journal of applied cosmetology

2

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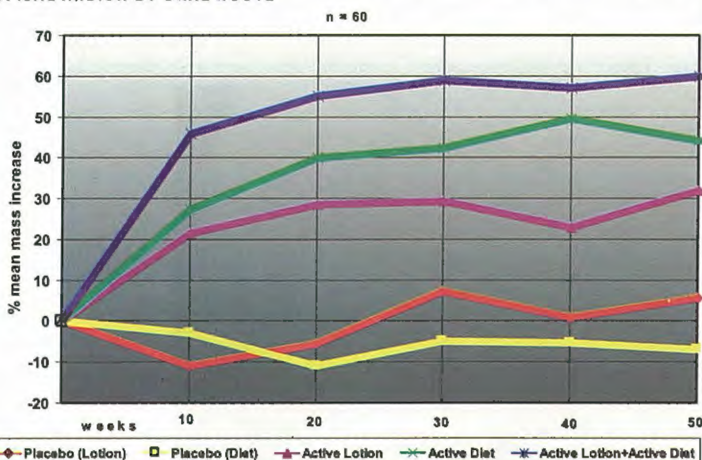

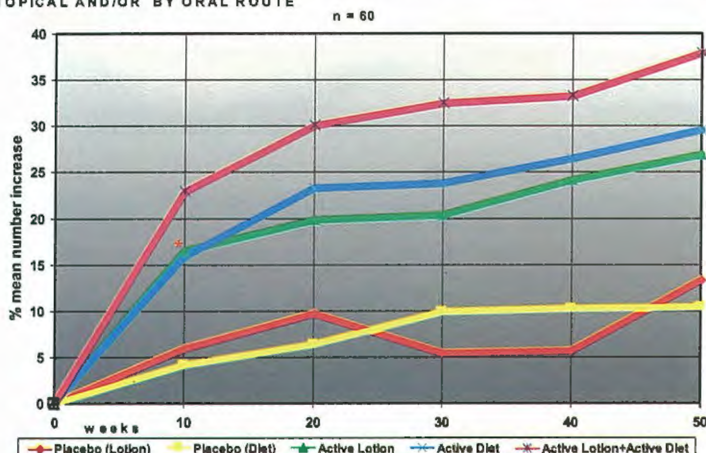

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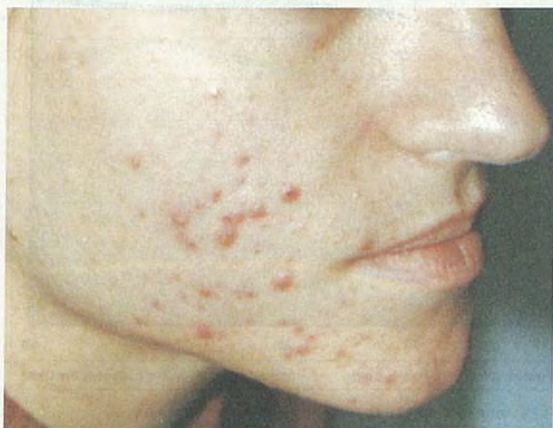

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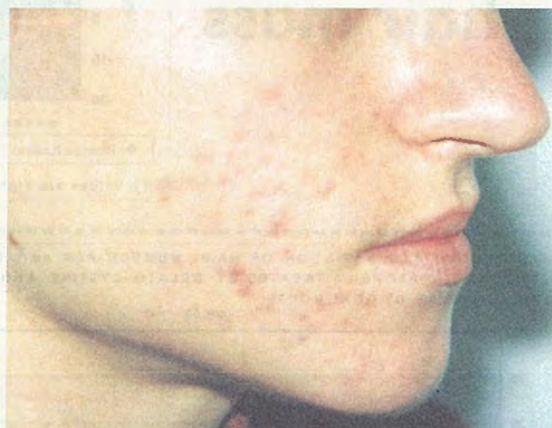

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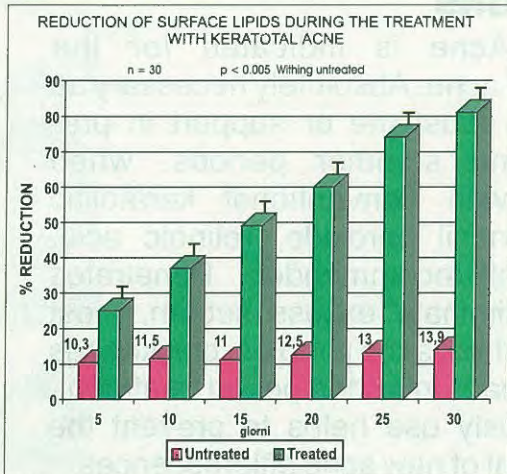

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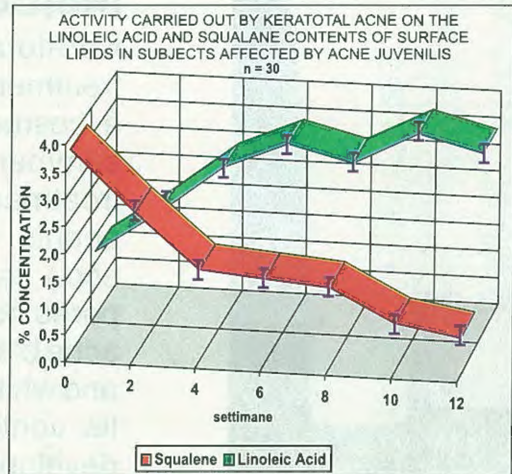

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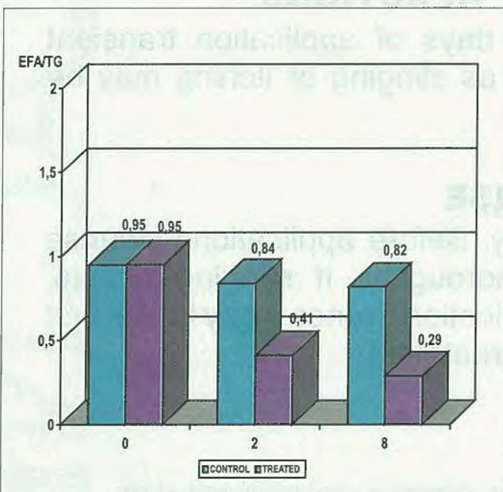

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HOW TO USE

Twice a day. Before applications cleanse the skin thoroughly; if stinging occurs, reduce application to once a day for the first ten days of treatment

REFERENCES:
*1,2 - **Data on file Mavi Sud***
3 - **M. Ghiczy, H.P. Nissen, H. Biltz (1996)** The treatment of Acne Vulgaris by phosphatidilcholine from Soybeans, with a high content of linoleic acid. *J. Appl. Cosmetol.* **14**, 137-145

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J. Appl. Cosmetol. **17**, 36-45 (April-June 1999)

DIAGNOSTIC PROCESS AND TREATMENT MONITORING OF SEBORRHOEIC DANDRUFF BY MEANS OF A IMAGEANALYTICAL PROCEDURE

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Received: *March 19, 1999*

Key words: *Dundruff, Image Analysis*

Summary

After briefly going into the clinical picture of (seborrhoeic) dandruff, its pathogenesis and therapy, the clinical proof procedure on the scalp is pointed out.
A new imageanalytical method, based on past examinations is described. Here, the number of scales (SZ) and the measuring area covered with scales (SF) are measured. From this, a relative scale size (SG) can be calculated
Additionally the scale sizes are shown in per cent in 9 categories.
In three exemplarily presented comparative tests, the suitability of the method for the evaluation of an antidandruff formula against a standard product, the influence of the basis and different effects of individual active antidandruff ingredients could be demonstrated.
Score-determinations on the scalp which were carried out in comparison had the same result, but overall were less selective.

Riassunto

Dopo aver descritto brevemente la patogenesi e la terapia della forfora seborroica, viene descritta una procedura di controllo da eseguire sul cuoio capelluto basata su un metodo di analisi di immagine. Viene misurato il numero di squame (SZ) e l'area che esse ricoprono (SF). Viene quindi calcolata la loro relativa grandezza media (SG).
La grandezza percentuale delle squame è suddivisa in 9 categorie. Con tre test comparativi viene verificata l'esattezza del metodo, controllando anche una formula antiforfora, paragonata ad una formulazione standard, verificandone anche l'influenza della sua base e di diversi principi attivi.
Con la metodica a punteggio si sono ottenuti gli stessi risultati, ma con minore selettività.

INTRODUCTION

Increased scaling off of the stratum corneum of the scalp, which oversteps the normal mark, leads to the clinical image of "dandruff".

Keratinization disturbances (e.g. a parakeratosis in case of psoriasis capitis) or a xerosis (e.g. in case of dermatitis atopica in the sense of an etat craquelé) can be pathogenetic causes. In the latter case, irritative factors (e.g. tensides) can additionally lead to an inflammatory hyperkeratosis.

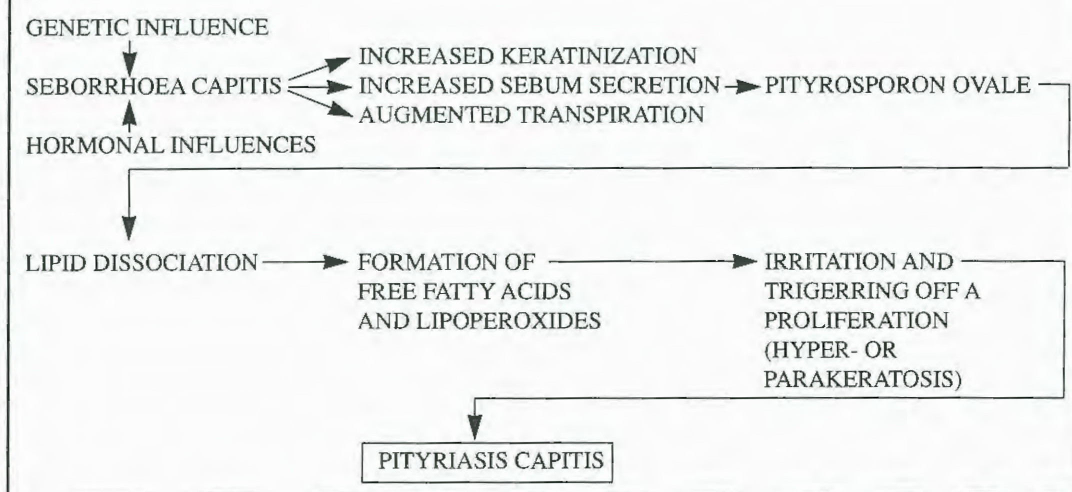
The most common form is, however, the so-called seborrhoeic dandruff (pityriasis capitis), which affects around 5% of the population (1). Men are more often affected than women and the main age group are the 20 to 40-year olds, so there is reason to believe that there are hormonal influences.

The question whether pityriasis capitis as a primarily non-inflammatory variation - in English it is often called "dandruff" - can be delimited from seborrhoeic dermatitis or whether there is a fluid transition, is being controversially discussed in the respective literature (2).

Considering of the clinical impression as well as the therapeutical approaches, the following developmental pattern can be assumed for pityriasis capitis (Table I).

The genetically predetermined and hormonally activated seborrhoea leads sui generis to an increased proliferation of the keratinous layer (example: intra-follicular hyperkeratosis in case of acne) and to an increased secretion of sebum and sweat. These, in turn, represent an ideal culture medium for the lipophile yeasts of the type pityrosporon ovale, which are present everywhere on the skin. They cause a lipid dissociation with formation of free fatty acids and lipoxides, which have an irritant effect on the skin. This leads to an inflammatory proliferation of the epidermal cells up to a hyper- or parakeratosis, respectively. The result is a changed scaling on the skin surface, i.e. in larger scales, which is found to be cosmetically disturbing. A minimal variation of seborrhoeic dermatitis develops, which includes an increased sensitivity of the scalp and is sometimes combined with itching and erythema.

In the case of an especially intensive secretion of sebum these changes, also called seborrhoea



sicca, turn into a seborrhoea oleosa by adhesion of the dandruff with sebaceous residues, which can then lead to firmly adhering dandruff caps and needs to be treated dermatologically.

The validity of these pathogenetic conclusions is confirmed by the frequent clinical observation that after a successful (antimicrobial) treatment of pityriasis capitis there is at first an increase of the amount of sebum on the scalp with corresponding influence on the hair style.

In the past, mainly keratolytics like salicylic acid and resorcin, as well as sulphur, selenium disulphide, zinc-pyrithion and tar were used for the treatment of the cosmetically disturbing dandruff. If there is a heavily inflammatory component, topical glucocorticoids were also used.

The new substances which have a good in vitro effect against p. ovale (3) are for instance piroctonolamin as well as some different azoles, also used as antimycotics.

For the treatment of cosmetic dandruff, i.e. a moderate seborrhoeic pityriasis capitis of the type seborrhoea sicca, antidandruff shampoos with tensides as formulas which are free of active ingredients are being offered (4).

The determination of the degree of a pityriasis capitis and a therapy control can be done by means of an evaluation of the dandruff according to scores on the head with hair. If necessary, this can also be done in individual areas of the scalp.

In order to objectively detect cosmetically disturbing dandruff, one can use a test procedure which was developed more than 20 years ago. Its imageanalytical updating is described methodologically in the following.

During the development of the early method it was already found out that compared to the determination of the amount of combed-out scales (number or weight), the differentiation of the sizes in predetermined categories e.g. by diameter or the surface of the scales, also represents a sensitive parameter.

It was therefore advisable to not only record the number of combed-out scales but also the categorisation into different sizes and the measuring area covered by scales in the imageanalytical process. The ratio of number of scales and covered measuring area can be used as an additional measure for a relative average scale size.

Thus, the evaluation of the dandruff status is similar to the photoanalysis applied in the evaluation of cellular cohesion on the hairless skin by use of adhesive films (6, 7).

METHOD FOR IMAGEANALYTICAL DETERMINATION OF DANDRUFF

Under defined conditions (combing procedure and closeness of the comb's teeth) the test

Fig. 1 - Combing out of the dandruff under defined conditions.

Fig. 2 - Measuring device for measuring scales.

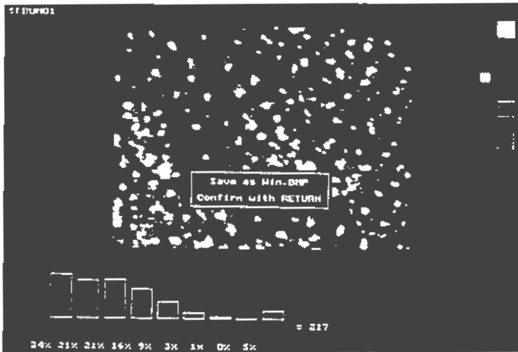


Fig. 3 - Dandruff image with analysis by means of special software.

Table II CLASSIFICATION FOR SCALE SIZE				
Category I	<	0,05	mm	∅
II	to	0,08	mm	∅
III	to	0,10	mm	∅
IV	to	0,13	mm	∅
V	to	0,15	mm	∅
VI	to	0,18	mm	∅
VII	to	0,20	mm	∅
VIII	to	0,23	mm	∅
IX	>	0,25	mm	∅

subject's dandruff is combed onto a black film (Fig. 1), then put into a Petri dish and distributed evenly in a 25×25 mm measuring field with a fine brush. This measuring field is then completely measured in the stationary measuring device, consisting of a high-resolution CCD camera and a fluorescent UV -lamp , installed for even illumination (Fig. 2). The picture, transmitted onto a PC monitor (Fig. 3) is then analysed according to the following parameters by means of a special software:

Number of scales in the measuring field (SZ)

Measuring area covered with scales (SF) in %

Relative scale size (SG)

$$SG = \frac{SF \times 100}{SZ}$$

Distribution of scale sizes in % into 9 categories (Table II)

A mistake in the method, which is negligible in practice, is that scales which are lying on top of each other by chance are not measured separately. In case of very high scale density, it is therefore advisable to evaluate the scales in two measurings.

When carrying out effectiveness studies of, for example, antidandruff shampoos, one has to take care that not only the procedure of combing out is done in a defined way, but also that the test subjects do not change their hairstyle or use different additional hair care products during the study.

STUDY DESIGN OF EFFECTIVENESS TEST OF ANTIDANDRUFF PRODUCTS

For a comparative test of antidandruff products, the test subjects with cosmetically disturbing seborrhoeic dandruff to be included in the test, should be chosen after a preliminary dermatological examination. The group should comprise a minimum of 20 test subjects. In the first examination, an initial imageanalytical condition is additionally determined. This is complemented by a dermatological dandruff score of the scalp (Table III). These parameters are complemented by an additional evaluation of the degree of dandruff by the test person according to the same scores.

Table III
SUBJECTIVE EVALUATION KEY FOR THE OBJECTIVE AND SUBJECTIVE DANDRUFF INVASION

Score	
0 =	No scales visually perceptible
1 =	Single scales
2 =	Several scales
3 =	Dense dandruff invasion
4 =	Extensive dandruff invasion

Following this, there is a conditioning phase with a neutral shampoo. This shampoo should be applied at least twice a week over a period of 14 days.
After that, the dandruff situation is once again examined by means of imageanalysis and scores (measuring time 0). After that, there is a treatment phase of 4 to 6 weeks with weekly examinations of the dandruff status. Afterwards, a rinsing phase of 2 to 4 weeks with fortnightly further examinations is advisable.
If several products are to be tested comparatively, i.e. different groups of test subjects are needed, an assignment of the test products to the different groups at measuring time 0 is advisable in order to achieve comparable initial values. This does not apply, if a double blind randomisation is intended.

EXAMPLES OF RESULTS FROM COMPARATIVE DANDRUFF STUDIES

In order to show the practical relevance of the results to be achieved as well as the usability of the presented test procedure, which we have been using for several years, three comparative tests are shown exemplarily in the following.

Evaluation of a test product in comparison to an introduced reference product

In order to test the effectiveness of a newly-developed antidandruff formula, one can carry out a comparison with a standard product, i.e. a product which is already on the market.
Table IV shows the result of such a test for photo-analytical evaluation. Here there is a clear increase of dandruff formation in all three measuring parameters for the test product after a conditioning phase of two weeks with a neutral shampoo. In the treatment phase over a period of 4 weeks, the measuring parameters decrease depending on time, i.e. formation of dandruff decreases. Here, the values for measuring time 0 compared to measuring time 4 are highly significant statistically. After putting the test subjects onto a neutral shampoo in the following 6 weeks, the dandruff increases again gradually up to the value of measuring time 0.
A striking fact in the reference group is that there is no significant increase of the dandruff values after the conditioning. This leads to differences of the initial values of the two groups at the beginning of the treatment phase. To avoid this, a randomisation is only advisable at this point in time.
In this test subject group B, the dandruff values also decrease during the 4-week treatment and even after withdrawing the verum in the following weeks, a further decrease of the dandruff values can be established.
In the evaluation of the score values of the scalp a similar picture presents itself, including the presented specific differences in the development in the two groups (Table V).

Evaluation of the influence of the basic formula which is free of active ingredients

The basic formula which is free of active ingredients is especially important for the effect of antidandruff products, especially shampoos, because the possibly irritant effect of these ingredients on the scalp, which is highly sensitive anyway (in the sense of a seborrhoeic dermatitis), could weaken the antidandruff effect of a substance, or as has been shown in some of our own examinations, even neutralise it.
In a comparison of two formulas with 0,1% pi-

Table IV

IMAGEANALYTICAL COMPARISON OF A TEST SUBSTANCE (A) AND A STANDARD SUBSTANCE (B)

A Shampoo with 2% Climbazol (n=23)
B Shampoo with 2% Ketoconazol (n=19)

MZ	AN	A			B		
		SZ	SF	SG	SZ	SF	SG
−2	P	218	9,5	4,4	179	7,6	4,2
0	P	246	18,2	7,4	161	7,9	4,9
1	V	182	15,0	8,2	143	5,6	3,9
2	V	224	9,8	4,4	161	5,5	3,4
3	V	180	6,4	3,6	159	4,3	2,7
4	V	149	5,1	3,4	157	4,5	2,9
6	P	198	6,8	3,4	132	4,3	3,3
8	P	236	9,4	4,0	119	4,3	3,6
10	P	277	10,3	3,3		–	
12	P	284	12,3	4,3		–	

MZ - Measuring Time (Weeks)
AN - Applied Product; V - Verum; P - Placebo
SZ - Number of Scales
SF - Area of Scales %
SG - Rel. Size of Scales

$$SG = \frac{SF \times 100}{SZ}$$

rocton-olamin in different basic ingredients, formula B is clearly superior to formula A in all relevant parameters of imageanalytical evaluation (Table VI).
The dermatological score comparison also shows the superiority of formula B (Table VII).

Evaluation of the influence of the active ingredients

As a last example, a comparative test with two different active ingredients (azoles) in the same shampoo basis is presented.
As is shown in Table VIII, the formula with Azol B proves to be more efficient in the imageanalytical evaluation. The differences between the two formulas become especially clear during the last two weeks of treatment.
It is possible that the differences in efficiency are due to the different solubility of the applied components.
In the score evaluation (Table IX), these differences are less pronounced, above all when the different initial values are not taken into account.

DISCUSSION

The determination of dandruff occurring with pityriasis simplex by analysis of scales that could be combed out and not in scores on the scalp was already described more than 20 years

Table V
DERMATOLOGICAL SCORE-COMPARISON OF A TEST SUBSTANCE (A) WITH A STANDARD SUBSTANCE (B)

A Shampoo with 2% Climbazol (n=23)
B Shampoo with 2% Ketoconazol (n=19)

MZ	AN	Score	
		A	B
–2	P	1,2	1,2
0	P	1,5	1,2
1	V	1,2	1,2
2	V	1,2	1,0
3	V	1,2	0,7
4	V	0,9	0,8
6	P	0,7	0,6
8	P	0,8	0,6
10	P	0,7	–
12	P	0,9	–

MZ - Measuring Time
AN - Applied Product

ago. By use of imageanalytical evaluation processes its quality can be improved and, at the same time, it can be simplified methodologically. The results achieved with this method correspond in principle to those of the in vivo evaluation of dandruff. It has to be said, however, that the latter evaluation is less selective.

Apart from the number of scales (SZ) and the measuring area covered with dandruff by which the relative scale size can be calculated, the classification of the different scale sizes gives some information about the pathogenesis. An increase of many small scales (e.g. in therapy) indicates an exsiccation of the stratum corneum. If, however, there is an increase of larger scales, or are they already present, an inflammatory epidermal proliferation can be inferred.

A shift in the classification from larger to smaller scales during treatment (Table X) is a very reliable indicator for the evaluation of a successful therapy.

Table VI
IMAGEANALYTICAL COMPARISON OF TWO FORMULAS WITH DIFFERENT BASIC FORMULA

A Basic Formula A with 0,1% Piroctn-Olamin (n=23)
B Basic Formula B with 0,1% Piroctn-Olamin (n=23)

MZ	AN	A			B		
		SZ	SF	SG	SZ	SF	SG
–2	P	172	1,4	8,4	217	17,4	8,0
0	P	245	26,4	10,8	297	21,9	7,4
1	V	186	19,1	10,3	191	13,6	7,1
2	V	196	15,8	8,1	151	7,4	4,9
3	V	183	13,7	7,5	150	7,0	4,7
4	V	152	11,4	7,5	113	4,4	3,9
6	P	294	18,1	6,2	241	10,7	4,4
8	P	370	25,3	6,8	305	12,6	4,1

MZ - Measuring Time (Weeks)
AN - Applied Product; V - Verum; P - Placebo
SZ - Number of Scales
SF - Area of Scales %
SG - Rel. Size of Scales

$$SG = \frac{SF \times 100}{SZ}$$

Table VII

DERMATOLOGICAL SCORE-COMPARISON OF TWO BASIC FORMULAS

A Basic Formula A with 0,1% Pirocton-Olamin (n=23)

B Basic Formula B with 0,1% Pirocton-Olamin (n=23)

MZ	AN	Score	
		A	B
–2	P	1,5	1,4
0	P	1,5	1,4
1	V	1,3	1,1
2	V	1,1	0,8
3	V	1,0	0,7
4	V	0,9	0,7
6	P	0,9	1,0
8	P	1,4	1,3

MZ - Measuring Time
AN - Applied Product

The imageanalytical method is not only suitable for the evaluation of a current state, but, as is to be shown in examples, for the evaluation of treatment types.

It is advisable to have a group of test subjects comprising about 20 people or more, and in case of comparative studies to use randomisation after a 2-week conditioning with a neutral shampoo, for example. For the evaluation of efficiency, a treatment cycle of 4 weeks is usually sufficient. The reaction time of applied substances can be evaluated in a neutral aftercare phase.

In the studies made up to now, it has become clear that the basic formulas without active ingredients used for the effect of antidandruff shampoos have a special significance. A drying-out of the scalp and, even more, an irritation of the sensitive scalp lead to an intensification of dandruff.

Table VIII

IMAGEANALYTICAL COMPARISON OF TWO FORMULAS WITH DIFFERENT ACTIVE INGREDIENTS IN THE SAME BASIC FORMULA

A 1% Azol A (n=24)

B 1% Azol B (n=27)

MZ	AN	A			B		
		SZ	SF	SG	SZ	SF	SG
–2	P	–	–	–	–	–	–
0	P	199	12,4	6,2	184	10,8	5,9
1	V	180	10,8	6,0	141	11,5	8,2
2	V	148	7,7	5,2	132	7,9	6,0
3	V	144	8,7	6,0	112	8,1	7,2
4	V	140	8,1	5,8	103	6,3	6,1

MZ - Measuring Time (Weeks)
AN - Applied Product; V - Verum; P - Placebo
SZ - Number of Scales
SF - Area of Scales %
SG - Rel. Size of Scales

$$SG = \frac{SF \times 100}{SZ}$$

Table IX

DERMATOLOGICAL SCORE-COMPARISON OF TWO FORMULAS WITH DIFFERENT ACTIVE INGREDIENTS AND THE SAME BASIC FORMULA

A 1% Azol A (n=24)
B 1% Azol B (n=27)

MZ	AN	Score	
		A	B
–2	P	–	–
0	P	1,2	1,5
1	V	1,4	1,5
2	V	1,0	1,2
3	V	0,7	0,9
4	V	0,8	0,8

MZ - Measuring Time
AN - Applied Product

Table X

EXAMPLE OF A FREQUENCY DISTRIBUTION OF SCALE SIZES

Substance A with 0,1% Pirocton-Olamin (n=23)

MZ	Freqnency distribution (%)								
	I	II	III	IV	V	VI	VII	VIII	IX
0	44,7	22,0	11,4	7,1	4,4	2,4	1,9	1,2	4,3
2	58,1	20,3	7,9	5,0	3,0	1,4	1,3	0,7	2,4
4	57,8	19,9	8,8	5,4	3,5	1,7	0,6	0,7	1,5

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A SPECIAL FOAM FOR CLEANSING THE SKIN

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Key words: cleansing foam, antibacterial activity, P. ovale, S. aureus, microbial count, Alfa 4 Micospuma®, hand-washing, piroctone olamine, chlorhexedine digluconate.

Summary

The skin with its area between 1.5 and 2.3 mq. is the largest organ of the human body.
With the exception of the nails, no skin area appears to be without a resident microbial flora and all areas have a transient or contaminant bacteria and fungi whose staphylococcus and micrococci represent the major groups.
What it is to remember is that gram-negative bacilli and fungi are particularly affected by high temperature and expecially by humidity.
For the above reasons we deemed it interesting to control the antimicrobial and antifungal efficiency of a new cleansing foam in different condition of temperature and humidity, in order to evaluate its effectiveness at different latitudes, given the present mobility of world population.
In this study it was used a handwash viable-count sampling technique, the hands being rinsen via standard way with our foam.
The studied foam caused a progressive reduction of 99% of bacteria and fungi after six successive treatments in any condition of humidity.
The same reduction was also obtained after a single application.
No side effects were observed.
This foam thanks to its antibacterial activity and user-friendliness can be considered a new cosmeceutical for the daily usage of frequent travellers and for daily hand washing of doctors and medical personnel at surgeries and hospital departments.

Riassunto

La cute, con un'estensione compresa tra 1,5 e 2,3 mq , è l'organo più grande del corpo umano. Con l'eccezione delle unghie, nessuna zona cutanea è priva di flora batterica e tutte le aree sono colonizzate con batteri e funghi di cui gli stafilococchi e i micrococchi rappresentano la parte predominante.
Ciò che è interessante ricordare è che i batteri gram-negativi ed i funghi sono sensibili alle alte temperature, ed in particolare all'umidità, variando quindi con le condizioni climatiche.

Per tutti questi motivi, è stata controllata l'efficacia antimicrobica ed antifungina di una nuova schiuma detergente utilizzata sia come bagno-doccia giornaliera, che come detergente, soprattutto delle mani, per valutarne la sua attività a diverse latitudini.
La spuma utilizzata si è rivelata molto attiva sia nell'uso continuativo, quale bagno-doccia del corpo, che come detergente delle mani.
La riduzione batterica elevata anche dopo un'unica applicazione, raggiungeva il 99% di efficacia dopo ripetute applicazioni senza provocare effetti collaterali negativi.
Interessante è stata anche l'alta attività rivelata nei confronti del pityrosporon ovale, presente spesso nella dermatite seborroica, nella pitiriasi versicolor ed in alcune forme di dermatite atopica.
Per tutti questi motivi, questa spuma rappresenta un utile mezzo per la detersione globale delle persone ospedalizzate prima di effettuare interventi chirurgici e per la detersione delle mani di persone che debbano detergerle continuamente per motivi di lavoro, quali i chirurghi plastici, gli odontoiatri o le infermiere addette, ad esempio, ai reparti di puericultura.

INTRODUCTION

The skin with its area between 1.5 and 2.3 mq. is the largest organ of the human body.
With the exception of the nails, no skin area appears to be without a resident microbial flora and all areas have a transient or contaminant bacteria and fungi whose staphylococci and micrococci represent major groups.
The main bacterial species commonly found on healthy human skin are the propionibacteria, coaugulase-negative staphylococci, and aerobic coryneform (1) Generally staphylococci and aerobic coryneforms are dominant on moist skin.
Moreover the dominant bacterium nearly contaminating infection following operations, for example, of the tip seems to be staphylococcus aureus (2,3) and as it is well known when the integrity of the skin barrier is interrupted by disease or trauma, a variety of nonresident bacteria and fungi can flourish. For this reason bacterial flora on the patient's own skin is an important source of postoperative wounld infections. (4,5)
Naturally bacteria and fungi life has always related to skin surface lipids, microbial antagonisms, bacterial adherence, desquamation, pH, toxic products or secretory antibody and, last but not least, environment humidity and temperature. In fact microrganisms survive much longer on wet skin, and hydration not only elevates the microbial density, but also alters the relative ratios. (6,7)

AIM

The aim of this study was to control the antimicrobial and antifungal effinciency of a new cleansing foam in such way to reduce the skin flora in different condition of temperature and humidity, in order to evaluate its effectiveness at different latitudes, given the present mobility of world population.

MATERIALS AND METHODS

Material

MICOSPUMA A (active A): aqua, (water) decylglucoside, glycerin, PPG-buthet-26, PEG-40-hydrogenated castor oil, chlorhexedine digluconate, sodium hydroxymethylglycinate, methyl gluceth-20, lactic acid, triclosan, piroctone olamine, bisabolol, linseed acid, disodium EDTA, parfum, (fragrance).

MICOSPUMA B (control B): aqua, (water) decylglucoside, glycerin, PPG-buthet-26, PEG-40-hydrogenated castor oil, sodium hydroxymethylglycinate, methyl gluceth-20, lactic acid, bisabolol, linseed acid, disodium EDTA, parfum, (fragrance).

Methodology

1st Study: 40 healthy volunteers (25 women and 15 men) aged between 18 and 27 years and divided in two sub-group (1 or 2) were involved in the study in a randomized way. All the volunteers were told to wash their entire body, including the scalp, with the MICOSPUMA A (active A) or (control B). The washing one day procedure entailed two consecutive throughout applications of the cleansing foam and rinsing under a hot shower, according to Brandberg and Andersson (7).
Before and after the shower bath, the bacterial skin samples were taken in 5 different skin areas of the body surface (forehead, cheeck, armpit, sternum and mid-thigh) according to Williamson and Kligman scrub method (8).
According to this tecnique a metal ring is held firmly against the skin surface and 1 ml. of wash fluid (0.075 M sodium phosphate buffer, pH 7.9, containing 0.1% v/v Triton-X 100) is pipetted into it. The skin surface within the ring is rubbed for 1 min. with a teflon policeman, which is lifted away from the skin every few

seconds and then replaced. Aliquots of the wash fluid are then plated onto the selected media, incubated in plastic bags at 37° C and read after 6 days.

No samples were taken before the skin was dry. The same study was performed controlling the effect of six consecutive daily bath. The degree of bacterial contamination was judged from the colony-forming unit (cfu) recorded on agar plates (25 cm2) after a 48 h. aerobic incubation at 37°C. To isolate P.ovale it is necessary to enrich the medium with lipid supplement such as glycerol, glycerol monostearate, tween 60 and cow's milk after an aerobic incubation at 37°C for at least 3-4 days, according to Leeming and Nothan (9)

The obtained results are reported in Tab 1-2 and Figure 1.

Table I

Amount of cfu/Plate recorded on 4 different skin areas before and after a one-day shower-bath with a cosmeceutical cleansing foam.

APPROXIMATE NUMBER OF cfu/Plate			
SKIN AREA	BEFORE WASHING	AFTER WASHING MICOSPUMA -CONTROL B n=20	AFTER WASHING MICOSPUMA -ACTIVE A- n=20
FOREHEAD	≈ 50	≈ 8,000	≈ 0
CHECK	≈ 11,000	≈ 120,000	≈ 350
STERNUM	≈ 60	≈ 1,000	≈ 0
ARMPIT	≈ 500,000	≈ 20,000	≈ 60
MID-THIGH	≈ 30	≈ 150	≈ 0

Table 2

Amount of cfu/Plate recorded on 4 different skin areas before and after six consecutive daily bath with a cosmeceutical cleansing foam.

APPROXIMATE NUMBER OF cfu/Plate			
ASKIN AREA	BEFORE WASHING	AFTER WASHING MICOSPUMA -CONTROL B n=20	AFTER WASHING MICOSPUMA -ACTIVE A- n=20
FOREHEAD	≈ 50	≈ 5,000	≈ 0
CHECK	≈ 11,000	≈ 90,000	≈ 10
STERNUM	≈ 60	≈800	≈ 0
ARMPIT	≈ 500,000	≈ 15,000	≈ 20
MID-THIGH	≈ 30	≈ 150	≈ 0

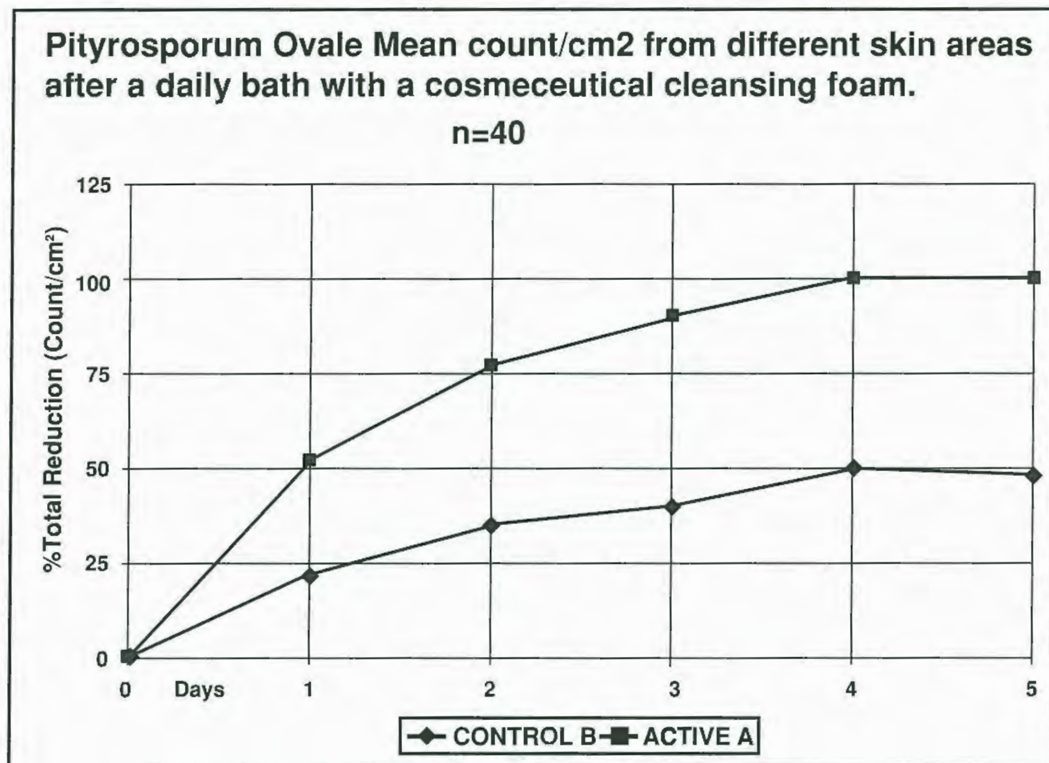

Fig. 1

2nd Study: This study was performed to control the efficacy of the ACTIVE A or CONTROL B micospuma on contaminated hands and forearms at normal condition and under occlusion. How it is known the occlusion of the skin, increasing the local humidity, elevates the microbial density. This generally happens to people leaving in countries with an high level of environment humidity.

The arms of 20 volunteers (10 men and 10 women) aged between 18 and 25 years were wrapped with a plastic film for 5 days and the bacterial samples were controlled each day according to Aly and Maibach (5). Before applying the wrapper the hand and the arms of the volunteers, previously, colonized with S aurens, so as to have at least 180 colony-forming units (cfu) were washed twice by an expert technician with the cleansing foam MICOSPUMA A or B respectively on the right or left arm and hand in a randomized way in 5-min periods. Each application was followed by rinsing under water, drying and bacterial sampling with contact plates according to Seeberg et al, (10).

Contact plates are specialized Petri dishes which are filled with any desired culture until the agar surface is slightly concave. They are pressed firmly onto the skin to remove surface bacteria.

The obtained results are reported in Figure 2-4.

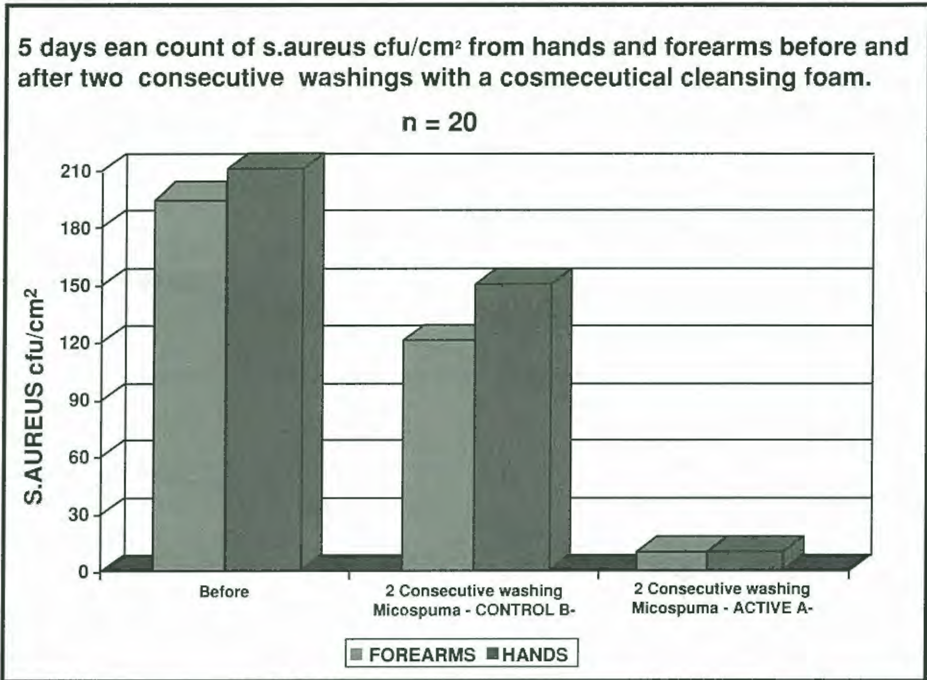

Fig. 2

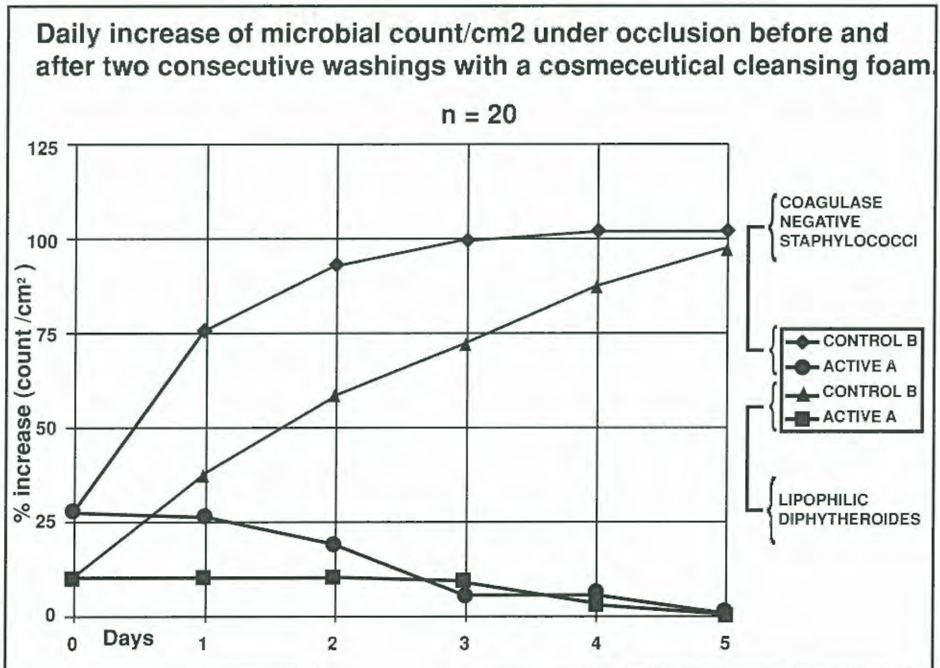

Fig. 3

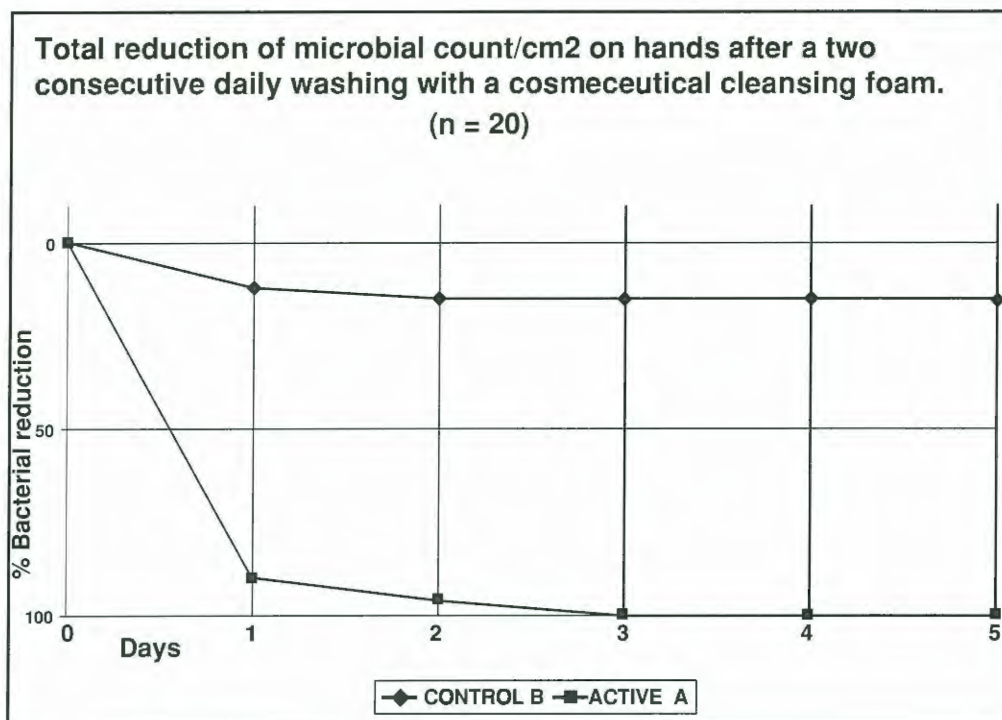

Fig. 4

RESULTS AND COMMENTS

How it is possible to see on tables 1 and 2 the total body washing with the cosmeceutical cleansing foam studied, (MICOSPUMA A) resulted in a marked reduction of the total skin bacteria both after one-day and five consecutive days of treatment, whereas the control foam, as a normal batb, increases the contamination. This phenomenon, reported also by other authors (7-11) seems to be linked to the loss of skin squamae that, together with the escreted lipids, promote the growth of the skin bacteria. The same results are obtained on the skin artificially colonized by staphylococcus aureus (fig.2), which represent the dominant bacterium in early infections following surgical operations. It is also interesting the demonstrated high effectiveness against the fungus pityrosporon ovale (fig.1) associated, with several skin diseases, such as seborrhoeic dermatitis, pityriasis versicolar, some form of atopic dermatitis, etc. (12-14). The effectiveness of this cleansing foam (*Alfa 4 Micospuma®*) seems to increase during the days of usage ranging the 100% of the P. ovale reduction in the first week of treatment. Finally the occlusion test gave also positive results. It is possible to observe (fig. 3) a rapid expansion of the controlled flora during the 5 days of treatment with the control foam, meanwhile the active MICOSPUMA A produces a persistent and continous antimicrobial effect totally eliminating the microflora in 5 days of treatment. The same results can be seen from fig.4 on the hands, following 5 consecutive day washings.

CONCLUSION

In conclusion this new cosmeceutical foam seems to be useful as normal or preoperative to-

tal body washing, beeng effective in reducing the bacterial flora of the skin also in one day use. Moreover beeing an auto-dosable, persistent, moisturizing, non irritating cosmetic preparation designed for frequent use, this micospuma may be used as daily preoperative hand washing to inhibit, to kill or remove pathogenic microorganisms on the skin. It is important to remember that with the right hand-washing product the risk of infection may be reduced for the user and for those individuals who are in frequent contact with people, such as in routine patient care and presurgery. For all these reasons this new cosmeceutical may represent an interesting cosmeceutical for the standard routine body and hand washing of the medical community and the hospitalyzed patients, especially in the surgery departments.

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SUN PROTECTION AND SKIN HYDRATION EFFECTS AND PHYSICO-CHEMICAL PROPERTIES OF SUN SCREEN LOTION CONTAINING WATER-SOLUBLE CHITOSANS

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Key words: *sun screen lotion, water-soluble chitosan, hydration effect, sun protection factor, apparent viscosity, in vivo, in vitro.*

Summary

The effect of the addition of water-soluble chitosans on sun protection and skin hydration effects and physico-chemical proporties of sun screen lotions thus prepared were studied. Water-soluble chitosans were prepared by ultrasonic treatment. Viscosities and color of sun screen lotions containing water-soluble chitosans were determined with a constant stress rheometer and a color and color difference meter respectively. Mildness of sun screen lotions was evaluated by the Draize scores after applying them to shaved rabbit skin. Efficacy of sun screen lotions on sun protection factor and on skin hydration were determined by minimal erythema doses and by the corneometer method in vivo respectively. The results show that apparent viscosity of sun screening lotion increased with increasing molecular weight and/or with increasing concentration of water-soluble chitosans used in the formula. Sun screening lotion containing 0.2% U3 chitosans has similar emulsion stability to that containing 0.3% xanthan gum. pHs of sun screen lotions containing water-soluble chitosans ranged between 6.7 and 7.2 whereas, those containing xanthan gum as control ranged between 7.3 and 7.8. Sun screening lotion containing 0.2% U3 chitosan showed better water-holding capacity than did lotion containing 0.3% xanthan. The sun protection factor (DPF) value of sun screening lotions containing 0.2% water-soluble chitosans ranged between 7.5 and 5.6 for UVA and 14.5 and 16.2 for UVB. Sun screen lotions containing water-soluble chitosans exhibit good sun protection, moisture holding capacitance and no irritative effects. Thus these will be useful in a wide range of applications in cosmetics.

Riassunto

E' stato verificato l'effetto provocato dai chitosani idrosolubili sulla protezione solare e sull'idratazione della cute, controllando anche le proprietà chimico-fisiche delle lozioni preparate.
La viscosità ed il colore delle lozioni è stata controllata mediante l'utilizzazione di un reometro e di un colorimetro, l'eventuale potere irritativo è stato valutato con il metodo Draize su cute depilata di coniglio.

Il fattore di protezione solare e l'idratazione sono stati valutati rispettivamente con la minima dose eritemigena e con il corneometro.
I risultati dimostrano che la viscosità delle lozioni solari aumenta con l'aumentare del peso e/o della concentrazione dei chitosani solubili aggiunti e utilizzati per le formulazioni.
La lozione solare contenente lo 0.2% del chitosano U3 ha mostrato di possedere le stesse caratteristiche della analoga formulazione con lo 0.3% di xanthan gum, mentre i relativi pH si attestavano rispettivamente tra 6.7 e 7.2 per il primo e tra 7.3 e 7.8 per il secondo.
Per quanto riguarda l'idratazione il prodotto a base di chitosano ha dimostrato di possedere maggiore proprietà idratante del prodotto a base di xanthan gum.
Per quanto riguarda l'SPF le lozioni a base di chitosani hanno un buon potere protettivo con valori tra 7.5 e 5.6 per gli UVA e tra l'14.5 e 16.2 per gli UVB, senza che si siano verificati effetti irritativi secondari

INTRODUCTION

Chitinous materials have wide ranges of applications in areas of food, biomedical, and chemical industries (1-2). In the food industry, chitinous materials can be used as thickening, gelling, foaming, antifreezing, and antimicrobial agents, as well as for enhancing emulsion stability of proteins, etc. (3). Some of the functional properties mentioned are the same as those needed in the processing of cosmetics. However, applications, of chitinous materials in cosmetics and biomedicine are limited due to their solvent restrictions (4), because chitin can not be dissolved in water or most common organic solvents. Chitin can only be dissolved in concentrated acids such as hydrochloric acid, nitric acid or sulfuric acid and hexa-fluoro-2 propanol, usually being dissolved in dimethyl acetamide or N-methyl-2-pyrrolidinone and 5% LiC1. Chitosan can be dissolved in dilute hydrochloric acid, nitric acid and 0.5% phosphoric acid, formic acid, acetic acid, and 100% citric acid, but it does not dissolve in neutral aqueous solutions (5-7). Many water-soluble chitin derivatives such as N-carboxymethyl chitosan with film-forming abilities and thickening properties (8), and succinyl chitosan (9) with water-holding and film-forming properties can be applied in cosmetics. A high molecular weight chitosan was reported being applied in skin and hair care products (10-12). Chitosan and microcrystalline chitin have surface active properties and can be used to enhance emulsion stability (13-14).

Water-soluble chitinous materials can be prepared by:

1) chemical modification to produce succinyl chitosan (9), carboxymethyl chitosan (8, 15), N-sulfofurfuryl chitosan (16), N-trimethyl acetate chitosan (17) and mercapto-chitins (18);

2) acid hydrolysis using nitric acid to obtain a 40% degree of deacetylation chitosan or using nitric acid to obtain oligomers (19-21);

3) enzyme hydrolysis using glycosidase, lysozyme, or chitinase to hydrolyze chitins or using chitosanase to hydrolyze chitosans (22);

4) mechanical treatment (23-24) using ultrasonic methods to prepare different molecular weight water-soluble chitosans, or using shear, ultrasonic, or combined shear and ultrasonic treatments to prepare water-soluble chitosans (25).

Chitinous materials have:

a) good occlusive and water-absorbing properties (9-10, 26-29);

b) good surface activity properties. Knorr (13) reported that microcrystalline chitin has better emulsion properties than does microcrystalline cellulose. Magdassi and Neiroukh (14) reported that chitin particles have both hydrophobic and hydrophilic groups and tend to be absorbed on the o/w interface of oil drops. In the presence of 0.005% (w/w) Tween 80, the emulsion system containing only 0.5% (w/w) chitosan show good emulsion stability;

c) very good film-formation properties (8, 27, 30). Sakurai et al. (30) reported that applying 0.3% hydroxypropyl chitosan on skin will form a smooth and pliable film with good water-holding properties. Gross et al. (31) reported that chitosan film is stable in high-humidity environments. It has better absorbiing properties on the hair than do traditional polymers used in hair products, and also prevents static charges during brushing;

d) good thickening properties. N-carboxymethyl chitosans can increase the viscosity of solutions. The viscosity-increasing capacities are related to their molecular weight (8). Li (24) reported water-soluble chitosans obtained by ultrasonic treatment have an effect on the flow consistency index, which increases with molecular weight and concentration of water-soluble chitosans used in the system.

Results of a one-time, cumulative irritation test on shaved rabbit skin and a one-time ocular test indicated no irritation to shaved skin or cornea, and no extraneous-material was left on the cornea (27). These results indicate that chitinous materials are good ingredients for cosmetics.

Excessive sun exposure is knows to cause solar eythema and is also suspected to induce long-term effects such as aging and tissue damage. UVA plays a major role in these deleterious effects (32).

The amount of sun screen applied, the size of the treated area, the regulation of the film thickness, the time between application and irradation, the phototype and other phenotypical variations of the volunteers, the quality and spectral distribution of the irradiance, and the uniformity of the solar simulator, etc. are factors effecting the SPF value of products (33). The efficacy of sun screen preparations depends not only on the absorption spectrum of the organic filtering (intensity and band width) but also on their photochemical behavior. The latter governs the degree of effective protection left after a predetermined exposure time (34). Horner et al. (12) reported an in vivo study showing a positive effect on the water resistance of sun protection emulsions by a high molecular weight chitosan, Hydagen® CMF, leading to a higher skin-protection property. Furthermore, chitosans have wound-healing properties (35-36), another advantage for sun protection products. The effects of using water-soluble chitosans as an ingredient in a sun screen lotion formula on the sun protection factor (SFP), hydration, and other physico-chemical properties were evaluated.

MATERIALS AND METHODS

Preparation of water-soluble chitosan

Water-soluble chitosans were prepared by ultrasonic treatment (37) for 3,30, and 120 min to obtain U3 chitosan, U30 chitosan, and U120 chitosan, respectively.

Characteristics of water-soluble chitosan

Molecular weight determination

The molecular weight of prepared water-soluble chitosans was determined by high performance liquid chromatogrpahy (HLPL) by the method of Chen et al. (38).

Degree of deacetylation determination

The degree of deacetylation of water-soluble chitosans prepared from an ultrasonic method was determined by FTIR methods (39).

Solubility test

The solubility of water-soluble chitosans was determined by the method of Yalpani and Hall (40). The molecular weight, degree of deacetylation, and solubility of water-soluble chitosans used in these studies are listed in Table I.

Preparation of sun screening lotion

The formula of the sun screening lotion modified from formulation 7019/1C of Sun Smat Inc. (Wainscott, New York, USA) is listed in Table II. Water-soluble chitosans were used to replace the thickening agent (xanthan gum) and chelating agent (Na_4EDTA). The procedures were to: mix group A and group B ingredients and heat to 75 °C separately; add Z-cote HP1 to mixture B and stir for 20 min; add group D ingredients to the C/B mixture, then pour the mixture into A mixture; add Germaben when the C/B/A mixture is cooled to 45 °C, then cool to get the product.

Characterization of the prepared sun screen lotion

Viscosity of sun screening lotion

A 5-ml aliquot of sun screening lotion was placed onto a cone/plate cell (pk 45) which was

Table I

MOLECULAR WEIGHT, DEGREE OF DEACETYLATION, AND SOLUBILITY OF WATER-SOLUBLE CHITOSANS PREPARED WITH VARIOUS SONICATION TIMES AT 300 W AND 4 ±0.2 °C

Sonication time (min)	Molecular weight (x 10^6 Da)	Degree of deacetylation (%)	Solubility in water (g/dl)
U3 chitosan	2.24	83.2	0.955[a]
U30 chitosan	1.62	82.9	0.965[a]
U120 chitosan	1.17	84.2	0.966[a]

[a] Values ($n = 3$) followed by the same superscript within the same column are not significantly different ($P>0.05$ by Duncan's multiple range test).
U3 chitosan, U30 chitosan, and U120 chitosan were obtained by ultrasonic treatment on a chitosan acetic acid solution for 3, 30, and 120 min; after which they underwent dialysis and freeze drying, respectively.

maintained at 25 °C. Viscosity measurements were performed at shear rates of 0-100 s^{-1} with a Haake Viscometer CV20 (Haake Mess-Technik Gmbh. Co., Germany).

Color and color difference measurements

A 8.0-g aliquot of sun screening lotion was placed in the cell of a Color and Color Difference Meter (Model JP7100F, Juki Optek Co., Japan) to measure lightness (L value), redness (a+value), and yellowness (b+value). A blank was used to calculate the color difference; The standard plate of a, b, and L are –0.01, –0.38, and 98.29 respectively. The whiteness was calculated by the equation:

$$W = 100 - [(100 - L)^2 + a^2 + b^2]^{1/2}$$

Table II

FORMULA FOR SUN SCREENING LOTION

Group	Trade name	Generic name	Percentage
A	Deionized water		77.5
A	KELTROL T	Xanthan Gum	0.3
A	PROPYLENE GLYCOL	Propylene Glycol	1.5
A	NA4EDTA	Sodium Etylenediamine Tetra Acetic Acid	0.1
B	IPM	Isopropyl Myristate	10.0
B	CRODAFONS N3N	DEA-Oleth-3 Phosphate	0.1
C	Z-Cote HP1	Zinc oxide/Dimethicone	5.0
D	ARLACEL 165	Glycerol Stearate and PEG 100 Stearate	3.0
D	DC 344 Fluid	Cyclomethicone	1.0
D	PROMUGEN D	Ceteayl Alcohol and Ceteareth-20	3.0
D	ESCALOL 557	Octyl Methoxycinnamate	7.5
E	GERMABEN II	(Propylene glycol; Diazolidinyl urea; Methylparaben; Propylparaben)	1.0

Stability test

High temperature storage

Sun screening lotion was placed in a beaker, covered with mylar to prevent evaporation of moisture, and maintained in a 50 °C oven where it was observed daily. The elapsed time when phase separation took place was recorded.

Cyclic temperature storage

Sun screening lotion was placed in a beaker, covered with mylar, and kept inside an oven. On successive days, the temperature was changed from 4 °C, to 25 °C, to 50 °C than back to 4 °C. The elapsed time when phase separation took place was recorded.

Centrifugation test

Sun screening lotion was placed in a tube and centrifuged at 3000 rpm for 30 min (Hitachi CF 15D2, Hitachi Co., Japan), after which any phase separation was recorded.

Sensitivity test

A 0.1-g aliquot of sun screening lotion was applied to ca. a 9 cm^2 patch of shaved rabbit (NZW) skin. Rabbits were kept in an air-conditioned room (25 ± 0.5 °C and 50-60% RH). The sensitivity of the skin was evaluated by the Draize score method (41).

Water-holding capacity test

The water-holding capacity of the skin was tested by the corneometer method (42-44). The corneometer measures changes of electrical capacitance which is related to the moisture contents of the skin before and after applying the sun screening lotion. A 0.2-g aliquot of sun screening lotion was even applied to ca. a 25 cm^2 patch of skin on the volar forearm of 7 healthy volunteers whom were fully informed of the nature of the study and the procedure involved. Changes of electrical capacitance were recorded over time with a skin alayzer SHP88 (Sebumeter + Corneometer + pH-meter, Courage + Khazaka/Germany) randomly at 8 points and expressed as capacitance increase ratio, CIR:

$$\text{CIR} = \frac{\text{Electrical capacitance after applying sun screening lotion}}{\text{Electrical capacitance of the skin with no sun screening lotion applied}}$$

Original electrical capacitances were between 13.4 and 14.2 corneometer unit.

Sun protection factor measurement

Animal test (in vivo test)

A 0.2-g aliquot of sun screening lotion was even applied to ca. a 25 cm^2 patch of shaved rabbit (NZW) skin and irradiated with UVA light with a UVA lamp (Model UVL-56, UVP, Co., USA) or UVB light with a UVB lamp (Model UVL-57, UVP, Co., USA) (45). Rabbits were kept in an air-conditioned room (25 ± 0.5 °C and 50-60% RH). The time before applying the lotions and irradiation was 15 min. The minimum erythema doses (MED) was assessed visually 24 h after UV exposure. Sun protection factor (SPF) is calculated by:

$$\text{SPF} = \frac{\text{Minimum erythema doses on skin with sun screening lotion}}{\text{Minimum erythema doses on skin without protection lotion}}$$

Artificial skin test (in vitro test)

A 0.025-g aliquot of sun screening lotion was applied onto a plate of artificial skin, then irradiated with UVA light with an UV Transmittan-

ce (UV 1000S, Labsphere, Co., USA) to obtain critical wavelength and SPF value. The SPF value obtained was used to evaluate the protection efficiency on UVA.

RESULTS

Viscosity of sun screening lotion

Results in Fig. 1. Show that the apparent viscosities of sun screen lotion measured at 10 s^{-1} are 9.2 × 10^4, 7.6 × 10^4, and 6.8 × 10^4 cp for those sun screen lotions containing U3, U30, U120 chitosans respectively. The apparent viscosities decreased to 0.5 × 10^4, 0.3 × 10^4, and 0.1 × 10^4 cp respectively when they were sheared at 100 s^{-1}. The results show that sun screen lotions containing water-soluble chitosans were shear-thinning solutions. Table III shows the effect of adding different molecular weights and concentrations of water-solumble chitosans on the parameters of the power law equation, e.g., flow behavior index (n) and flow consistency index (k) of sun screening lotion measured at 23 ± 0.2 °C. The flow behavior index of sun screening lotions is less

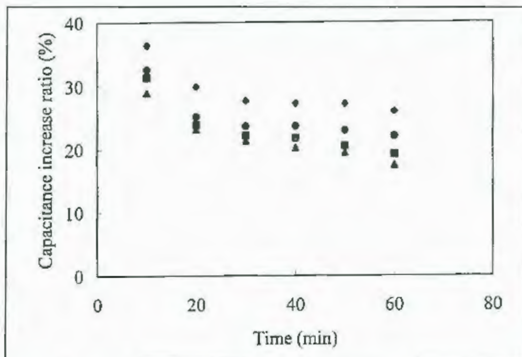

Fig. 1 - Relationship between shear rate and apparent viscosity of sun screening lotions containing 0.2% of different molecular weight water-soluble chitosans at 23 ± 0.2 °C (MW: ♦ 2.42 × 10^6 Da, ■ 1.62 × 10^6 Da, ▲ 1.17 × 10^6 Da, ● 0.3% Xanthan Gum 1.3 × 10^6 Da).

than 1. The results indicate that the sun screening lotions are pseudoplastic fluids. The flow consistency indexes (k) of sun screening lotion increased from 4.13 to 4.82 with increasing concentrations of U3 chitosan from 0.1% to 0.2% in the formula. Results in Table IV show that at a shear rate of 7 s^{-1}, the apparent viscosities of sun screen lotions increased from 6.2 × 10^3 to 9.0 × 10^3 cp with increasing chitosan concentrations from 0.1% to 0.2% of U3 chitosan in the formula. The flow consistency index (Table III) or the apparent viscosity (Table IV) of sun screen lotion increased with increasing molecular weight of water-soluble chitosans used (of the same concentration of water-soluble chitosan). Apparent viscosities of sun screening lotion containing 0.3% xanthan are lower than those containing 0.2% U3 chitosan but higher than those containing 0.2% U30 or 0.2% U120 chitosan.

Color of sun screening lotion

Table V shows the effect of adding different molecular weights and concentrations of water-soluble chitosan on b, a, and whitness of sun screening lotions. The b+ or a+ value increased with increasing concentration of water-soluble chitosan (of the same molecular weight) used. The b+ value of sun screen lotion containing 0.3% xanthan gum was similar to those lotions containing 0.2% water-soluble chitosan but higher than those containing 0.1% water-soluble chitosans. However, the a+ value is lower than those containing water-soluble chitosans. The whiteness of sun screening lotions containing different concentrations of water-soluble chitosans (of the same molecular weight) or containing different molecular weight water-soluble chitosans (of same concentration) were not significantly different; Differences in whiteness among sun screening lotions containing 0.3% xanthan gum and those containing water-soluble chitosans (0.1-0.2%) were not significantly different neither.

Table III

EFFECT OF ADDING DIFFERENT MOLECULAR WEIGHTS AND CONCENTRATIONS OF WATER-SOLUBLE CHITOSANS ON THE PARAMETERS OF THE POWER LAW MODELS OF SUN SCREENING LOTION AT 23±0.2 °C

Conc. (%)	U3 chitosan		U30 chitosan		U120 chitosan	
	K	N	K	N	K	N
Control	4.52^{2}	0.37^{dc}				
0.10	4.13^{4}	0.40^{ab}	4.11^{4}	0.40^{a}	4.07^{4}	0.41^{a}
0.20	4.82^{1}	0.36^{e}	4.32^{3}	0.38^{cd}	4.26^{3}	0.39^{bc}

K: consistency index; N: flow behavior index.
a-e Values (n = 3) followed by the same superscript within the same column are not significantly different (p>0.05 by Duncan's multiple range test).
1-4 Values (n = 3) followed by the same superscript within the same column are not significantly different (p>0.05 by Duncan's multiple range test).
U3 Chitosan, U30 Chitosan, and U120 Chitosan are the same as in Table I.

Table IV

EFFECT OF MOLECULAR WEIGHT AND CONCENTRATION OF WATER-SOLUBLE CHITOSANS USED ON THE APPARENT VISCOSITY AND SHEAR STRESS (SHEAR RATE OF 7 s^{-1}) OF SUN SCREENING LOTION AT 23 ± 0.2 °C

Conc. (%)	U3 chitosan		U30 chitosan		U120 chitosan	
	η_{app} (× 10^{3} cps)	Shear stress (Pa)	η_{app} (× 10^{3} cps)	Shear stress (Pa)	η_{app} (× 10^{3}	Shear stress (Pa)
Control	8.42^{2}	5.62^{dc}				
0.10	6.2^{5}	4.25^{cd}	6.0^{56}	4.19^{d}	5.8^{56}	4.14^{d}
0.20	9.0^{1}	5.73^{a}	7.6^{3}	4.83^{b}	6.8^{4}	4.36^{c}

a-e Values (n = 3) followed by the same superscript within the same column are not significantly different (p>0.05 by Duncan's multiple range test).
1-6 Values (n = 3) followed by the same superscript within the same column are not significantly different (p>0.05 by Duncan's multiple range test).
U3 Chitosan, U30 Chitosan, and U120 Chitosan are the same as in Table I.

Emulsion stability of sun screening lotion

Table VI shows the effect of adding different molecular weights and concentrations of water-soluble chitosan on the emulsion stability of sun screen lotion. Sun screening lotions containing 0.2% water-soluble chitosans were stable to centrifuging forces regardless the molecular weight of water-soluble chitosans used. However, those containing 0.1% water-soluble chitosans were not stable to centrifuging forces. Sun screening lotions containing 0.2% U3 chitosan or 0.3% xanthan gum were stable for more than 3 mo during high temperatures, or stable for 10 rounds of cyclic temperature storage. However, for those containing 0.2% U30 chitosan or 0.2% U120 chitosans, they could only last for 2 mo of high-temperature storage or for 7-8 rounds of cyclic temperature storage. Emulsion stability of those sun screen lotions containing 0.1% water-soluble chitosan only lasted for 1 wk of

Table V

EFFECT OF ADDING DIFFERENT MOLECULAR WEIGHTS AND CONCENTRATIONS OF WATER-SOLUBLE CHITOSANS ON b, a AND WHITNESS VALUES OF SUN SCREENING LOTION

Conc. (%)	Control	U3 chitosan	U30 chitosan	U120 chitosan
0.1	2.07^{ab}	1.90^{c}	1.78^{d}	1.96^{bc}
0.2		1.98^{b}	2.00^{b}	2.100^{a}
a value				
Conc. (%)	**Control**	**U3 chitosan**	**U30 chitosan**	**U120 chitosan**
0.1	0.58^{5}	0.63^{d}	0.69^{c}	0.73^{b}
0.2		0.68^{c}	0.75^{a}	0.76^{a}
Whiteness value				
Conc. (%)	**Control**	**U3 chitosan**	**U30 chitosan**	**U120 chitosan**
0.1	93.28^{a}	93.25^{a}	93.27^{a}	93.27^{a}
0.2		93.07^{b}	93.18^{ab}	93.14^{ab}

a-d Values ($n = 5$) for b value followed by the same superscript within the same column are not significantly different ($p>0.05$ by Duncan's multiple range test).
** The higher the b value, the yellower the product.
a-e Values ($n = 5$) for a values followed by the same superscript within the same column are not significantly different ($p>0.05$ by Duncan's multiple range test).
** a+ values indicate reddness, a- indicates greenness, the higher the a+ value, the redder the product.
a-b Values ($n = 5$) for whiteness values followed by the same superscript within the same column are not significantly different ($p>0.05$ by Duncan's multiple range test).
** whiteness = $100 - [(100-L)^2 + a^2+b^2]^{1/2}$. The higher the whiteness value, the whiter the product.
U3 Chitosan, U30 Chitosan, and U120 Chitosan are the same as in Table I.

high-temperature storage or 4 rounds of cyclic temperature storage.

Safety of vital moisture cream

Table VI shows that the Draize scores were 0 for sun screening lotions containing water-soluble chitosans. However, for that containing 0.3% xanthan gum, the Draize score was 2.

Water-holding capacity

Fig. 2 shows the changes of electrical capacitance increase ratio with time after applying sun screening lotion containing 0.2% of different molecular weight of water-soluble chitosans and 0.3% xanthan gum measured at 23 ± 0.2 °C and RH 63%. After applying sun screen lotion, the electrical capacitance increase ratio increased 28%-38%, then decreased, and finally leveled off. The electrical capacitance increase ratios were 26%, 22%, 19.2% and 17.5% after applying sun screening lotions containing 0.2% U3 chitosan, 0.3% xanthan gum, 0.2% U30 chitosan, and 0.2% U120 chitosan, respectively, for 60 min.

Sun protection factor of sun screen lotion

The effect of adding 0.2% of different molecular weight water-soluble chitosans on the sun protection factor (SPF) value of sun screening lotions via in vivo test ranged between 7.5 and 5.6 for UVA and 14.5 and 16.2 for UVB (Table

Table VI

EFFECT OF ADDING DIFFERENT MOLECULAR WEIGHTS AND CONCENTRATIONS OF WATER-SOLUBLE CHITOSANS ON THE STABILITY, PH AND SAFETY OF SUN SCREENING LOTION

Sample	Conc.	Stability test			pH	Safety***
	%	Centrifuging*	50 °C	Cyclic temp.		(Draize score)
Xanthan	0.30	No separation	>3 mo	>1mo	7.3-7.8	2
U3 chitosan	0.20	No separation	>3 mo	>1mo	6.8-7.1	0
U3 chitosan	0.10	Separation	1 wk	2 wk	6.9-7.2	0
U30 chitosan	0.20	No separation	2 mo	3.3 wk	6.7-7.0	0
U30 chitosan	0.10	Separation	1 wk	2 wk	6.9-7.2	0
U120 chitosan	0.20	No separation	2 mo	3 wk	7.0-7.2	0
U120 chitosan	0.10	Separation	1 wk	3 wk	6.8-7.0	0

Centrifuging at 3000 rpm for 30 min. at 25 °C.
** Cyclic temperatures were at 25 °C→50 °C→4 °C→25 °C.
*** Draize scores of 0 indicates no erythema.
U3 chitosan, U30 chitosan, U120 chitosan are the same as in table I.

VII). UVA values are moderate, whereas UVB values ranged between 16.0 and 19.7 via in vitro test (Table VII).

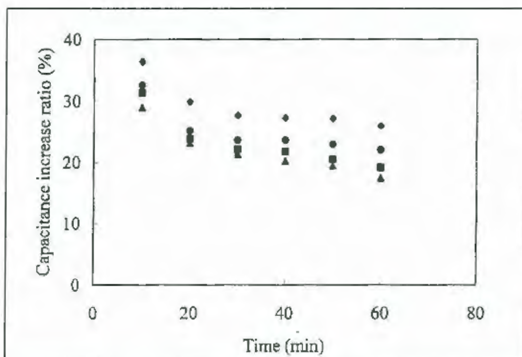

Fig. 2 - Changes of capacitance increase ratio with time after applying sun screening lotion containing 0.2% of different molecular weight water-soluble chitosans measured at 23 ± 0.2 °C and RH 63%. ((MW: ♦ 2.42 × 10^5 Da, ■ 1.62 × 10^5 Da, ▲ 1.17 × 10^5 Da, ● 0.3% Xanthan Gum 1.3 × 10^6 Da).

DISCUSSION

Viscosity of sun screening lotion

The apparent viscosity of sun cream lotions decreased with increasing shear rate (Fig. 1). The results indicate that sun cream lotions containing water-soluble chitosans were shear-thinning solutions. Table III shows the flow behavior index to be less than 1 for all sun cream lotions prepared. Results in Table III confirm the shear-thinning properties of sun cream lotions shown in Fig. 1. Apparent viscosities of sun cream lotions increased with increasing concentrations of water-soluble chitosans used (of the same molecular weight) or increased with increasing molecular weight of water-soluble chitosans used (of the same concentration of water-soluble chitosan) as shown in Table IV. Judging from the volume ratio of the oil phase and water phase and the HLB value of the surfactant used, the sun cream lotions prepared by the formula

Table VII
EFFECT OF ADDING 0.2% OF DIFFERENT MOLECULAR WEIGHT WATER-SOLUBLE CHITOSANS ON THE SUN PROTECTION FACTOR (SPF) VALUE OF SUN SCREENING LOTION BY IN VIVO TEST

Sample	SPF value	
	UVA*	UVB**
Control	7.2	15.4
U3 chitosan	7.5	16.2
U30 chitosan	6.8	15.0
U120 chitosan	5.6	14.5

* UVA wave length of 365 nm.
** UVB wave length of 302 nm.
In vivo test: Three shaved rabbits were exposed to UVA light with a UVA lamp (model UVL-56, UVP) or UVB light with UVB lamp (model UVL-57, UVP) at 22 ± 0.2 °C.
The time needed to produce erythema was recorded to calculate the SPF value.
U3 chitosan, U30 chitosan, U120 chitosan are the same as in Table I.

listed in Table II are oil-in-water type emulsions. The viscosity of an o/w emulsion system depends on the viscosity of a continuous phase which in turn depends on the concentration and/or molecular weight of the polymer used in the continuous phase. Therefore, viscosities of sun creams lotions containing 0.3% xanthan gum were lower than those of lotions containing 0.2% U3 chitosan but were higher than those containing 0.2% U30 or U120 chitosan or 0.1% water-soluble chitosans studied (Table IV). Muzzarelli (8) reported that N-carboxymethyl chitosans can increase viscosities of a solution, which is related to their molecular weight. Li (24) reported that water-soluble chitosans obtained by ultrasonic treatment affect the flow consistency index. The flow consistency index increased with increasing molecular weight and concentration of water-soluble chitosans used in the system. Results of both reports are consistent with the results shown in Fig. 1, and Table III and IV.

Color of sun screening lotion

Results in Table V show that the color of sun screen lotions containing water-soluble chitosans were a redder but a slightly less orange color than those containing 0.3% xanthan gum. It may be due to the astacence remaining at the time of chitosan preparation. An increasing red color of sun screen lotion may appeal to consumers due to the perceived warmth of this color.

Emulsion stability of sun screening lotion

Results in Table VI show that sun screen lotions containing 0.2% U3 chitosans were stable to centrifuging forces, stable for more than 3 mo in high temperatures, or stable for 10 rounds of cyclic temperature storage. However, those containing lower molecular weight or lower concentrations of water-soluble chitosans were not stable. Those results indicate that a minimum apparent viscosity of 8.4×10^3 cps (at a shear rate of 7 s^{-1}, Table IV) is required for sufficient emulsion stability. This stability was attributed to higher molecular weight and/or concentration of polysaccharide used, which increased the viscosity of the continuous phase forming a physical barrier between the oil/water interface, thus, reducing the chances of oil drops coalescencing and stabilizing the emulsion (46).

Safety and stability of sun screen lotion

Table VI also shows that the Draize scores of sun screening lotion were 0 for those containing water-soluble chitosans. This indicates that those sun screening lotions resulted in no erythema on shaved rabbit skin. However, sun screening lotion containing 0.3% xanthan gum produced a Draize score of 2. This may be due to the pHs of those sun screen lotions containing water-so-

luble chitosans being between 6.8 and 7.2 whereas, pHs of sun screening lotions containing 0.3% xanthan are 7.3-7.8. The results indicate that chitosans have better chelating ability than does xanthan gum.

Water-holding capacity

The efficacy of skin hydration in terms of water-holding capacity of the skin was tested by the corneometer method (42-45). The corneometer measures changes of electrical capacitance related to the moisture contents of the stratum corneum before and after applying sun cream lotions. Results in Fig. 2 show that after applying sun cream lotions containing 0.2% of different molecular weight water-soluble chitosans or 0.3% xanthan gum, the electrical capacitance increase ratio increased, then decreased, and finally leveled off. The reason for this pattern my be because after applying sun cream lotions, moisture content of the skin increased, so the electrical capacitance increased accordingly. Water evaporated as the time went by, so the electrical capacitance decreased. At last, the ingredients dissolved in water formed a film on the surface of the skin after the water had evaporated which prevented further water evaporation and therefore, the electrical capacitance increase ratio leveled off. Results in Fig. 2 also shows that the water-holding capacity of sun screening lotion containing 0.3% xanthan gun was better than those containing 0.2% U30 or U120 chitosan, but was inferior to that containing 0.2% U3 chitosan. This may be due to different apparent viscosities (Table IV) resulting from using different molecular weight polymers; The water-holding capacity of sun screening lotion increased when using water-soluble chitosans of higher molecular weight.

Table VIII
EFFECT OF ADDING 0.2% OF DIFFERENT MOLECULAR WEIGHT WATER-SOLUBLE CHITOSANS ON THE SUN PROTECTION FACTOR (SPF) VALUE OF SUN SCREENING LOTION BY IN VITRO TEST

Sample	SPF value	
	UVA*	UVB**
Control	a*	18.6
U3 chitosan	a	19.7
U30 chitosan	a	17.7
U120 chitosan	a	16.0

* a indicates SPF value is moderate.
** Wave length of 352-362 nm.
In vitro test: Sun screening lotion was applied to an artificial skin then UV transmittance (UV 1000S, Labsphere, Co., USA) was measured.
U3 chitosan, U30 chitosan U120 chitosan are the same as in Table I.

Sun protection factor of sun screen lotion

Results in Table VII and VIII show that SPF value of sun screening lotions containing 0.2% U3 chitosan via in vivo test ranged between 7.5 and 5.6 for UVA and 14.5 and 16.2 for UVB (Table VII). UVA values are moderate, whereas UVB values ranged between 16.0 and 19.7 via in vitro test (Table VIII). Results also show that both UVA and UVB values increased with increasing apparent viscosity of sun screening lotions resulting from using different molecular weight water-soluble chitosans. Although the SPF value of formula 70191/1C are claimed to be 21.47 by Sunsmart Inc. in vivo with 5 subjects. The discrepancy may be due to the percentage of water used in our formula was higher than the original one. Horner et al. (12) reported an in vivo study which showed that a high molecular weight chitosan, Hydagen® CMF, had a positive effect on the water resistance of sun protection emulsions, therefore leading to higher skin protection properties. Furthermore, chitosans have wound-healing properties (35-36) which is another advantage for sun protection products.

CONCLUSION

Sun screen lotions containing different molecular weights and/or concentrations of water-soluble chitosans are pseudoplastic fluids. Apparent viscosity of sun screen lotions increased with increasing molecular weigh and/or concentration of water-soluble chitosans used in the formula. Increasing apparent viscosity of sun screen lotions via using water-soluble chitosans improve the stability of the products, enhance skin hydration and sun protection effects of sun screen lotions thus prepared. These beneficial effects may be attributed to water-soluble chitosans have good water-holding capacity, thickening, and would-healing, properties.

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CONSIDERING A NEW HYPOTHESIS ABOUT THE INFLUENCE OF SOME DRUGS ON HAIR

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Key words: diffuse alopecia, drug-induced hair loss, hair shaft shape, contraceptive pills, hair keratin genes, mutation, DNA-analysis, telogen effluvium.

Summary

Drug-induced hair loss is one of the most common reasons for the development of diffuse alopecia. Oral contraceptives intake can also give rise to increased hair shedding. We noticed the change of the shape of the hair shafts that developed during the pills intake. Changes of the shape of the hair shaft transverse sections were also seen in the transmission microscope. The above changes remained stable for several years. We suggested that the phenomenon resulted from mutation in hair kerating genes.

Riassunto

La perdita dei capelli indotta dal consumo di farmaci è una delle ragioni più comuni nello sviluppo dell'alopecia diffusa. L'uso di contraccettivi per via orale può anche facilitare l'incremento della caduta dei capelli.

Sono stati osservati cambiamenti che si verificano a livello dello stelo del capello durante il consumo di contraccettivi orali.

Le modificazioni dello stelo del capello, sezionato trasversalmente, sono state osservate anche mediante l'utilizzazione del microscopio a trasmissione.

I suddetti cambiamenti restano immutati per diversi anni.

Riteniamo, dunque, che tale fenomeno possa essere imputabile ad una mutazione avvenuta a livello dei geni della cheratina.

It is very well known that certain groups of drugs, widely used by dermatologists, cardiologists, psychiatrist, neurologists, etc. in their clinical practice may produce a negative effect of the hair growth, resulting in development of alopecia, not equally severe in all cases, through different mechanisms. Basically most of the drugs interfere with the cycle of the hair follicle by the disturbance of the reactions between matrix and dermal papilla cells, shorteniug the duration of the anagen phase of its development thus leading to the premature entering of the follicle into catagen and telogen phases. It results in excess hair shedding (telogen effluvium) with subsequent development of the clinical condition, termed as "diffuse hair loss". Light microscopic examination reveals the increased number of telogen hair roots and sometimes dystrophic anagen hair roots are also seen. It was noticed that oral contraceptives have the same effect on the hair.

Increased hair shedding is seen in the majority of women during the pills intake or 3-4 weeks after their withdrawal (1-3).

According to different authors' data the trichogram analysis not always reveals significant changes in anagen/telogen ratio (3, 5). As for our studies, we found that in 87% of women taking the contraceptive pills the amount of telogen hairs was increased up to 40%. In the patients observed no other reasons for the hair loss could be found. It was shown by A.M. Kligman (4), if the amount of telogen hair roots is more than 25%, it is diagnostic for telogen effluvium.

During our studies we observed a very interesting phenomenon, which has not yet been described. Besides the mentioned above changes in trichogram, oral contraceptives also cause the changes in the shape of the hair shaft, in other words, wavy hair becomes straight. The comparison in the transmission microscope of the shape of the transverse sections of the hair shafts, plucked from the same scalp area before and during the contraceptive pills intake shows the results, which also correspond to the visual cosmetic changes.

Association of diffuse hair recession with changes of the hair shaft shape in some individuals can create cosmetic problems due to sometimes dramatic decrease of the hair volume and difficulties in hair styling. As we could see during our observations, most of the patients looking for the means to solve their hair problems, in order to improve the hair condition start making rather vigorous cosmetic procedures, mostly very damaging even for healthy hair. Needless to say, they only worsen the situation.

Interestingly, that not all the scalp hairs are involved in the process. Hair shafts changes are seen only in the frontal, temporal and parietal regions, that is in the areas involved in male pattern baldness, whereas the hair recession caused by contraceptive pills has a diffuse pattern.

As the shape of the hair shaft depends upon the presence of S-S bonds between the adjacent aminoacid residues with high sulfur content in the polipeptides forming the hair keratin, we suggested that the hair shaft shape changes may occur as a result of disruption of those bonds. Seemingly, it may happen in case of the changes in the consequence of aminoacid residues, or, in other words, the native structure of hair keratin.

It is known that after the withdrawal of contraceptive pills, like any other drug, that caused the hair recession, the process of hair shedding ceases and the hair regrows spontaneously within several months (5). However, we noticed, that hair shafts retain their new straight shape even after the withdrawal of the pills for rather a long period of time (four years and even longer). That fact served a reason for us to suggest the mutation in hair keratin genes. DNA-analysis might reveal that mutation.

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FATTY ACIDS AND INFLAMMATORY DISEASES

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Long-chain fatty acids serve two primary functions in humans. As part of triacylglycerols they represent the major source of energy. As part of phospholipids and other complex lipids, fatty acids are critical structural components of cellular membranes. Therefore they play a key role in the skin barrier function and represent a major source of proinflammatory mediators such as prostaglandins, leukotrines and other lipids in inflammatory skin disorders.

As it is known the major function of the epidermis is to form a permeability barrier, which prevents excessive loss of the body fluids. This barrier is located mainly in the stratum corneum organized as a two-component model of anuclear corneocytes embedded in lipid-enriched intercellular membrane bilayers.

Disturbances within this barrier lead to alteration of skin homeostasis. An essential fatty acid deficiency disturbs the permeability barrier increasing the water flux, known as Trans Epidermal Water Loss (T.E.W.L.).

Bulk fatty acids are essential in barrier homeostatis and their synthesis is regulated by barrier function permeability.

This close connection between the biosynthesis of free fatty acids and their role in epidermal function is clearly described in the first chapter.

In the second and third chapters the role played by arachidonic acid (AA), both at physiological and pathological level, is widely reported.

AA is a polyunsaturated fatty acid with 20 carbon atoms and 4 double bonds, either derived from dietary sources or synthesized by desaturation and elongation of linoleic acid, in the liver. It cannot be synthesized in human epidermis. Stored in the cell membrane and primary esterified at the second carbon of the phospholipid glycerol backbone, AA is released from the phospholipids by the action of phospholipases A_2 (PLA_2) or C (PLC).

Just PLA_2 activated by Ca^{2+}, seems to play an important role in inflammatory skin diseases, even if the molecular mechanisms of regulation are not known at present.

Then, the biological effects of eicosanoids in human skin and their role in psoriasis and atopic dermatitis (AD) are widely explaned.

In particular leukotriene LTB_4 seems to play an important role in the phatogenesis of psoriasis and LTA_4 seems to be intimately associated with the inflammatory processes of A.D..

The modulation of inflammatory and hyperproliferative processes of cutaneous essential fatty acids and hydroxy fatty acids is the subject of the fourth chapter.

Although the body is able to synthesize most saturated and monounsaturated fatty acids from carbohydrates, the diet provides performed versions of the majority of fatty acids. Two

polyunsaturated fatty acids (PUFA), linoleic and alpha linolenic acid (LA), can be niether synthesized by the body, nor are interconvertible. The shorter-chain EFAs , linoleic acid (n-6 family) and α-linolenic (n-3 family), serve as initial unsaturated precursors for *in vivo* biosynthesis of the longer-chain PUFAs.
Moreover, they must be provided from plant sources in the diet. The 18-carbon LA is involved in the maintenance of the epidermal barrier and may be enzymatically metabolized into 13-hydroxy-9,11-octadecadienoic acid (13-HODE), a major hydroxy fatty acid in normal epidermis. 13-HODE plays a role in modulating cutaneous hyperproliferation *"in vivo"*.
The 20-carbon arachidonic acid (AA) is the second prominent PUFA in the skin, constituting approximately 9% of its phospholipids content.
The lipoxygenation of n-6 and n-3 PUFAs in the skin, generating potent monohydroxylated metabolites, seems to play important roles *in vivo* to attenuate cutaneous inflammatory and hyperproliferative processes.
These possibilities imply that the dietary intake of purified triglycerides from vegetable or fish oils may offer an alternative therapeutic modality for alleviating inflammatory disorders.
Increasing the amount of PUFA will also increase the requirement for anti-oxidants such as vitamins E, C and carotenoids. Human skin is functionally highly dependent on unsaturated fatty acids which not only contribute to the integrity of the skin barrier function but also act as source of mediators important in inflammatory skin diseases. Sebum also contains PUFA which may play a role in acne and in hair growth.
This way, are described the roles PUFA play with regard to different pathologies.
Supplementation with fish oil causes a modest clinical benefit in psoriasis, probably via effects on eicosanoid biosynthesis. Therefore it may be useful to establish in addition antipsoriatic therapies.
Same way local applications of polyunsatured fatty acids, contained in borago oil, and a dietary intake of the same oil, should be useful in atopic dermatitis, because of the widespread effects of linoleic/α-linoleic acid deficiency in atopic patients.
Regarding the role of dietary fatty acids in the aetiopathogenesis of acne, there is evidence of a coherence of sebum linoleate concentration and comedo formation.
Essential fatty acid deficiency leads to sebaceous gland hypertrophy and hyperkeratinization of the ducts. Moreover α-linoleic acid has been reported to be potent 5-α-reductase inhibitor, suggesting a link between unsaturated fatty acids and androgen action.
However, this interesting book gives a big room to the inhibitors of eicosanoid biosynthesis in skin inflammation, such as acetyl salicilic acid or indomethacin, showing also the main cutaneous side effects.
The book goes on with a chapter describing the role of the PGHS pathway on keratinocyte proliferation and differentation. The last chapter is wealthy detailed in describing the main methods used for quantification of fatty acids and derivatives in skin inflammation.
Furnished with a rich and exhaustive bibliography, this interesting book is easy and quick to read. It can help cosmetic chemists and dermatologists to better understand all the proinflammatory and antinflammatory fatty acids and derivatives involved in skin diseases but can also be useful to all experts and people involved in Cosmetic Dermatology, such as physicians, biologists, physiologists, pharmacologists, chemists or laboratory technicians.

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Editor in Chief

NOVEL COSMETIC DELIVERY SYSTEM

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Included in the Cosmetic Science and Technology Series, this interesting book provides a lot of scientific and technical informations useful for the setting up of an innovative new cosmetic product. As a matter of fact, if a cosmetic, active both at skin level and at its appendages, has to be formulated, it is necessary to know deeply not only the raw materials to be used but mostly the rules regulating its absorption accross the stratum corneum.

It is indispensable to know the classical delivery systems such as emulsions or suspensions, and also the new technological products based, for example, onto liposomes or onto micro capsules or cyclodextrins methodology.

The book answers all these questions and gives the reader the guidelines necessary for designing new and innovative delivery systems.

The book is divided into five parts. The first one covers all the biological aspects related to the skin; the second provides a concise review of the methods used to assess the bioactivity and the stability of Cosmetic Products and ingredients; from the third to the fifth part, the new technologies and all the systems, to be probably used in the future, are described.

Even from the first chapter the book deals with the debated subject, the so-called "cosmeceuticals", the supposed third cathegory representing the products "on border-line" between cosmetic products and drugs.

In the "cosmeceuticals" should be included all the new-born active principles, such as glucan enzymes, exfoliants, and all the adjunctive agent to use in the mitigation of time wrinkles, mottled hyperpigmentation and tactile roughness.

What the authors give for sure is that "the conventional cosmetic preparations will gradually be replaced in the coming years by the delivery systems based on high technology".

Because of the present higher competition, it is necessary to improve the performance of the active ingredients used and the market "appeal" of the new cosmetic products.

The performance of cosmetic is directly linked with its activity towards the skin and/or its appendages.Therefore, the knowledge of skin permeability is fundamental to predict and measure the percutaneous absorption of the cosmetic products.

All the problems linked to this subject, to the compositions and structure of the Stratum Corneum (SC), and to the formation and function of the skin barrier, are widely described in the second chapter where can be found also examples of skin models necessary to assess the barrier integrity and the safety of cosmetic formulations. After a scrupolous description of the most common approaches for enhancing skin permeability, by physical or chemical methodologies, the five groups of skin

penetration enhancers are categorized and summarized in the third chapter.
With the fourth chapter on skin hydration, the section of the book dedicated to the structure and functions of the human skin ends. In this chapter are described the theorical aspects of cutaneous hydration, and it's explained the key role played by the water, linked or not, in mantaining the skin homeostasis.
Skin hydration and dehydration are strictly linked to the role of surface lipid film and polar lipids in the intercellular spaces of SC, and to the presence of natural moisturizing factors (NMF) . The origin and role of NMFs and the methods of testing moisturizing activity is finally reported. The fifth chapter focuses on assessing the bioactivity of both cosmetic product and active ingredients.
According to the E.U. laws, a cosmetic is a product which enhances appearance but has not to affect the structure or the function of the skin . However, they may be designed, for example, to alleviate specific skin conditions, such as dehydration. We know that hydration of the skin also increases percutaneous absorption potential, modifyng in such a way the structure of the skin, always physiologically.
For these reasons, it is important to know the bioactive ingredients and the positive and negative effects they can have on the structure of the skin. These problems are described and discussed in this interesting chapter.
Stability testing of cosmetic products is another main problem well examined in chapter sixth. It is necessary to approach this problem with a scientific mind, having a clearly defined hypothesis for determining what to test.
The understanding of why the test needs to be done, helps us to establish appropriate controls. Therefore, it is necessary to understand the status of the formula to be tested, how much and where test samples will be stored, and what to look for identification of instability.
A proper answer has given to all these questions associated with the stability testing of cosmetic products. Quantitation methodologies to control molecules's penetration are well described and reported in chapter seven, from the tape stripping to the quantitative skin autoradiography by image analysis.
The final recommendation is to place a greater effort to validate the different quantitation techniques available.
The eighth chapter is completely dedicated to the multiple emulsions called also emulsions of emulsions or double emulsions. Various possibilities of their preparation are described to give the reader the basic tools to form and evaluate the resulting multiple emulsions with.
For these reasons, it's reported the process for the emulsion preparation throughtout the inversion method, or two-step method. Of course, the important role played by the emulsifiers and by the oil phase on the formation and behavior of multiple emulsions, is well explaned. Therefore, the importance of the emulsification methodology is stressed.
Interesting are also chapter ninth and tenth focused respectively on water-in-oil (W/O), highly concentrated emulsions (gel emulsions), and fluorocarbon gels.
The first constitutes an interesting class of emulsions because of their large internal phase-volume fraction, their low surfactant content and their unusual rheological and optical properties; the second one, has unique properties, such as extreme hydrophobicity and high spreading characteristics as well as chemical and biological inertness.

Both these gels have properties and characteristics useful to formulate a range of innovative cosmetic products.

After having read the interesting chapter eleventh, which introduces the fascinating problem regarding the olfactory perception of fragrance compounds, a big room is given (chapters twelfth and thirteenth) to the technology and the usage of liposomes, able to improve skin condition themselves without any added ingredient.

As it is known liposomes are lipid vehicles composed of one or more lipid bilayers surrounding an equal part of aqueous compartments. Generally, their membrane components are phospholipids, particularly phosphatidylcholine, even if bilayer membrane vehicles have been also constructed using single-chain amphiphiles or non-ionic surfactants.

What is interesting to remember is the facility with which phospholipidic liposomes and/or phospholipids alone can be skin absorbed, because of their composition similar to biological membrane -constituents.

They represent a very useful "base" for the formulation of "active" cosmetics necessary to maintain the skin homeostasis.

As matter of fact, the barrier early repairing depends on a preformed pool of lipids within the epidermis and it seems confirmed that any skin treatment which supplements the right quality and quantity of lipids, such as ceramides, cholesterol and phospholipids, would represent a true skin protectant against future damages also.

Liposomes play also a fundamental role in maintaining the skin moisture.

It is known that the stratum corneum lipids, which form the lamellar structure, serve as skin's water modulators.

The stability of unloaded liposomes depending on the lipid composition, the manufacturing process and the bacterial contamination, are other problems well described in these chapters.

A big room was given also to the rules regulating the penetration of liposomes into human stratum corneum, to their influence on the moisture content of human skin and, of course, to their safety.

The chapter thirteenth has been dedicated entirely to the hair-targeting properties of liposomes.

Topically applied, liposomes have properties that can be used in the hair industry to enhance hair conditioning, replace lost melanin or colour the hair shaft, and cosmetically treat hair disorders, such as hair loss.

They have the unique ability to target the hair shaft or follicle opening. Naturally the liposomal interaction within the hair follicle differs according to the type and the composition. Therefore, liposomal formula must be "custom-tailored".

In this part of the book, dedicated to vesicular and molecular systems, soon after the liposomes, the reader is introduced to the fascinating technology of cyclodextrins, obtained, as it's known, from the enzimatic degradation of starch. Together with the three natural cyclodextrins, α, β and γ, by new production technologies have been developed different kind of derivatives, such as methylated and hydroxypropylated or glucosyl and maltosyl cyclodextrines .

Due to their characteristics, cyclodextrines are used in cosmetic formulations to include components preventing drawbacks (poor stability or irritating effects, bad odour , etc) or to emeliorate solubilization and decrease side effects of some active compounds used.

A lot of new ideas are forwarded about the usage of these sugar derivatives considered as promising adjuvants for the improving the quality of cosmetic products.
The book ends with three chapters dedicated to the up to date delivery systems such as the microcapsules or nanosponges and the polyvinyl or nylon particles.
All these microcapsules or nanosponges, which represent new ways to formulate innovative cosmetics, are required in the cosmetic field in order to answer to the diversification of consumer's needs. They offer a protective function over a long period and permit a releasing, for a prolonged period of time, to the core active substances used in the final product.
These special microcapsules, or nanoparticles, are reservoir systems made up of a continuous or discontinuous polymerized envelope surrounding a liquid or gelified core.
All the encapsulated substances, their major or minor stability and their efficacy of course depends on the polymer used for encapsulating, on the method of microcapsules preparation adopted which determines the size of the particles themselves and their major or minor porosity.
This interesting book surely reaches the goals in stimulating scientists to formulate "more effective and exciting cosmetic products".
However, the text should be used as a reference book, not only for the experts of the field in the cosmetic and pharmaceutical industry, but also for the dermatologists, plastic surgeons, biologists, physiologists who want to deepen their knowledge in the new methodologies set up in the systems to vehicle both drugs and cosmetics, and for the students of chemistry and medicine who want to enter the charming and continuously changing world of skin carriers.

P. MORGANTI
Editor in Chief

IN-COSMETICS USA

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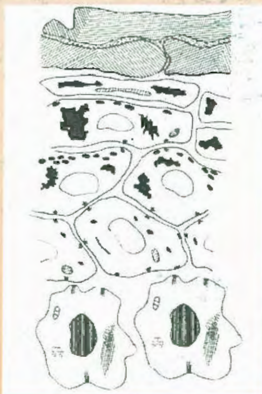

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