

The prospect of 21C Cosmetic Science

Ok-Sub Lee

Pacific R & D Center

The History of the Cosmetic technology in Korea

Years	Items	Contents
Before 1960	Importation of raw materials	Traditional formula
1960 ~ 1980	Stability Usability	Selection of surfactants & polymers Combination of oils & waxes
1980 ~ 2000	Safety Efficacy	Anti-irritation & Allergy Natural & bio-materials
After 2000	Cosmeceuticals Globalization	Regulation of biological function of the skin Anti-wrinkle, whitening Hair growth, Sebum control Equalization of Brands

The Quality of Cosmetics

Items	Key word	Contents
Technology	Safety	No irritation & Allergy
	Efficacy	Moisturizing Anti-wrinkle Whitening Sebum control
	Stabilization	No contamination with microorganisms No separation No change of fragrance & color
Sensory	Skin-feel	Natural, softness, silky, duration
	Fragrance	Pleasant odor
	Color	Fashionable
Knowledge	Identity of Brand	Marketing

R & D of Cosmetics (1)

Desires of Consumers	Scientific Terms
Anti-Wrinkle	Prevention of photo-aging Stimulation of cell growth & collagen synthesis Regulation of cytokines
Moisturizing	Ceramides & pseudoceramides Lamella liquid crystal Moisturizing polymers
Protection	Anti-oxidation UV- protection
Whitening	Inhibition of melanogenesis

R & D of Cosmetic (2)

Consumer Desires	Scientific Terms
Hair-growth	Estrogen-like natural materials
Anti-acne	Sebum Control Sebocytes
Aroma-therapy	Using essential oils for skin therapy
New inorganic materials	Surface coating Combination of organic & inorganic materials
New formula	Capsulation DDS system
Test methods	Alternative animal safety tests Cell based efficacy Test

Anti-Wrinkle Products

1. Intervention of wrinkle process
→ cells, cytokines, collagen & elastin synthesis etc.
2. Study of Anti-wrinkle Products
 - ① Moisturizing of Stratum corneum
 - ② Protection from UV-ray
 - ③ Enhancement of cell growth and turn-over rate
 - ④ Inhibition of elastase activity
 - ⑤ Activation of cytokines
3. Raw materials
 - ① AHA, BHA, GABA
 - ② Ceramides
 - ③ Vitamins (Retinol, tocopherol etc)
 - ④ Natural herbal materials or oligo-peptides

Effects of natural herbal materials

- 1. Anti-inflammatory effects**
- 2. UV-absorbing effects & DNA protector**
- 3. Moisturizing & . Emollient effects**
- 4. Inhibition of enzymes (elastase, collagenase)**
- 5. Anti-lipoperoxidation & scavenging effects of free radical**
- 6. Inhibition of tyrosinase**
- 7. Stimulation of ATP synthesis**
- 8. Enhancement of skin penetration**

Whitening Products

- 1. Intervention of hyper-pigmentation**
→ mechanism of pigmentation process
- 2. Study of whitening products**
 - ① UV-ray cut-off**
 - ② Inhibition of tyrosinase activity**
 - ③ Activation of Cell turn-over**
- 3. Raw Materials**
 - ① Sunscreen agents**
 - ② Anti-oxidants**
 - ③ Chemicals : Arbutin, Kojic acid, etc**

The action Mechanism of the Depigmentation Materials (I)

Materials	Mechanisms	Remarks
Sunscreen agents	Cuts off UV	No effect on Pigmentation except blocking UV
SOD Glutathione	Scavenges free radicals	Obscure effect, not stable
Glucosamine Galactosamine Manosamine Tunicamycin	Inhibits tyrosinase synthesis	No specificity to tyrosinase, Potent cytotoxic effect
Arbutin	Inhibits tyrosinase activity	Obscure effect
Kojic acid	Interrupts intermediates in melanin biosynthesis	Slight skin irritation & allergy reaction Not stable

The action Mechanism of the Depigmentation Materials (II)

Materials	Mechanisms	Remarks
Hydroquinone	Cytotoxic effect on melanocytes	High toxicity to the skin
Tocopherol Vitamin C der.	Reduce melanin formation	Obscure effect Not stable
Azealic acid	Stimulates melanin elimination through the keratinocytes	Obscure effect
AHA Vitamin A	Enhance cell regeneration, Exfoliate the skin	Obscure effect Skin irritation
Licorice extract	Inhibits tyrosinase Scavenges free radicals	Obscure effect

Test Methods of Whitening products

Tools	Materials	Methods
Enzymes	Tyrosinase (mushroom, cell extracts) TRP, Catalase	Activity assessment Radioactivity Melanin content
Cells	B16 melanoma Melanocyte Melanocyte-Keratinocyte co-culture	Radioactivity Western Blotting Northern Blotting Cell number Melanin content
Animals	Brownish gunia pig	Microscopy, Chromametry
Human	Human	Microscopy, Chromametry

Evaluation of Depigmentation Materials

Categories	Evaluation Parameter
Inhibition of Tyrosinase activity	Tyrosinase activity (Enzymes, cells)
Inhibition of TRP activity	TRP activity (cell-extract)
SH (thiol) compound	Ratio of eumelanin/pheomelanin
Anti-oxidation	Amounts of peroxy lipids, radicals
Cell survival	Growth rate of cells (eg.fibroblast)
Anti-inflammation	Histamin release, amount of PG
Anti-irritation	Amounts of cytokines, receptors

Acne

Disease of sebaceous follicle

Four major factors

Abnormal keratinization of follicular epithelium

Increased sebum production

Proliferation of *Propionibacterium acne*

Inflammation

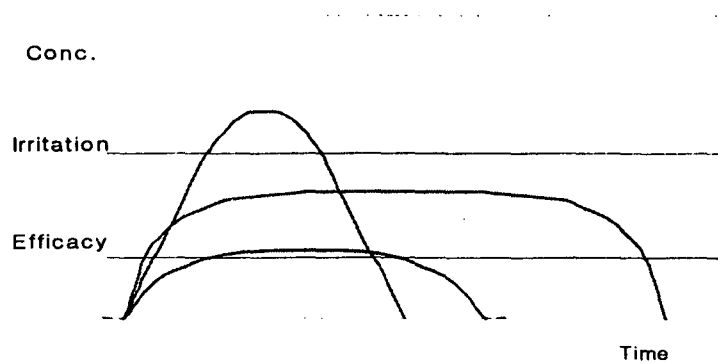
Anti-irritation

Selection of non-irritating materials

Higher irritating dosage

Lower efficacy dosage

Control of material penetration



New Product System

- 1. Encapsulation in cyclodextrin**
- 2. Microencapsulation using polymers**
- 3. Lamella liquid crystal**
- 4. Multiple or microemulsion**
- 5. Liposome**
- 6. Gel matrix**
- 7. Porous microsphere**

Progress of Emulsion Technology in Cosmetics

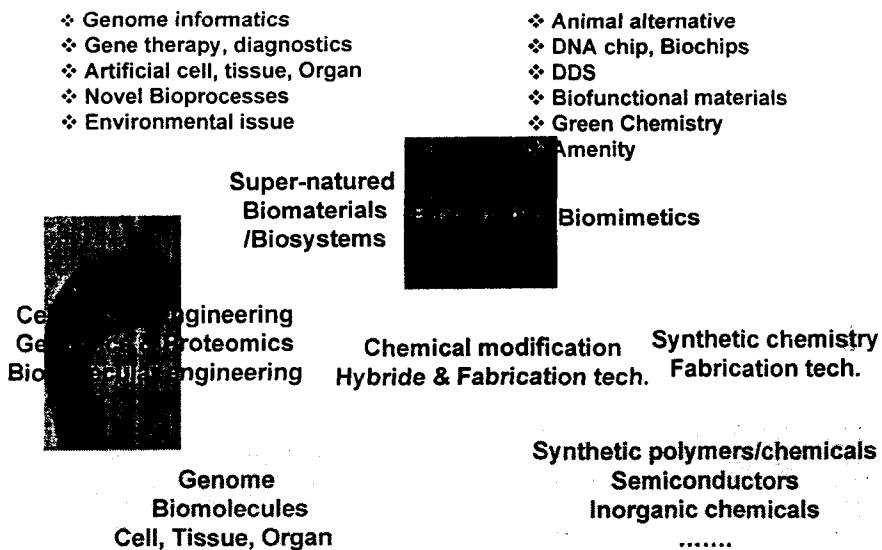
Year	Technology
1950	HLB & Required HLB Theory (3 phase system study) Using sorbitan emulsifier
1960	PIT Theory Inversion emulsification
1970	Solubilization & EIP method Surfactant-fatty alcohol liquid crystal system
1980	Low interfacial tension emulsification Phase & Liquid Crystal emulsification Multiple emulsion, Nano-particle emulsion
1990	Lamella liquid crystal emulsion Emulsion process (membrane,high pressure etc)
2000	DDS study using emulsion system

Trends of Ingredients Development

1. Cosmeceutical Ingredients

Who	What	How
Pharmaceutical Co.	Anti-wrinkle	Molecular biology
Biotech Co.	Whitening	Pharmacology
Cosmetic Co.	Hair growth	Biotechnology
	Sebum control	Combinatorial chemistry

21C Needs & Seeds in Bio Industry



Conceptual Ingredients

Natural / Mild	Active Care	Active Ingredients	Color Therapy
Botanical Herbs Fruit acids Aquatic / marine Tea tree Oil	Anti-Pollution UV Filter Vitamin BioProteins (Peptides / Amino Acids) Sugar	Heat-Activated Clay Water ICE	Color Care Color Stay Color Up Color Vive,...

Prospects of Cosmetics R&D

Categories	Contents
Skin Science	Retardation of aging Inhibition of melanogenesis Prevention of Hair loss Prevention / care of acne Prevention of allergy and irritation
Materials	Extraction of new ingredients from natural product and their application Production of materials using biotech. Synthesis of new materials and their derivatives
Formulation	Selective skin penetration system Stabilizing system of active ingredients Customer-oriented formula
Evaluation tools	Safety evaluation system Efficacy evaluation system
Information technology	Customer-oriented services Application of emotional technology

Characteristics of Future society

- 1. Silver society (Longer-average-life)**
- 2. Matured society (Pursuit of safety and well being)**
- 3. High-Technology- oriented society**
(Progress of electric industry, material industry and biotechnology)
- 4. Information-oriented society**
(Progress of communication tools and computer)
- 5. Globalized society**
(Increase of similarity of life-style)

Trends of Cosmetics

- | | |
|--|---------------------------------------|
| Trend 1
NATURAL
RESOURCES | Trend 5
SIMPLIFY |
| Trend 2
SPIRITUALITY | Trend 6
GLAMOUR GIRL |
| Trend 3
COMPASSION | Trend 7
INDIVIDUAL |
| Trend 4
POSITIVE LIVING | Trend 8
COMFORT |

Prospects of Cosmetics Development

Categories	Contents
Personalization	Order-made products for individual skin characteristics Recombinatable Products
Characterization	1. Differentiation of efficacy 1) Anti-wrinkle, acne-care, depigmentation 2) Make-up products with skin-care functions 3) Body-care products for slimming and resilience 4) Hair-care products for healthy hair 2. Distinction of usage and esthetic methods 3. Products of new appearance
Simplification	Multi-functional products Products which simplify process of make-up
Subdivision	Products according to skin-types Products according to seasons, ages, preferences

Cosmetics Research in New Millennium

- 1. Physiology of skin cells**
- 2. Functions of DNA and RNA in skin cells**
- 3. Functions of proteins in skin cells**
- 4. Development of new active ingredients and evaluation methods**
- 5. Progress of selective skin penetration**
- 6. Esthetic methods : Changes of Beauty-expression methods**
- 7. Shift from 2nd industry society to 3rd, 4th industry society**
- 8. Application of advanced technology & science in other area**
- 9. Creation of new culture**