ORIGINAL ACTIVE COMPLEXES USED IN ANTI–WRINKLE/ANTI–AGEING COSMETIC PRODUCTS

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Lucrarea prezintă complecşi activi originali, elaboraţi pe baza materiilor prime atent selecţionate, selectaţi prin evaluarea caracterisiticilor fizico–chimice şi a stabilităţii în condiţii distructive şi structurale. Influenţa acestora asupra eficacităţii produselor dermato–cosmetice anti–îmbătrânire / anti–rid în care sunt utilizaţi s–a evaluat prin teste in vivo şi in vitro.

The paper presents some original active complexes, based on carefully characterized raw materials, selected through the evaluation of physico–chemical and structural characteristics and of their stability under destructive conditions. The influence of these conditions on the efficacy of corresponding anti–ageing / anti–wrinkle cosmetically products in which are used was evaluated through in vivo and in vitro tests.

Keywords: active complexes, antioxidant activity, structural characteristics, anti–ageing / anti–wrinkle cosmetically

1. Introduction

Throughout life, the skin suffers (by the changes in the natural protection and recovery mechanisms) a series of transformations due to physiological (intrinsic or chronologic ageing) and environmental / external (extrinsic or photo–ageing) factors.

Thus, ageing is an inevitable and irreversible physiological event with a slow evolution, succeeding in its visible manifestations during individual growth period, but starting even from the conception moment. Many theories try to explain the ageing phenomenon based on the "genetic fatigue", the mutations of the DNA chains, or the influence of the free radicals formed in the cells.

The process mirrors the individual biological age and does not correspond always with the chronological age, appearing at the skin level due to the changes in the aspect and structure through [1]:

– a thinning epidermis which turns pale, dry, wrinkled and less elastic due to the affliction of the cellular recovery zone;

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– dermal atrophy, more evident to women;
– strong drying and scaling of the skin due to the diminishing and partial changes in the adipose tissue of the hypodermis;
– decreased cell recovery speed due to metabolic deficiencies;
– changes in pigmentation due to pigment maculae or achromous spots, star–shaped lesions, purple spots.

The dermis, deeply affected by these processes due to its fibrilar and chemical structure, influences the epidermis and thus the ageing process becomes visible at the skin surface. Thus, the wrinkles appear due to the diminishing quantity of collagen and the content in glycosoaminoglycans from the extracellular matrix and implicitly a diminution of the dermis thickness (loss of ecogenicity), skin rigidity (of the horny layer and the dermis) resulting from a diminution of the metabolic activity of the fibroblasts along with the diminution in the adherence at the collagen fibers and the limitation of the organization of the dermal tissue [2, 3].

The cosmeceuticals can not stop the biochemical processes of the intrinsic ageing but they can slow down / diminish them and can struggle against the effect of some environmental factors by:
– restoring firmness and elasticity;
– diminution of the biochemical processes from the skin resulting from the sun or heat activity, climatic or pH changes;
– restoring the hydro–lipidic balance of the skin.

Our paper presents some original complex antioxidant structures which positively influence the anti–wrinkle / anti–ageing efficiency of some cosmeceuticals.

2. Experimental part

Materials:

– extracts from plants (corn flower, rose petals, wild thyme, marsh mallow, linden tree);
– vegetal proteins (soybean, wheat, silk);
– vitamins (A, E, B_5, ascorbyl phosphate);
– coenzyme Q_{10};
– emollients (vegetal oils);
– minerals (magnesium aspartate, zinc and copper gluconate).

Technique

For the elaboration of the original complexes we determined the physico–chemical characteristics of the raw materials by spectral techniques in the IR and UV–VIS domains. Their efficiency was tested by the evaluation, through

in vivo specific tests, of the anti–wrinkle / anti–ageing effects of the cosmeceuticals:

– profilometry tests;
– evaluating the hydrating effect;
– evaluating the variation of the sebum content at the surface of the skin;
– evaluating the thermo–stability.

Apparatus

– Visioscan VC 98 for the skin profilometry;
– Cutometer MPA for the skin elasticity, equipped with CORNEOMETER CM 824 probe for the hydrating effect and SEBUMETER SM 815 probe for the sebum secretion;
– FT–IR 620 spectrometer (Jasco) in the 4000 – 400 cm^{-1} in order to establish the structural characteristics;
– UV–VIS–NIR V570 spectrophotometer (Jasco) with the diffuse reflexion (ILN–472) and the corresponding software for the structural analysis and for the color characteristics, before and after accelerated ageing at various temperatures [4].

3. Results and discussion

A cosmetic with an anti–ageing / anti–wrinkle effect should meet the following requirements:

– to present optimal effects, without secondary or negative effects;
– to be adequate to an intended age segment;
– to have a corresponding penetrability;
– not to contain any impurities which might affect its physico–chemical characteristics (for instance, transitional metals with prooxidant effect);
– to be biodegradable and stable (it should not change its properties during the shelf life).

From this starting point, six types of original active complexes have been prepared (Table 1) containing, in relation with their function, plant extracts, vegetal oils, vitamins, proteins and minerals, but also amino–acids with the capacity to participate in enzymatic reactions and to stimulate the skin recovery processes.

Table 1

Original active complexes used in cosmeceuticals with anti–wrinkle / anti–ageing effect

Crt. No.	Code of active complex	Composition	Destination
1.	**CB–1**	minerals and rose petals extract	anti–ageing
2.	**CB–2**	minerals and wild thyme extract	anti–ageing
3.	**CB–3**	peptidic derivatives, vitamin E and marigold oil	anti–ageing
4.	**CB–4**	proteins and pro–vitamin A and marigold oil	anti–ageing
5.	**CB–5**	proteins, grape oil, vitamin E and coenzyme Q_{10}	anti–wrinkle
6.	**CB–6**	coenzyme Q_{10} and vitamin E	anti–wrinkle

The raw materials used for the bioactive complexes have been characterized in detail as regards their structure and stability under destructive conditions [5 – 7] in order to guarantee a corresponding quality and to maintain the cosmetic characteristics along their shelf life.

The characteristics of the active complexes were investigated by spectral methods, while the anti–oxidative activity by chemiluminescence.

Structurally, they contain bands pointing to the presence of acid groups (ν1744 cm^{-1}), aliphatics with long chains (ν724 cm^{-1}) and a relatively low degree of unsaturation (ν 3010 and ν 967 cm^{-1} – trans C=C).

The weight losses, although quite low at 80^0C thermodestruction, are within the acceptable limits and can be regarded as insignificant (Table 2).

During the thermoxidative process, the complexes did not change their initial colour proving their high stability mainly due to the presence of the unsaturated groups of trans type in the emollients and to the presence of natural antioxidants (vitamins, flavonoids and anthocyans from plants) [8].

All the active complexes present a remarkable antioxidant activity which is not substantially affected by the thermodestruction at 80^0C.

Table 2

Stability characteristics of the active complexes

Complex	Losses by thermodistruction (%)		Antioxidant activity (%)		
	1h × 50^{0}C	1h × 80^{0}C	initially	1h × 80^{0}C	Δ AA
CB–1	0,84	1,26	69,3	71,2	+1,2
CB–2	0,20	0,35	70,1	72,4	+2,3
CB–3	0,13	0,38	60,8	66,2	+5,4
CB–4	0,35	0,50	65,3	67,6	+1,7
CB–5	0,17	0,66	73,4	71,1	–2,3
CB–6	0,26	0,72	76,6	74,2	–2,4

Based on the data obtained, the CB–6 active complex has been selected, in various concentrations for different cosmeceuticals destined for face care (Table 3). All the four products, firstly prepared in laboratory conditions, were then produced at industrial scale according to the European legislative requirements [9], adopted also by Romania.

Table 3

Cosmeceuticals based on the selected active complex

Sample code	Product
CBL–1	day anti–wrinkle cream
CBL–2	night regenerative cream
CBL–3	anti–dark eye rings cream
CBL–4	cleansing milk & tonic

The samples were characterized by *in vitro* and *in vivo* tests performed at the room temperature (15 – 20^{0}C) in order to establish the stability of the products during their storage and at 40^{0}C – temperature corresponding to the technological conditions of their production and close to the human body temperature.

Spectral measurements did not show any structural changes while the chromatic characteristics presented only insignificant variations of the main parameters even at very long exposure times to temperature (Table 4). Exception is CBL – 1 sample that shows important decrease in chroma.

Table 4

Stability of the cosmeceuticals based on the selected active complex

Sample	Testing conditions	L^* (%)	C^*	$H(^0)$	AA (%)
CBL–1	initially	81,62	41,01	100,47	68,02
	75h × 40^0C	82,23	9,05	92,46	65,43
CBL–2	initially	78,06	3,49	109,07	55,53
	75h × 40^0C	84,23	6,42	94,51	54,24
CBL–3	initially	77,59	4,59	110,54	89,41
	75h × 40^0C	84,19	4,00	97,65	87,59
CBL–4	initially	80,62	1,58	108,97	50,20
	75h × 40^0C	86,15	5,86	100,18	48,48

L^* – luminosity, C^* – chrome, H – shade angle

Thus, it is obvious that cosmeceuticals prepared maintain their antioxidant character under the testing conditions being well protected by the selected natural antioxidants.

The *in vivo* specific tests allowed us to evaluate the cosmeceuticals compatibility with the human skin and to establish their efficiency. The tests performed on volunteer human subjects, under dermatologic and ophthalmologic control, proved the products to be safe for human health and hypoallergenic. The results of the tests on the cosmetic efficiency are presented in Table 5.

Table 5

Cosmetic efficiency of the cosmeceuticals based on selected active complex

Characteristic	Maximum value (%)			
	CBL–1	**CBL–2**	**CBL–3**	**CBL–4**
Immediate hydrating	63,6	62,5	63,6	65,6
Elastic aspect	65,5	77,8	–	–
Velvet–like	31,4	48,9	80,0	–
Smoothing	68,1	48,1	–	–
Anti–wrinkle	35,7	39,6	–	–
Suppleness	–	–	70,0	–
Relaxation	–	–	45,0	–

By comparing the bio–physical parameters of the skin from an area treated with a product comparative with *placebo*, we evaluated the cosmetic efficiency due to the content of the active complex. In this way, we argue that the cosmeceuticals ensure:

– CBL–1 and CBL–2, the re-hydrating, the smoothing and an improvement of the elastic aspect of the skin as they have an anti-wrinkle effect;

– CBL–3, the relaxation and the improving of the skin suppleness as it has and anti-dark circle effect;

– CBL–4, the re-hydrating of the skin by recovering the hydro-lipidic balance of the skin.

4. Conclusion

The paper presents the structural and antioxidant characteristics of six original active complexes elaborated from raw material of natural origin. They allowed us to select one of these active complexes, which was used in four cosmeceuticals with anti-wrinkle / anti-ageing effect demonstrated by *in vivo* tests.

The products, elaborated according to the national and European requirements in this domain, follow the actual trends of the market regarding the use of the natural raw materials obtained from plants.

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