

Abstracts

The Annual Scientific Meetings and Seminars of the Society of Cosmetic Chemists are important venues for informing the participants about the state of the art and recent technical advances in the field of Cosmetic Science. To provide broader dissemination of that information, the Publication Committee has decided to publish abstracts of the technical presentations made at these Meetings and Seminars in the *Journal*.—The Editor.

Society of Cosmetic Chemists Annual Scientific Meeting

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SCIENTIFIC SESSION I BIOTECHNOLOGY OF COSMETICS

Biology of connective tissue and relevance to cosmetic technology

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In recent years rapid progress has been made in many areas of biotechnology. The techniques that have evolved from biotechnology are being applied to increase understanding of connective tissue physiology and biochemistry. This presentation will focus on connective tissue, particularly skin, and will provide recent information on chemical composition and physical structure and on cell biology of the extracellular matrix. This better understanding of connective tissue biology has obvious relevance to cosmetic technology, and could lead to production of cosmetic formulations to maintain tissue integrity and improve desirable characteristics of these tissues.

The potential impact of recombinant DNA technology on the cosmetic industry

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Biotechnology can make an impact on the cosmetic industry, but must be cost effective. Applica-

tions range from novel antimicrobial agents and stabilizers to biopolymers. An economic analysis of a compound produced both by extraction and recombinant DNA techniques, and illustrating potential problems, will be given.

Potential impact of genetic engineering on the cosmetic industry

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Biotechnology involves the use of living organisms or their components in industrial processes. Genetic engineering techniques can alter the hereditary apparatus of microorganisms, plants, and animals. Recombinant DNA techniques can be used to insert important genes into vectors to transfer the genes from one host to another. An engineered host can be used to produce large quantities of pure nonprotein components such as antibiotics and polysaccharides and proteins such as enzymes, antibodies, and hormones. New sources of unique materials for use in cosmetics will become available as selected genes are cloned, and purification of their product optimized. One can envision the development of cosmetics with unique properties with primary emphasis on the *in vitro* production of components normally found in the various secretions.

Biotechnology and the cosmetics industry: impact of new production technologies

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Applications for certain biotechnology-derived raw materials in cosmetics and other product areas are necessitating the development of novel manufacturing methods. Many of the newly developed compounds being produced are technically complex to prepare and handle, labile, and required in large quantities of high purity. Some recent developments in production technology will be considered, concentrating on the manufacture of chemical specialties of biological origin. The development of a new process for producing hyaluronic acid will be used as an example. The advantages and disadvantages involved in using manufacturing techniques which employ aerobic and anaerobic cell-culture production systems with genetically modified components will be discussed. Particular attention will be given to the current capabilities, limitations, and future development needs of such processes. Some significant developments in downstream processing which have particular relevance to biological materials will also be discussed with respect to their anticipated impact on the development of biological processes.

SCIENTIFIC SESSION II**Photographic standardization of dry skin**

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Photographic standards were developed to provide visual definition for a range of scaling, cracking, and erythema observed with typical dry skin. All photographs were obtained with a Nikon f-3 camera and 105 mm macro lens under standardized conditions. Photographic standards were selected by viewing over 1,000 photographs taken during a study to evaluate the effect of lotion treatment on dry skin. Normal and most severe cases of dry skin were assigned 0 and 9, respectively. Intermediate grades of untreated dry skin were ranked in order of dry skin severity by an iterative procedure where all photographs were reviewed independently by several qualified readers, and repeated until all readers agreed with each other's selections. When clinical photographs taken under standardized conditions in a comparative study were evaluated using the photographic standards, significant improve-

ments were shown in scaling, cracking, and erythema with lotion treatments. Photographic standards of dry skin provided visual definition and documentation of skin condition. Also, they lend themselves to blind, independent evaluations of dry skin by multiple observers.

Enhancement of the sensitivity of the Buehler method by use of the Hill Top Chamber

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Tests of delayed contact hypersensitivity were conducted on guinea pigs using Buehler methodology to compare the sensitivity of the method using the Hill Top Chamber (HTC), a new plastic occlusive chamber and patch system, and the Webril patch (WP). Skin reactions were induced at significantly lower concentrations for samples tested with the HTC than for those tested with the WP. Four compounds, 1-chloro-2, 4-dinitrobenzene (DNCEB), neomycin sulfate (NS), p-phenylenediamine (PPDA), and potassium dichromate (PD) were used as allergens. For each compound, the following steps were carried out: (1) three 0.4 ml induction applications, one per week, on the same site on the same animal; (2) two week period of relaxation; (3) a challenge application on a naive site; and (4) rechallenge applications. For PPDA, EC_{50} were significantly lowered from 0.04% to 0.02% in animals induced with the WP and HTC, respectively. For PD, EC_{50} were significantly lowered from a calculated value of 11.0% to 0.6% in animals induced with the WP and HTC, respectively. Concentrations of 20% and 10% NS in petrolatum produced significantly higher percentages of responders in animals sensitized via the HTC than in those with the WP. Similar results were found in comparisons involving DNCEB.

Effect of the chemical irritants anthralin and benzoyl peroxide on mouse skin epithelial cell protein production

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The widely used topical agents anthralin (An) and benzoyl peroxide (BP) are potent skin irritants. In the mouse skin model these compounds are hyperplasiogenic and effective skin tumor promoters. Using the animal model, we compared the effect of these compounds with the tumor promoter 12-O-tetradecanoylphorbol-13-acetate (TPA) on protein production in epidermal cells. The compounds were applied topically to the shaved dorsal skin of

mice. 24 and 48 hr. later skin fragments were pulse labelled with ^{35}S -methionine to assay total protein production. After labelling, proteins were extracted and separated using 2-dimensional gel electrophoresis with isoelectric focussing in the pH range 5-7 in the first dimension, and 10% polyacrylamide gels in the second dimension. Using this technique we were able to detect over 100 individual proteins under control, TPA, An, and BP treated animals. TPA and An treatment were found to alter the production of at least 10 distinct proteins, 9 of which appear to be keratins. BP treated epidermis closely resembled control skin, suggesting that it may act by a mechanism differing from that of TPA and An. Further studies using pulse labelled skin fragments should facilitate the characterization of proteins involved in the skin irritation process and the mechanism by which BP and An act.

An alternative to direct panelist-judge interaction in evaluating underarm deodorants

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This report describes a novel method which eliminates the unpleasant and problematical close contact between deodorant panelists and judges. Instead of direct sniffing of the axilla, samples of axillary secretions are obtained using the bottom end of disposable glass test tubes rotated briefly in the axillary vault. The tubes are removed, then handed to judges positioned out of sight of the subjects. The judges then score each pair of tubes and record their data.

Results correlate well with tests conducted in the conventional manner. In addition to eliminating the potential problems of subject-judge contact and recognition, this technique isolates the axillary odor from smoke, fragrances, and other odors which may be present on the subject's body or clothing. The axillary odor remains on the tube for several hours if covered and refrigerated.

The effects of dl-alpha-tocopheryl acetate on ultraviolet light-induced epidermal ornithine decarboxylase activity

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Ornithine decarboxylase (DOC) activity increases in response to ultraviolet (UV) light irradiation. Applying Vitamin E (dl-alpha-tocopheryl acetate) prior to UV irradiation produces a 92% reduction in induced-ODC activity. Our mathematical model predicts that this reduction is due to both a physical

blocking of the UV light and a biochemical effect within the epidermis. Vitamin E can be an effective blocking agent if incorporated into a sunscreen, and may also prevent damage caused by the UV light which reaches the stratum corneum.

Finding a preservative system suitable for aloe vera gel

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The "ideal" preservative system for aloe vera gel consists of two components: physical heat and chemicals. The effect of different temperatures with time was examined for aloe vera gel in terms of pH, color, enzyme activity, and bacterial counts. The most lethal temperature was 90°C for 15 minutes, provided a stabilizing agent such as citric acid has been added. The "contact" power and long-range effects of twenty-five different preservatives on "raw" aloe vera gel and pasteurized gel were evaluated over a 7 day period. The results indicate these preservatives are geared to gram negative organisms, since they are very ineffective against total counts and, in particular, molds and yeast. Since most of these preservatives are purported to be broad spectrum, these results are surprising. The preservative with the best general performance was diazolidinyl urea + methyl - and propyl - paraben and propylene glycol (Germaben II).

Release of zinc pyrithione from shampoo bases and the effect of various additives

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Based on previous work on the use of ZNPT in shampoos, it was demonstrated that its antidandruff activity greatly depends upon the release rate of the ZNPT from the shampoo base. Therefore a series of ZNPT shampoos were prepared containing several additives: alcohol (95%) 5, 10, and 15%; DMSO 5, 10, and 15%; PEG-400 5, 10, and 15%; and uvea 5, 10, and 15%. The release rates from these shampoos were determined at time intervals of 15, 30, and 45 min., and compared with a control shampoo and two commercial products. It was found that the release rate decreased in the following order: alcohol (95%) > propylene glycol > DMSO, uvea > PEG-400 > control > commercial products. The data also demonstrated that the release rate was influenced by the percentage of the additive present in the formulation and the time of

determination of each release rate. Several other differences and similarities will be discussed.

Xanthan gum and its role in personal care products

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Xanthan gum is the high molecular weight, extracellular polysaccharide from *Xanthomonas campestris*. Solutions containing xanthan gum have high viscosities at low gum concentrations, are highly pseudoplastic, and possess a yield value. They also show viscosity which is highly stable in the presence of salt and over wide ranges of pH and temperature. In addition, xanthan gum is compatible with many formulation ingredients, such as acids, bases, reducing agents, salts, solvents, enzymes, surfactants, preservatives, and other thickeners.

Some of the benefits provided by xanthan gum in personal care products are (a) good emulsion stability; (b) low viscosity under shear, which allows ease of application; (c) excellent suspension of particulate solids, which is most useful in highly pigmented products as well as some medicated products; (d) enhanced foam stability, an important feature in liquid shampoos and liquid soaps; (e) good skin feel; (f) no "balling up" of the product on application; (g) improved viscosity stability and uniformity with temperature change.

Structure/property relationships for silicone polyalkyleneoxide copolymers and their effects on performance in cosmetics

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High performance, silicone based wetting agents, commonly referred to as silicone polyalkyleneoxide copolyols, are frequently used in the personal care and cosmetic industries. The unique, highly designed structures of commercially available silicone polyalkyleneoxide copolymers impart properties desirable to the cosmetic formulator.

These versatile additives find utility as emulsifiers, moisture barriers, flow control and leveling agents, softeners, dispersants, lubricants, potential wetting agents, etc. Utilizing model compounds, the effects of structural changes (such as molecular weight, degree of organomodification, silicone/polyalkyleneoxide balance, or type of polyether side chain) on the various wetting properties were assessed. Differences in surface tension lowering, cloud point, wet out times, and foam heights were related to structural modifications. Some sugges-

tions as to the selection of these silicone copolymers for cosmetic formulations will be discussed.

Free amino acids of stratum corneum as a biochemical marker to evaluate dry skin

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Free amino acids of stratum corneum were studied by using simple extracts from facial skin surface of female subjects.

The composition of free amino acids obtained from dry and flaky skin (dry skin) was significantly different from those of normal skin, in which citrulline, alanine, pyrrolidone carboxylic acid, and urocanic acid decreased, and their precursor amino acids increased. These changes were found to be similar to those observed in hyperkeratotic skin induced by an application of detergent.

Our previous findings indicated that free amino acids and their metabolites from stratum corneum are produced via degradation of certain epidermal proteins and further metabolization during the final stage of the keratinizing process.

These results suggest that the hyperproliferative alteration of epidermis is involved in dry skin during winter months. The present study indicates that the analysis of free amino acids extracted from skin surface will provide a non-invasive biochemical method for evaluating dry skin conditions.

Organoclays in cosmetics

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The function of organoclay in cosmetics will be described in detail, as well as the mechanism of gel formation. The effect of the solvency of various organic fluids on gel properties will also be discussed. The important role of moisture in gel formation will be stressed, with nail lacquer systems as an example. Practical hints for quality control of organoclays will be given that can directly relate to product performance, such as suspension of active materials in antiperspirants. Electron micrographs of various organoclay materials help visualize performance properties. Utilizing these concepts, the cosmetic formulator should be better able to predict how organoclay products will perform in a given system and how to solve production problems with organoclays.

Free formaldehyde in anionic shampoos

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An analytical method has been developed for determining the free formaldehyde content of anionic shampoos, with and without protein, with formaldehyde derived preservatives. The preservatives studied were 1,3-dimethylol-5, 5-dimethylhydantoin, methane bis [N,N'-(5-ureido-2, 4-diketotetrahydroimidazole)-N,N'-dimethylol], N-(hydroxymethyl)-N-(1,3-dihydroxymethyl-2, 5-dioxo-4-imidazolidinyl)-N'-(hydroxymethyl) urea, cis-1-(3-chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride, and formaldehyde.

The method is based upon establishing an equilibrium of formaldehyde between the sample, the vapor phase, and an aqueous trapping solution. The trapping solution is measured colorimetrically for free formaldehyde at 513 nanometers using phenylhydrazine hydrochloride. Studies were conducted at temperatures of 23°C and 60°C at concentrations of 0.1-0.8% contained preservative.

The order of formaldehyde release found was methane bis [N,N'-(5-ureido-2, 4-diketotetrahydroimidazole)-N,N'-dimethylol] < 1,3-dimethylol-5, 5-dimethylhydantoin < N-(hydroxymethyl)-N-(1,3-dihydroxymethyl-2, 5-dioxo-4-imidazolidinyl)-N'-(hydroxymethyl) urea < cis-1-(3-chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride. The amount of free formaldehyde released was the same at 23° and 60°C. Protein reduced the concentration of free formaldehyde present.

In the absence of protein, the ratio of free to total formaldehyde increased with decreasing preservative concentration.

SCIENTIFIC SESSION III FORMULATING COSMETIC AEROSOLS IN THE 1980'S

Aerosol hair care preparations

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The advent of the aerosol package stimulated the development of not only new products, but new raw materials for use in them. In particular, aerosol hair sprays spawned a host of synthetic resins to replace and supplement the now almost obsolete shellac originally used. As a result of this development, there are now in the aerosol spray hair care category not only hair fixative sprays, but lusterizers, conditioners, and setting lotions.

In the aerosol foam hair care grouping are waving lotions, hair dyes, shampoos, conditioners, and setting lotions. One must also mention aerosol foam depilatories, which might be labelled a "hair control" rather than a "hair care" product.

These aerosol preparations are not used solely by women, but have been adopted by men as well. This is especially true of hair fixative sprays which have, to some extent, replaced men's hair dressings packaged in bottles and tubes.

The most recent development is the introduction of the "conditioner and styling mousses" which promise to become another major hair care product.

Fragrance in aerosol products

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Aerosol products often contain water ranging in pH from 3 to 13. Others are hydroalcoholic, and sometimes contain active ingredients such as phenolic or quaternary derivatives. Using the wrong perfume with any of these compositions may cause container corrosion, the development of strange odors and colors, or other unwanted effects. With aerosols containing high levels of isobutane or propane propellants, certain ingredients in the fragrance blend may slowly precipitate. Some products require fragrance to cover chemical odors of other ingredients, while others are used to mask or destroy chemical odors in the home. The degree of atomization must be considered, since a finely dispersed spray will cause significant portions of all the perfume notes to be presented to the nose at the same time, unlike the non-aerosol preparations, where the essential oils evaporate in successive stages. Finally, the amount of fragrance in aerosols ranges from about 0.03% in the "unscented" products, past an average value of about 0.18% to as high as 60% for one unusual item. At high levels fragrance oils can cause problems with valve gaskets. Careful research is needed when developing aerosols containing any amount of fragrance ingredients.

New era in aerosol propellants

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A new line of aerosol propellants has recently been introduced. The four products include: (1) dimethyl ether; (2) chlorodifluoromethane; (3) 1,1-difluoroethane; and (4) 1,1,1-chlorodifluoroethane. The physical, chemical, and toxicological properties of these propellants will be described. Interrelation-

ships of concentration, vapor pressure, flammability, and solubility will be explained, and formulations specifically directed to the use of these propellants in personal and other products presented.

SOCIETY OF COSMETIC CHEMISTS FRONTIERS OF SCIENCE LECTURE

Theory in chemistry

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The motion of the electrons in a molecule is behind every physical, chemical, and biological property of a molecule. The most easily perturbed, the least tightly bound electrons are most important in determining these properties. Such electrons move in "frontier" orbitals. An account of the frontier orbitals and their role in determining the geometry of molecules and the course of chemical reactions will be given.

SCIENTIFIC SESSION IV

Percutaneous transport of antihistamines

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Percutaneous penetration *in vitro* was followed temporally for selected antihistamines: chlorpheniramine, diphenhydramine, pheniramine, and pyrilamine. For these compounds, dermal transport was a function of solute lipophilicity. The permeability constants, diffusion constants, transport fluxes, and computed time lags were functions of the solute octanol/buffer partition coefficients. The use of guinea pig skin and rat skin preparations in these studies led to additional observations: (1) epidermal separation was achieved readily with ammonium thiocyanate; (2) dermal transport was comparable to that achieved with skin prepared with ammonium hydroxide or stripping; and (3) guinea pig skin preparations yielded results more consistent than rat skin preparations.

A review of silicon chemistry for the cosmetic chemist

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Since their first commercial skin care application in the early 1950's, silicones have become known to the personal care formulator for their unique chemical and physical properties. These properties have led to applications in virtually every class of per-

sonal care products, including antiperspirants, cosmetics, hair care products, and skin care products. In order to explain the properties of silicones, a review of silicon chemistry will be presented. The similarities and differences between carbon and silicon chemistry will be discussed, and the unusual properties of siloxane polymers will be explained in terms of the differences between siloxane bonds and the carbon-carbon bonds in organic polymers. Many of the important physical characteristics of silicones will be shown to be a direct consequence of the peculiarities of siloxane chemistry. A brief review of the industrial synthesis of silicones will be given, with special emphasis on silicones of interest to cosmetic chemists. Also, the chemical and physical properties of silicones will be related to potential benefits in a variety of product categories.

Low-energy emulsifications. Part VI: applications in high-solids emulsions

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Low-energy emulsification (LEE) is a technique by which thermal and mechanical energies are selectively applied to only a portion of the emulsified components at certain emulsification stages. By applying far less energy than the conventional hot process, LEE can not only reduce energy costs, but can also significantly reduce cooling time and increase production efficiency. Frequently, the use of a refrigerated system can be completely eliminated through the application of LEE in commercial processing of cosmetic and pharmaceutical emulsions.

Although LEE has proven to be very useful in processing a wide range of emulsions, it has been difficult in the past to apply it to O/W emulsions having solid contents greater than 30% because of the potential phase inversion problems. Phase inversion of the concentrate often leads to poor emulsification and poor stability. By using a new technique of double withholding, LEE can successfully process a wide range of relatively high solids emulsions while avoiding the common phase inversion problems.

The athymic nude mouse grafted with human skin as a model for evaluation of radiolabeled cosmetic ingredients

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During recent years considerable attention has been directed toward transdermal delivery as a means of administering biologically active chemicals to the body. As a result, a large body of information has

accumulated relative to the permeability of skin and the effects of various permeation enhancers on diffusion into and through the skin. The potential impact of such information on the cosmetics industry is obvious. One problem for such studies is that an ideal model does not exist. Various animal studies, human studies, and *in vitro* diffusion studies all have drawbacks which limit their usefulness. Although still not ideal, the use of the nude mouse onto which human skin has been grafted has many advantages. In this model the human skin maintains most of its inherent qualities and can be used to study permeation of radiolabeled compounds by means of autoradiography, tape-stripping, or similar analytical methods. Results indicate that a number of compounds are capable of permeating into or through the epidermis.

Electron spin resonance as a possible new technique for characterizing the fluidity of cosmetic semisolid bases

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An investigation was made for the possibility of using electron spin resonance (ESR) as a new technique for characterizing the fluidity (viscosity) of cosmetic semisolid bases. Currently used methods of fluidity (viscosity) measurements do not normally yield consistent results for semisolid bases; the inconsistency is related to the different ways of applying stress to a sample during measurements. ESR was selected because it can provide information on molecular motion without actually

(mechanically) disturbing a sample. The present study suggests that ESR has the potential for developing into a quick (a few minutes per sample), sensitive (a few milligrams of sample needed), nondestructive, and reliable method for characterizing fluidity of semisolid bases. Details of the methodology and its potential will be demonstrated by application to 4 semisolid bases, 3 belonging to the polyethylene glycol (PEG) family and petrolatum, and the advantages and possible shortcomings of this method will be discussed.

Germall II and Germaben II: a significant advance in cosmetic preservation

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In spite of increased sophistication of cosmetic scientists in preventing microbial contamination of cosmetic products, the battle to formulate safe, well-preserved cosmetics is far from won. Germall II (Diazolidinyl Urea), the newest and most active member of the Germall (imidazolidinyl urea) family of antimicrobial preservatives, retains the safety of Germall 115 (Imidazolidinyl Urea), and also provides enhanced activity against mutated bacteria, yeast, and mold. The physical, toxicological, and microbiological properties of Diazolidinyl Urea will be described, and applications to cosmetic formulations will be discussed. Diazolidinyl Urea, a combination of Germall II and parabens, is a complete broad-spectrum preservative in clear liquid form. The properties of Germaben II will be described, and applications will be presented which stress economy and convenience of use.