tests

- Group I: Participants (5 women aged 23-43) applied emulsion with encapsulated folic acid in niosomes and placebo form on left and right forearm, respectively. Skin topography (Visioscan) was evaluated before application and after 2 hrs.
- Group II: single-blind, split-face study in group of 20 women aged 49-69. Participants applied emulsion with encapsulated folic acid no. 07755 on the left eye area and nasolabial fold and placebo on right side, twice a day for 3 weeks. Skin topography was performed (VISIA, Primos, and VISIOSCAN); melanin content and elasticity were evaluated using Mexameter and Cutometer, respectively. At the end of the study participants completed a satisfaction questionnaire.

Results – ex vivo penetration measurement of folic acid in niosomes

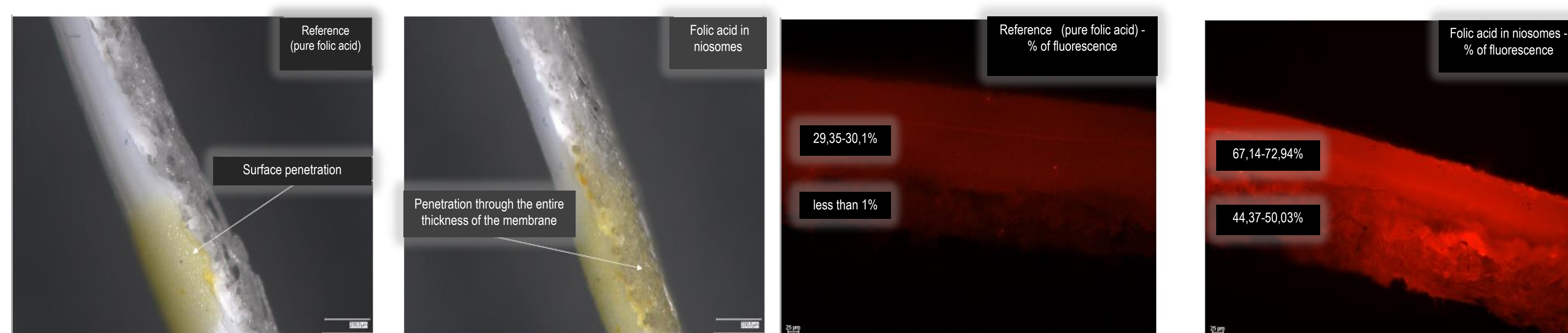


Figure 1. The study showed that encapsulated folic acid in niosomes penetrated at least 2-fold deeper (left side) and in 2-fold greater (right side) amount into the StatM membrane, compared to pure folic acid. Fluorescence intensity was shown in %. The brightness of StatM slices was higher for folic acid in niosomes compared to pure folic acid (around 70% compared to 30% for pure folic acid)

Conclusions

Our studies indicated that folic acid enclosed in niosomes penetrated deeper and in greater amount to stratum corneum compared to the ure form. Cream with encapsulated folic acid in niosomes was well tolerated and displayed better results in instrumental measurements than placebo version. Obtained results indicate that usage of special carriers for vitamins, like folic acid, allowed to achieve better anti-aging effect.

Results – *in vivo* efficacy of emulsion with folic acid in niosomes no. 07755



Figure 2. Instrumental analysis (VISIA) for emulsion no. 07755 showed the reduction in the number of wrinkles by 51% and volume/size by 37% (GZ, age 67), the reduction in the number of wrinkles by 15% and volume/size by 23% (AB, age 51), the reduction in the number of wrinkles by 10% and volume/size by 3% (EG, age 52) after 3 weeks cream application.

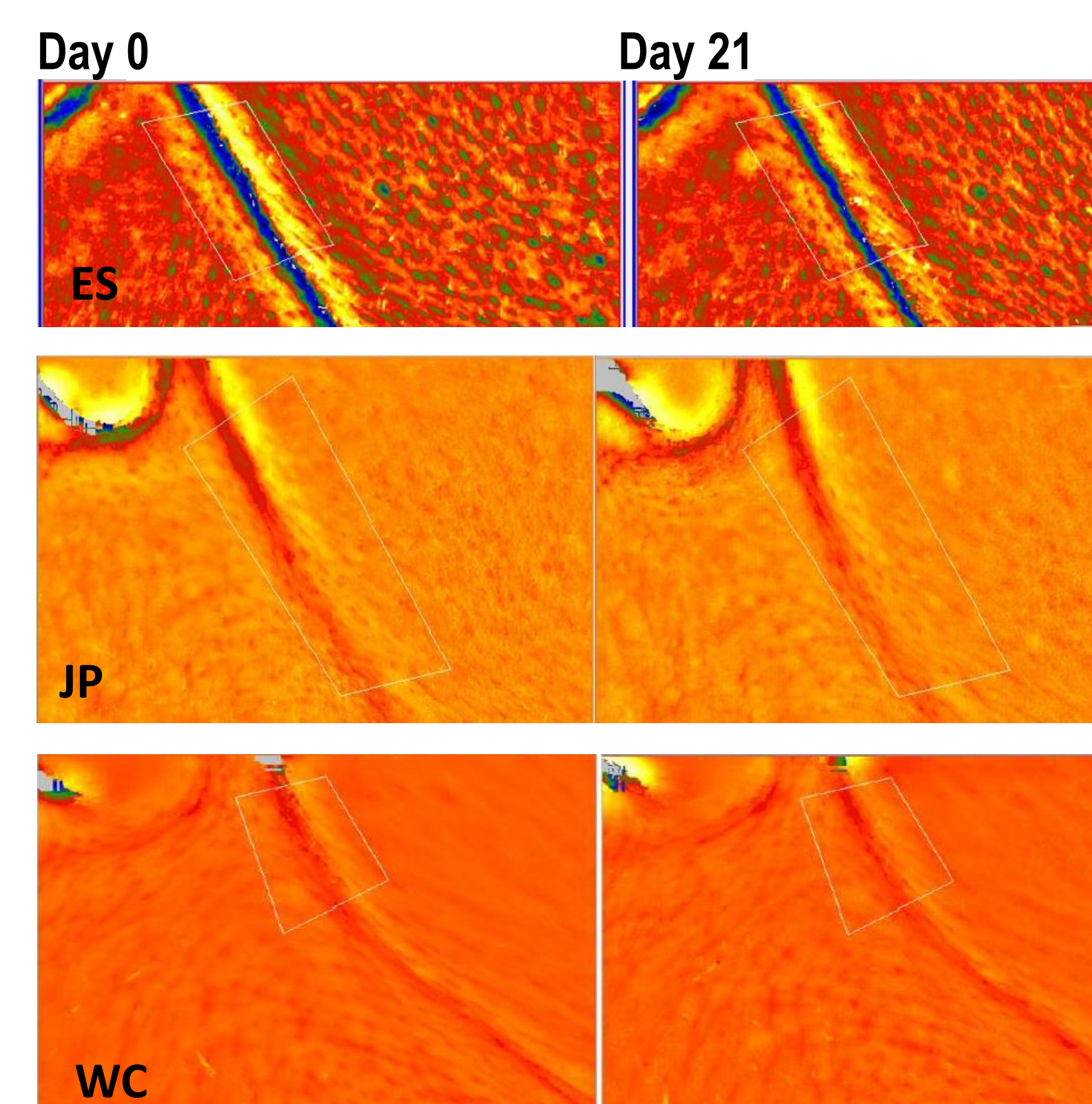


Figure 3. Instrumental analysis (PRIMOS) for emulsion no. 07755 showed a reduction in nasolabial fold volume of 1.03702 mm³ (ES, age 60), 1.71919 mm³ (JP, age 49) and 0.31877 mm³ (WC, age 69) after 3 weeks of product usage.

Table 1. Skin topography analysis (Visioscan) after one application of the emulsion no. 07755 compared with placebo version.

Skin texture parameters n=5	% of change (folic acid in niosomes)	% of change (placebo version)
Skin smoothness (Sesm)	+16%	no improvement
Number of wrinkles	-6%	no improvement

Reduction in the number of wrinkles by 6% and an improvement in skin smoothness by 16% in comparison to placebo was observed.

Table 2. Skin instrumental analysis after 3 weeks application of the emulsion no. 07755 compared with placebo version.

Skin parameters n=20	% of change (emulsion no. 07755)	% of change (placebo)
elasticity (Cutometer)	+17% in 50% of subjects	no improvement
melanin level (Mexameter)	-9% in 50% of subjects	-7% in 55% subject
wrinkles (Visia)	-19% (size/volume) in 50% of subjects	no improvement

The improvement in skin elasticity and the reduction in size and volume of wrinkles compared to placebo was noticed.

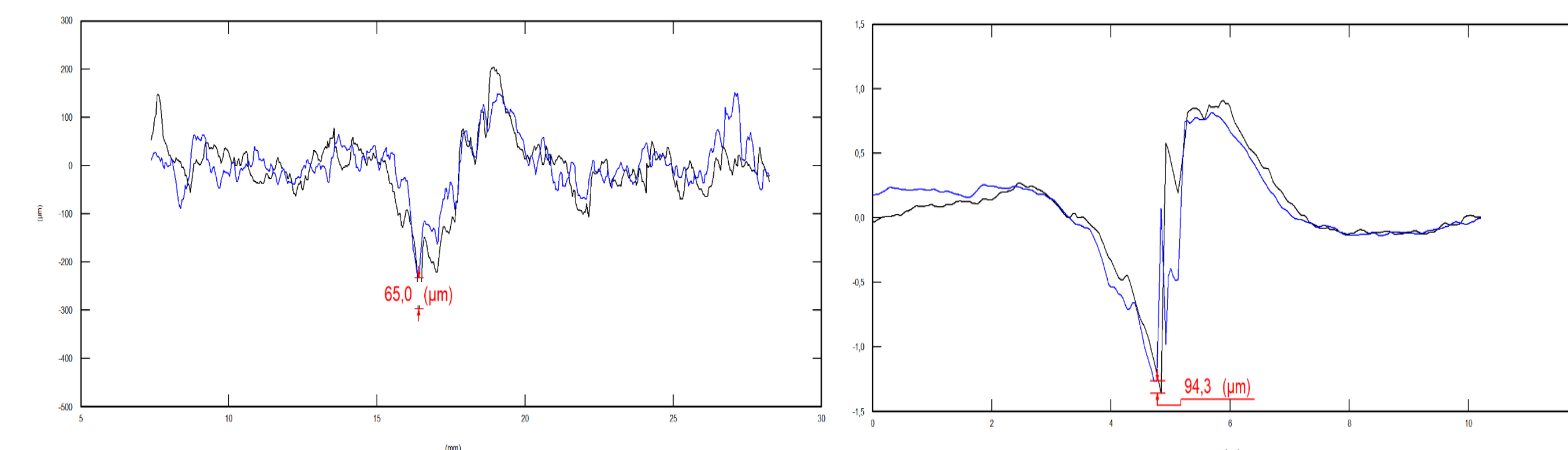


Figure 4.

Reduction in the depth of the nasolabial fold (by 65.0 μm) in the volunteer JP, age 49 after 3 weeks of using emulsion no. 07755 (black line - before, blue line - after 3 weeks)

Figure 5.

Reduction in the depth of the nasolabial fold (by 94.3 μm) in the volunteer EM, age 65 after 3 weeks of using emulsion no. 07755 (black line - before, blue line - after 3 weeks)

Table 3. Subjective evaluation after 3 weeks of using emulsion no. 07755 and placebo version.

Efficacy after 3 weeks of products usage	% of respondents (no. 07755)	% of respondents (placebo)
Reduces/decreases the appearance of dark circles under the eyes	70%	65%
Reduces/decreases the appearance of puffiness (bags) under the eyes	68%	52%
Lightens the skin around the eyes	80%	60%
I feel that the number of lines/wrinkles in the eye area has decreased	56%	48%
Gives a noticeable rejuvenation effect to the skin around the eyes	72%	52%

The tested product with folic acid in niosomes showed stronger skin brightening properties (80%); skin rejuvenation (72%); wrinkles, puffiness and dark circles under the eyes reduction (56%, 68%, 70% respectively) in comparison to placebo version.