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Cosmetic Science and Technology Series

Volume 26

Multifunctional Cosmetics

edited by
Randy Schueller
Perry Romanowski

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Multifunctional Cosmetics

edited by

Randy Schueller and Perry Romanowski

*Alberto Culver Company
Melrose Park, Illinois, U.S.A.*



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About the Series

The Cosmetic Science and Technology series was conceived to permit discussion of a broad range of current knowledge and theories of cosmetic science and technology. The series is composed of both books written by a single author and edited volumes with a number of contributors. Authorities from industry, academia, and the government participate in writing these books.

The aim of the series is to cover the many facets of cosmetic science and technology. Topics are drawn from a wide spectrum of disciplines ranging from chemistry, physics, biochemistry, and analytical and consumer evaluations to safety, efficacy, toxicity, and regulatory questions. Organic, inorganic, physical and polymer chemistry, emulsion and lipid technology, microbiology, dermatology, and toxicology all play important roles in cosmetic science.

There is little commonality in the scientific methods, processes, and formulations required for the wide variety of cosmetics and toiletries in the market. Products range from preparations for hair, oral, and skin care to lipsticks, nail polishes and extenders, deodorants, body powders and aerosols, to quasi-pharmaceutical over-the-counter products such as antiperspirants, dandruff shampoos, antimicrobial soaps, and acne and sun screen products.

Cosmetics and toiletries represent a highly diversified field involving many subsections of science and "art." Even in these days of high technology, art and intuition continue to play an important part in the development of formulations, their evaluations, selection of raw materials, and, perhaps most importantly, the successful marketing of new products. The application of more sophisticated scientific methodologies that gained steam in the 1980s has increased in such areas as claim substantiation, safety testing, product testing, and chemical analysis and



has led to a better understanding of the properties of skin and hair. Molecular modeling techniques are beginning to be applied to data obtained in skin sensory studies.

Emphasis in the Cosmetic Science and Technology series is placed on reporting the current status of cosmetic technology and science and changing regulatory climates and presenting historical reviews. The series has now grown to 26 books dealing with the constantly changing technologies and trends in the cosmetic industry, including globalization. Several of the volumes have been translated into Japanese and Chinese. Contributions range from highly sophisticated and scientific treatises to primers and presentations of practical applications. Authors are encouraged to present their own concepts as well as established theories. Contributors have been asked not to shy away from fields that are in a state of transition, nor to hesitate to present detailed discussions of their own work. Altogether, we intend to develop in this series a collection of critical surveys and ideas covering diverse phases of the cosmetic industry.

The 13 chapters in *Multifunctional Cosmetics* cover multifunctional products for hair, nail, oral, and skin care, as well as products with enhanced sunscreen and antimicrobial properties. Several chapters deal with the development of claim support data, the role of packaging, and consumer research on the perception of multifunctional cosmetic products. The authors keep in mind that in the case of cosmetics, it is not only the physical effects that can be measured on the skin or hair, but also the sensory effects that have to be taken into account. Cosmetics can have a psychological and social impact that cannot be underestimated.

I want to thank all the contributors for participating in this project and particularly the editors, Perry Romanowski and Randy Schueller, for conceiving, organizing, and coordinating this book. It is the second book that they have contributed to this series and we appreciate their efforts. Special thanks are due to Sandra Beberman and Erin Nihill of the editorial and production staff at Marcel Dekker, Inc. Finally, I would like to thank my wife, Eva, without whose constant support and editorial help I would not have undertaken this project.

Eric Jungermann, Ph.D.



Preface

In the last several years our industry has seen a shift toward the widespread acceptance of, and even demand for, products that offer more than one primary benefit. A variety of technological and marketing factors have contributed to this shift. From a technological standpoint, improved raw materials and formulation techniques have improved the formulator's ability to create products that can accomplish multiple tasks. In fact, certain performance attributes that were at one time viewed as incompatible or mutually exclusive (such as simultaneous shampooing and conditioning of hair or concurrent cleansing and moisturizing of skin) are now routinely delivered by single products. From a business perspective, changing marketing tactics have also played a role in the escalation of product functionality. Marketers have become increasingly bold in their attempts to differentiate their products from those of their competitors. Thus, products that claim to have three-in-one functionality attempt to outdo those that are merely two-in-ones. For these reasons, among others, it has become important for cosmetic chemists to understand how to develop and evaluate multifunctional personal care formulations.

In this book we discuss multifunctional cosmetics from a variety of viewpoints. First, and most fundamentally, we attempt to define what constitutes a multifunctional product. The first two chapters establish the definitions and guidelines that are used throughout the book. The next several chapters describe the role of multifunctionality in key personal care categories. Three chapters are devoted to hair care, with special emphasis on one of the most influential types of multifunctional products, the two-in-one shampoo. In the last several years, two-in-ones have risen to an estimated 20% of the shampoo market, and we can trace the history and technical functionality of these formulations. Other multifunctional hair

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care products we explore include those designed to deliver, enhance, or prolong color as they clean or condition hair.

Chapters 5–7, 9 delve into the role of multifunctional products in skin care. After an overview of the category we discuss the growing importance of shower gels and bath products that claim to cleanse and moisturize skin in one simple step. We also address how facial care products can perform multiple functions such as cleansing, conditioning, and coloring. We then discuss how antiperspirant/deodorant products use dually functional formulas to control body odor. Chapter 7 discusses the relatively new area of cosmeceuticals—products that have both drug and pharmaceutical functionality.

While the book is primarily concerned with hair and skin care products, one chapter is devoted to oral care. There is a clear trend in this category toward products that perform more than one function; for example, toothpaste formulations have gone beyond simple cleansing by adding functionality against cavities, tartar, plaque, and gingivitis.

The next two chapters focus on specific functional categories. We discuss how to add moisturizing or conditioning functionality to products that have another primary functionality. For example, Chapter 9 deals with expanding product functionality by adding sunscreen protection; Chapter 10 describes how to include antibacterial properties in a product.

The last three chapters describe some of the executional details one should be aware of when creating multifunctional products. We discuss general considerations related to formulation and how to design and implement tests for supporting claims. We also cover legal considerations, particularly with respect to OTC monographs, in which covering more than one function can lead to problems. The final chapter is devoted to the role of packaging in multifunctional products.

Randy Schueller
Perry Romanowski



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Definition and Principles of Multifunctional Cosmetics

Perry Romanowski and Randy Schueller

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A popular late-night comedy television program once made a joke about a product that was a combination floor wax and dessert topping. While this is a humorous example, it does support the central point of this book: consumers love products that can do more than one thing. This is a critical principle that formulating chemists should learn to exploit when designing new products and when seeking new claims for existing products. If formulators can create products that excite the consumer by performing more than one function, these products are more likely to succeed in the marketplace. In fact, in many cases, creating products with more than one function is no longer a luxury, it is a necessity that is mandated by consumers.

This book is written to share with the reader some approaches for formulating and evaluating multifunctional products. But first, to provide a conceptual framework for our discussion, we must state what the term “multifunctionality” means in the context of personal care products. The opening section of this chapter defines the term by describing four different dimensions of multifunctionality. We then discuss three key reasons why this trend is so important to this industry. On the basis of this conceptual foundation, the remainder of the chapter provides an overview of the specific product categories discussed throughout the book.



While the reader may have an intuitive sense of what multifunctionality is, there is no single, universally accepted definition. Therefore, we begin by attempting to develop a few standard definitions. We hope to better define the concept by discussing four different dimensions of multifunctionality: performance-oriented multifunctionality, ingredient-based multifunctionality, situational multifunctionality, and claims-driven multifunctionality.

1 PERFORMANCE-ORIENTED MULTIFUNCTIONALITY

Multifunctionality based on performance is probably the type that first comes to mind. Products employing this type of multifunctionality are unequivocally designed to perform two separate functions. One of the most obvious examples of this kind of multifunctionality is the self-proclaimed two-in-one shampoo that is intended to simultaneously cleanse and condition hair. This type of formulation was pioneered by Proctor & Gamble with Pert Plus in the late 1970s. Pert contains ammonium lauryl sulfate as the primary cleansing agent, along with silicone fluid and cationic polymers as the conditioning ingredients. Proctor & Gamble researchers found a way to combine these materials in a way that allows concurrent washing and conditioning of the hair. The result is a product that is able to offer consumers the legitimate benefit of saving time in the shower because it eliminates the need for a separate conditioner. Thus Pert has become a classic example of a multifunctional personal care product.

In a somewhat different context, antiperspirant/deodorants (APDs) also exhibit multifunctional performance. To appreciate this example, the reader must understand that “antiperspirant/deodorants” are very different from “deodorants.” Deodorants are designed solely to reduce body odor through use of fragrance that masks body odor and antibacterial agents that control the growth of odor-causing microbes. Because they are designed to reduce odor only, deodorant are mono-functional products. Antiperspirants, on the other hand, contain active ingredients (various aluminum salts) that physiologically interact with the body to reduce the amount of perspiration produced. Because these aluminum compounds also help control bacterial growth, antiperspirants are truly multifunctional: they control body odor and reduce wetness. In this context, it is interesting to note that all antiperspirants are deodorants but not all deodorants are antiperspirants. We also point out that since these aluminum salts are responsible both product functions, they could be considered multifunctional ingredients—this type of multifunctionality is discussed later in the chapter.

This principle of performance-oriented multifunctionality has been applied to almost every class of cosmetic product. For example, the number of makeup products that make therapeutic claims is increasing. One trade journal, *Global Cosmetics Industry*, noted three cosmetic products that combine the benefit of a



foundation makeup with a secondary benefit. Avon's Beyond Color Vertical Lifting Foundation is also said to be effective against sagging facial skin, Clinique claims that The City Cover Compact Concealer also protects skin from sun damage, and Elizabeth Arden's Flawless Finish Hydro Light Foundation adds ceramides, sunscreen, and an α -hydroxy acid (AHA) to smooth and protect skin. *Global Cosmetics Industry* anticipates that the combination of multifunctional claims, combined with strong brand names and affordable prices, will allow such products to thrive in the coming years. A number of other examples are cited in Tables 1–8.

TABLE 1 Multifunctional Hair Care Products and Manufacturers' Claims

Pert Plus Shampoo and Conditioner
Provides a light level of conditioning
Gently cleanses the hair
L'Oréal Colorvive Conditioner
Up to 45% more color protection
Keeps color truer, hair healthier
Conditions without dulling or weighing hair down
Ultra Swim Shampoo Plus
Effectively removes chlorine and chlorine odor
With rich moisturizing conditioners
Jheri Redding Flexible Hold Hair Spray
Holds any hair style in place flexibly
Leaves hair so healthy it shines

TABLE 2 Multifunctional Soaps and Bath Products and Manufacturers' Claims

Dove Nutrium
Restores and nourishes
Dual formula
Skin-nourishing body wash
Goes beyond cleansing and moisturizing to restore and nourish
FaBody Wash
Moisturizers that feed the body and exotic fragrances that fuel the senses
Nourishes the skin
Cleans without drying
Dial Anti bacterial Hand Sanitizer
Contains moisturizers
Kills some germs



TABLE 3 Multifunctional Skin Care Products and Manufacturers' Claims

Body @ Best All of You Gel Lotion
White lotion and clear red glitter
To moisturize and give a hint of glitter
Biore Facial Cleansing Cloth
Cleanses
Exfoliates
Noxema Skin Cleanser
Cleanses
Moisturizes
Nair Three-in-One cream
Depiliates
Exfoliates
Moisturizes

TABLE 4 Multifunctional Makeup Products and Manufacturers' Claims

L'Oréal Hydra Perfect Concealer
Foundation makeup
Protects and hydrates with a sun-protection factor (SPF) factor of 12
Revlon Age-Defying All-Day Lifting Foundation
Helps visibly lift fine lines away
Skin looks smoother and softer
Ultraviolet protection helps prevent new lines from forming
L'Oréal Color Riche Luminous Lipstick
Rich color with lasting shine
Moisturizes for hours, enriched with vitamin E
Hydrating lip color
Almay Three-in-One Color Stick
Accents lips, cheeks, and eyes in a few quick strokes
The perfect tool that does it all
Moisturizing color glides on smoothly
Neutrogena Skin Clearing Makeup
Actually clears blemishes
Controls shine and is a foundation makeup

TABLE 5 Multifunctional AntiPerspirant/Deodorant Products and Manufacturers' Claims

Mitchum Super Sport Clear Gel Antiperspirant and Deodorant
Antibacterial odor protection
Clinically proven to provide maximum protection against wetness
Arrid XX Antiperspirant Gel
Antibacterial formula works to help kill germs
Advanced wetness protection



TABLE 6 Multifunctional Nail Care Products and Manufacturers' Claims

Sally Hanson Hard As Nails
Helps prevent chipping splitting and breaking
Enhances color
Restructurizing strengthens and grows nails
Moisturizing protection and ultrahardening formula
Sally Hanson Double-Duty Strengthening Base and Topcoat
All-in-one moisturizing basecoat
Protective shiny topcoat

TABLE 7 Multifunctional Oral Care Products and Manufacturers' Claims

Colgate Total
Helps prevent
Cavities
Gingivitis
Plaque
Crest Multi-Care
Fights cavities
Protects against cavities
Fights tartar buildup
Leaves breath feeling refreshed
Aqua-Fresh Triple Protection
Cavity protection
Tartar control
Breath freshening
Arm & Hammer's Dental Care Baking Soda Gum
Whitens teeth
Freshens breath
Reduces plaque by 25%
Listerine antiseptic mouthwash
Kills germs that cause
Bad breath
Plaque
Gingivitis
Polydent Double-Action Denture Cleanser
Cleans tough stains
Controls denture odor
Keeps user feeling clean all day



TABLE 8 Miscellaneous Multifunctional Products and Manufacturers' Claims

Coppertone Bug Sun
Sunscreen with insect repellent
Offers convenient dual protection in one bottle for total outdoor skin protection
Protects from harmful UV rays while it also repels mosquitoes and other pests
Moisturizes
Allergans Complete Comfort Plus Multi purpose Contact Solution
Cleans and rinses
Disinfects
Unique package stores lens
Quinsana Plus Antifungal Powder
Cures athlete's foot and jock itch
Absorbing powder helps keep skin dry
Mexana Medicated Powder
Antiseptic
Protectant
Gold Bond Medicated Lotion
Moisturizes dry skin
Relieves itch
Soothes and protects
Pampers Rash Guard Diapers
Absorbs moisture
Clinically proven to help protect against diaper rash

2 INGREDIENT-BASED MULTIFUNCTIONALITY

There is a second class of multifunctionality that does not require a product to perform multiple tasks. Even though a product is monofunctional, it may contain ingredients that perform more than one function. There are many examples of this type of multifunctionality. Consider that certain fragrance ingredients also have preservative properties. And conversely, phenoxyethanol, chiefly used for its preservative properties, also imparts a rose odor to products. To a certain extent many, if not most, cosmetic ingredients are "accidentally" multifunctional. For example, the ingredients used in skin lotions to emulsify the oil phase components (fatty alcohols such as cetyl and stearyl alcohol) also serve to thicken the product. In fact, some of these ingredients have emolliency properties as well. Therefore, in this example, a single ingredient could serve three functions in a given product. Likewise in a detergent system, the surfactants that provide foaming properties also thicken the product. While ingredient-based multifunctional-



ity may seem trivial, it can provide a way to leverage new claims by using an existing formula.

In addition, using multifunctional ingredients allows formulators to prepare products more efficiently and economically. This approach is useful when one is formulating “natural” products that have fewer “chemicals.” Since many consumers think that a long ingredient list means that the product has too many harsh chemicals, using fewer ingredients that perform multiple functions may help make the product more appealing to the consumer. In addition, products formulated with fewer ingredients may be less expensive and easier to manufacture.

3 SITUATIONAL MULTIFUNCTIONALITY

Another dimension of multifunctionality is exemplified by products that claim to be functional in multiple situations. For example, consider a product whose primary function is to fight skin fungus. Yet, such a product may claim to cure both athlete’s foot and jock itch. The function is the same (both maladies are caused by a fungus), but the situation of use is different, thus essentially making the product multifunctional.

In addition to the situational uses explicitly described by marketers, consumers tend to find alternate uses for products on their own. At least one published study [1] has indicated that consumers find multiple uses for products for three primary reasons: convenience, effectiveness, and cost. Savvy marketers have learned to exploit such alternate situational uses to help differentiate their products in the marketplace. An understanding of situational multifunctionality can help support advertising that promotes new uses for old brands. Wansink and Gilmore found that in some cases, it may be less expensive to increase the usage frequency of current users than to convert new users in a mature market [2]. Defining multifunctional benefits for a product can help revitalize mature brands, and there are numerous examples of brands that have energized their sales by advertising new usage situations. For example, Arm & Hammer Baking Soda was once primarily known for use in baking. But sales dropped as people began using more prepackaged baked goods. Church & Dwight responded by marketing the brand as a deodorizer for refrigerators, and sales skyrocketed. More recently the manufacturer has also promoted the use of baking soda in products such as toothpastes and antiperspirants in an attempt to make more compelling deodorization claims for these products.

It is interesting to note that consumers tend not to stray across certain usage lines when using products in alternate situations. They are not likely to use a household product for cosmetic purposes and vice versa. Wansink and Ray [2], who explain consumers’ tendency to use products in similar contexts (i.e., foods as foods and cleaners as cleaners) from a psychological standpoint, say there are mental barriers that consumers are hesitant to cross, particularly for products used



in or on their bodies, such as foods and beauty products. Consumers do not like to think that the Vaseline Petroleum Jelly they use to remove makeup can also work as a lubricant for door hinges. Cosmetic scientists must be aware of these mental barriers when attempting to exploit situational multifunctionality.

4 CLAIMS-DRIVEN MULTIFUNCTIONALITY

Sometimes marketers simply list multiple, exploitable benefits of a product. For example, a shampoo is primarily designed to cleanse hair but it also leaves hair smelling fresh and *sexy*? While this secondary benefit may seem trivial to the formulator, it may be an important fact that the marketer can choose to exploit. Such “trivial” benefits can make good label copy claims, and we urge the reader to consider these secondary product benefits when helping marketing to develop claims.

Similarly, copy writers may dissect a single performance benefit to make it sound more impressive. For example, advertising claims that describe a product’s ability to soften and smooth hair, and make it more manageable, are essentially referring to the single technical benefit of conditioning. While this distinction might seem unimportant to the formulator, it is of paramount importance to marketers because it allows them to differentiate their product from the competition. Formulators should strive to leverage their knowledge of formula characteristics and look for “hidden” claims that may be useful in marketing. Chemists need to recognize that it is not necessary to base every claim to multifunctionality on quantifiable performance differences.

5 WHY MULTIFUNCTIONALITY IS SO POPULAR

5.1 Increasing Consumer Expectations

In the opinion of the authors, multifunctional products are becoming increasingly popular for three key reasons: increasing consumer expectations, maturing cosmetic technology, and expanding marketing demands. The first reason is related to consumers’ desire for products that can perform more than one function; people are demanding more performance from products of all types. This trend can be seen in many product categories beyond personal care: sport–utility vehicles are cars that also behave like trucks; computers are not just calculating devices but are also entertainment centers that play CDs and DVDs; telephones are not just for verbal communication, they are capable of scanning and faxing documents. Today even a simple stick of chewing gum is expected to perform like a cavity-fighting sword of dental hygiene. The same set of growing expectations has affected the market for personal care products as well. While shampoos were once expected to simply cleanse hair, the simultaneous delivery of conditioning or color protection benefits as well is anticipated in many cases.



5.2 Maturing Technology

A second factor driving the rise of multifunctional personal care products has to do with the level of maturity of the technology used to create cosmetics. As cosmetic science has matured, it has become increasingly difficult for formulators to improve upon any single aspect of a product's performance. Consider cleansing products like shampoos or soap bars. For centuries, all these products were based on soaps, which are saponified fatty acids. Because of their surfactant nature, soaps are able to remove dirt and grease from a variety of surfaces. However, soaps also tend to dry the skin and can combine with hard water ions to form insoluble deposits, resulting in the notorious "bathtub ring." During the 1940s, advances in organic chemistry led to synthetic detergents such as sodium lauryl sulfate and α -olefin sulfonates, which were vastly superior in performance to soap. Today, the majority of cleansing products (including some bar soaps) use synthetic detergents. Surfactant technology has continued to evolve over the last 50 years, yet the same compounds created in the 1940s are still widely used because they are still highly functional and economical.

Surfactant technology has become so sophisticated that most improvements are incremental: synthesis chemists may succeed in making new molecules that are somewhat milder or that are more easier to manufacture, but it is very difficult to produce new raw materials that provide dramatically improved performance that is perceivable by the consumer. Of course, this is not meant to say that there have been no new ingredient-based technological breakthroughs in the last five decades; chemists continue to create new polymers that are more effective conditioning agents and film formers. But for many product categories, it can be difficult for formulators to make "quantum leaps" in improving the basic performance of their products because the raw materials they are using are already highly effective and cost-efficient. To create new products that demonstrate additional consumer-perceivable benefits, formulators attempt to add additional functionality to their products. Instead of concentrating on "better" cleaning, formulators have begun to add secondary properties, such as conditioning and moisturizing.

By combining more than one function into a single product, formulators can satisfy growing consumer expectations. In fact, certain performance attributes that were at one time viewed as incompatible or mutually exclusive (such as simultaneous shampooing and conditioning of hair or concurrent cleansing and moisturizing of skin) can now be combined in single products.

5.3 Expanding Marketing Demands

The third reason for increasing multifunctionality comes from the business sector: marketers have become increasingly bold in their attempts to differentiate their products from their competitors'. To increase consumer appeal in this competitive age, marketers claim that their products will save consumers time by performing



more than one duty at once. This strategy requires marketers to add multiple functions to their products. Thus, products that claim to have “three-in-one” functionality attempt to outdo those that are merely “two-in-ones.”

The impact of these three factors has made it very important for formulators to look for ways to diversify the functionality of their products. Indeed, formulators who stay competitive in the market place are constantly striving to satisfy these diverse consumer expectations.

BOOK LAYOUT

This book was designed to examine how the concept of multifunctionality affects product development. It was compiled with the cosmetic formulator in mind and is intended to provide practical information that can help guide formulation efforts.

The first part of this book is dedicated to specific formulation issues encountered during attempt to develop multifunctional products. To this end, Chapter 2 discusses the technical challenges related to formulating products with functions that once had seemed to be mutually exclusive, such as simultaneous cleansing and moisturizing. The role of consumer and marketer expectations is examined, and a process for formulating multifunctional products is advanced.

The next two chapters look specifically at the formulation of multifunctional hair care products. Chapter 3 reviews the historical development of these hair care products. It also provides a comprehensive look at the different ingredients that can be used to create multifunctional effects in hair care products. Chapter 4 discusses the development of two-in-one shampoos, the most common type of multifunctional hair care product. This product type is particularly important because it arguably represents the most significant technical advance in shampoo technology since the development of synthetic detergents.

Chapters 5 and 6 discuss the formulation of multifunctional products for skin care. Chapter 5 provides a detailed look at the development of ingredient mixtures for multifunctionality in skin care products. Methods for choosing appropriate materials and evaluating their effectiveness for various functionalities are given. Similarly, Chapter 6 discusses formulation of multifunctional nail care products and methods for their evaluation.

Chapter 7 surveys the topic of introducing therapeutic functionalities with cosmetic products. It discusses the controversial concept of cosmeceuticals, with its associated technical and legal challenges. The chapter provides a review of some of the regulatory aspects of formulating these products and formulation considerations. Numerous therapeutic ingredients are discussed, as are methods for their inclusion in a formula. Chapter 8 examines the development of multifunctional oral care products. The various multiple functions these products can have are considered, and methods for their formulation are discussed.



The next two chapters examine specific product functionalities and how these can be introduced into numerous products. Chapter 9 looks at methods for blocking the damaging effects of sunlight. It reviews the state of technology today and suggests paths for future research. Methods for incorporating sunscreen ingredients in various formulation types are also introduced. Likewise, Chapter 10 discusses methods for adding antibacterial functionalities to cosmetic products. Specific ingredients are reviewed, as are future trends in this area of technology.

The final three chapters are related to areas that affect the development of multifunctional products but do not specifically deal with formulating. Chapter 11 reviews the techniques involved in developing claims support for multifunctional products. Numerous methods are proposed for both skin care and hair care products. Additionally, an overall strategic approach is proposed for specifically dealing with products of these types. Chapter 12 examines the role of packaging in the development of multifunctional products. Numerous aspects of the package are reviewed, along with their impacts on the functionality of the cosmetic product. The book ends with a chapter on consumer research and how it can be used to aid in the development of multifunctional products. Ideas about which product functionalities should be combined and methods for gathering this information are discussed.

The field of cosmetic chemistry is an evolving one, with products being designed to have greater and greater functionality. It is hoped that this work will provide a solid basis for all who desire to combine cosmetic functionalities and inspire the development of superior formulations.

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