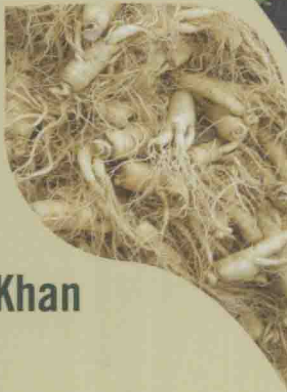


Third Edition

# Leung's Encyclopedia of Common Natural Ingredients

## Used in Food, Drugs, and Cosmetics



**Ikhlas A. Khan**

**Ehab A. Abourashed**

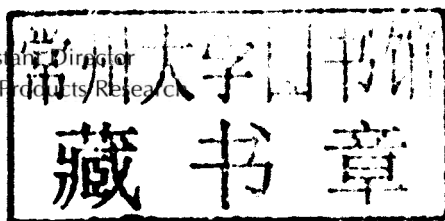
# LEUNG'S ENCYCLOPEDIA OF COMMON NATURAL INGREDIENTS

USED IN FOOD,  
DRUGS, AND COSMETICS

**Third Edition**

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LEUNG'S  
ENCYCLOPEDIA  
OF COMMON  
NATURAL  
INGREDIENTS

USED IN FOOD,  
DRUGS, AND COSMETICS

**Third Edition**

**From I. A. Khan**

Dedicated to My Parents  
and  
My Family, Shabana, Farjad, and Sariya  
For Their Love and Support

**From E. A. Abourashed**

To Abir and Our Two Daughters Ayat and Nada  
For Their Love, Patience, and Support  
And ... to My Parents

# Foreword to the First Edition

The publication of *Encyclopedia of Common Natural Ingredients Used in Food, Drugs, and Cosmetics* is a welcome addition to the libraries of those of us interested in natural products. The reasons for publishing this unique encyclopedia are aptly dealt with by the author in the Preface, and the principal audience has been identified as practicing technologists in the food, drug, and cosmetic industries and their purchasing agents and marketers. But, as well, it should prove to be an important reference for teaching and research in economic botany, food technology, natural products chemistry, and pharmacognosy, for it brings together information about a variety of substances that, for various reasons, are not included in recent compendia dealing with one or another of these disciplines. Yet, as the author points out, these are materials that find significant usage in our society.

Dr. Albert Y. Leung's education as a pharmacist and pharmacognosist, coupled with his extensive experience in natural products industries, provide him with a unique background that accounts for his successful synthesis of this information into a practical compendium. The material is accurately and succinctly presented, the individual monographs are selectively supplemented with a current bibliography that allows for further reading on a particular product, and the selection of products included has been skillful.

Dr. Leung is to be commended for his efforts in bringing us this most worthy publication.

ARA G. PAUL, PH.D.

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and Dean  
College of Pharmacy  
The University of Michigan  
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# Foreword to the First Edition

By some peculiar irony, the rapid technological advances made by the chemical industry since World War II have worked to obscure the solid basic knowledge the industry once had of some of its natural building blocks, the botanicals that were (and still are) the prime ingredients in so many drugs, cosmetics, flavors, industrial reodorants, and so on. The recently trained chemist, pharmacologist, or food flavorist (or, for that matter, the person involved in sales, marketing, or purchasing of these materials) in all likelihood has missed the fact that these materials have considerable historical significance, that they still have application in so diverse a list of products, and even what specific role they play in familiar products. After all, these older, possibly no-longer-glamorous natural substances may seem unsophisticated and awkward to handle to those trained in the glories of what might be called synthetic chemistry—the molecular juggling of carbons, hydrocarbons, acids, and alcohols to evolve pristine crystals and powders.

Many of the veteran bench chemists with experience in natural materials have retired or passed on to their ultimate reward (hopefully, a golf cart or a fishing boat in some warmer clime), so the time is coming when there will be less use of such fascinating ingredients as bloodroot, horehound, or ylang ylang oil. The veteran chemists used these materials to make cough remedies or perfume oils before there were synthetics, and when they are gone, the individual little pockets of knowledge have been in danger of dying out. They appreciated that these unique materials provide special product attributes, in the same way that classic spices do for a good chef. Then too, much of the chemical and biological

information has been buried in foreign scientific literature, thus making it unavailable to the average technologist.

Dr. A. Y. Leung has been observing this widening information gap for several years, perceiving that one logical way to bridge it was to put together a compendium of materials of natural origin. He has gone about the task with logic and a sense of order, selecting the cardinal facts without deluging the reader or peruser of the book with a veritable mountain of biological data. As befits the only reference book that covers food, drug, and cosmetic aspects of common natural ingredients, Dr. Leung has identified each entry according to biological name, its alternative or slang description, a general description of the plant from which it is derived, chemical composition, pharmacological or biological activity, and uses and commercial preparations. And for those needing more information, he has included a comprehensive list of references.

Such handy organization of material makes this book especially useful to the working chemist or technologist, to the purchasing director, and to the person in sales or product development or marketing, for in one fell swoop he or she is given clear, comprehensive information with no unnecessary embellishment. Exotica become less exotic, the strange becomes more familiar.

Because of the ongoing work of the *Cosmetic Ingredient Review* and the Research Institute for Fragrance Materials, it is a safe bet that in the not-so-distant future there will be a demand for a second edition of this monumental work. These efforts will produce much information about the toxicity or safety

of these materials, information that will give better clues as to whether it may be opportune or diplomatic or safe from a regulatory standpoint to persist in using a material that may be allergenic or sensitizing. Also, Dr. Leung has tried to emphasize the quality of commercial preparations, with an eye toward the purchasers and end users who will ultimately find the volume so useful.

Anyone with a sense of romance will cherish the names of these materials, and anyone with an appreciation for order and thorough documentation will regard this book as useful and to the point.

DONALD A. DAVIS, EDITOR  
*Drug and Cosmetic Industry*  
New York



# Preface to the Third Edition

Ten years after the publication of the second edition, we accepted the invitation to complete the third edition of this encyclopedia. As it turned out, it was a massive task that took more than three years to accomplish even though many of the initially planned new ingredients were eventually left behind. The reader may notice that the included ingredients are almost the same as those of the second edition (ca. 300 main entries and about the same number of related species and varieties) and that the new ones are included under a new section entitled “**Indian Traditional Medicine—Ayurveda.**” Nevertheless, the total number of pages of this edition has increased by at least 50% from the previous one. The reason for this is the fact that since the inception of the Dietary Supplement Health and Education Act of 1994 (DSHEA), interest in dietary supplement/herbal medicine research has witnessed an unprecedented revival resulting in an exponential increase in scientific/industrial journals on herbals and alternative medicine and reports published therein over the past decade, not only in the United States but all over the world as well. Faced with such a massive body of data, we had to make a decision to focus our efforts on updating the literature related to the currently included ingredients rather than diverting our attention to the inclusion of new entities. Pursuing this strategy, we ended up searching Medline as our main online source, reviewing thousands of published reports for quality and content, and summarizing the findings of those

satisfying our evaluation criteria. This resulted in the inclusion of more than 6500 references in the current edition. A number of the most prominent textbooks published in the field during the same period have also been added to the *general references*. Of these, two textbooks focusing on clinical trials with herbal products (BARRETT; BLUMENTHAL) and a translated atlas of phytopharmaceuticals (WICHTL) are worth mentioning.

The general format of the previous edition has been generally maintained (Source, Description, Chemical Composition, Pharmacology, Uses, Commercial Preparations, Regulatory Status, and References) with minor updated headings for “**Toxicology**” and “**Dietary Supplements/Health Foods**” to reflect the latest trends and regulations. The reader should refer to prefaces to the first and second editions for a thorough description of each heading. The newly added section includes a background on Indian traditional medicine and lists information on nine commonly used herbal ingredients.

The *general references* and *glossary* have been updated and moved to the end of the book and assigned as Appendices A and B, respectively. Two new appendices (Appendices C and D), explaining and illustrating the botanical terminology frequently encountered in the text, have also been added.

It is our hope that this new edition will provide updated information on classical herbs and/or their common ingredients included in

the previous edition. Such information should continue to be useful to readers with various backgrounds who share an interest in natural product applications in medicine, nutrition, and cosmetics and who are looking for a comprehensive compilation of the recent liter-

ature summarizing the most prominent findings in this field.

IKHLAS A. KHAN AND EHAB A. ABOURASHED

*Oxford, Mississippi*

*March 2009*

# Preface to the Second Edition

Fifteen years have passed since the publication of the first edition. During this period, basic information on most of the traditional ingredients in the encyclopedia has remained essentially the same. However, usages and use trends of many of these ingredients have changed. A whole new field of food/drug products, loosely categorized as “health foods,” has established itself in North America; so has the use of herbal teas. Although a few conventional food and drug companies have tried to capitalize on the market generated by these new fields, most members of the medical, pharmaceutical, and food establishments have so far chosen to ignore them. However, these rapidly expanding fields of health foods and herbal teas have made it very difficult for one to ignore. For this reason, up-to-date and accurate information on their ingredients should be made readily available, not only to provide useful data for technologists and consumers interested in these ingredients, but also to counterbalance the proliferation of promotional literature from marketers that is often grossly inaccurate and misleading, as well as negative information from opposing interest groups that is based on bias and self-interest and not on relevant traditional and scientific data available. Consequently, I have included information to support the “new” uses in this edition. As Chinese herbs constitute a majority of all natural products used in the world, which have increasingly found their way into American cosmetic, health food, and herbal tea products in recent years, new ingredients described in this second edition reflect this trend.

Due to other commitments that limited my availability for this revision, I enlisted the capable assistance of Steven Foster who has earned a reputation for his writings. He has been instrumental in updating much of the information in the original entries of the encyclopedia as well as introducing most of the new non-Chinese ingredients in this revision.

Concomitant with the development of health foods and herbal teas, many books on natural products have appeared since the first edition was published. Some of these books contain well-researched information, while others are simply indiscriminate compilations of data, which only help to perpetuate the confusion relating to information in the herbal products field. In order to help minimize the spread of dubious data, books containing excessive outdated, secondary, and/or misleading data, as well as those consisting primarily of indiscriminate compilations of data, including some English titles on Chinese medicinal plants (even though aggressively marketed), are not included in the *general references*.

An unusual, but positive, alliance emerged during the past decade. Numerous scientists and practitioners from traditional fields (pharmacognosy, pharmacology, chemistry, medicine, botany, etc.) have joined forces with herbalists and manufacturers and developers of health foods and herbal teas to promote research and information dissemination in the field of medicinal plants and herbal products. Thus, the Herb Research Foundation, established in 1983 with an advisory board of respected scientists in various fields, has been engaged in promoting research in the various aspects of herbs. Along with the more recently

founded American Botanical Council (1988), it publishes *HerbalGram*, a quarterly journal that provides accurate information on many commonly used natural products. In this new edition, we have selected as **general references** some of the books that we find useful and that we believe had an impact in the industry in recent years. Also, the extensive use of information from the Chinese literature in this new edition reflects the greatly increased availability of data on natural products from China during the past decade. As there is no standard translation of Chinese pharmaceutical and biomedical titles, I have used the transliterated titles of such references whenever there is a possibility of confusion. The *pin-yin* system of transliteration has been selected over the Wade-Giles system because the former is now standard in Chinese literature originating in the People's Republic of China, which is by far the more abundant than that originating elsewhere.

Along with the greatly increased availability of information and books on natural products, I have observed a tendency in both the professional and lay press in the overly simplified interpretation of this information. It is tempting to assign the biological activity of a compound present in a natural product to the product itself prematurely, irrespective of the amount present. For example, taking this approach, the common spice, ginger, could easily be turned into a panacea as it contains dozens of active compounds, each of which by itself has been shown to have various biological activities. These activities include antimicrobial (essential oil components such as linalool, geraniol, chavicol, 1,8-cineole, etc.); narcotic (cumene); spasmolytic (borneol, myrcene); analgesic (borneol, gingerols, shogaols); diuretic (asparagine); antihistaminic (cital); lipotropic (lecithins); anti-inflammatory ( $\alpha$ -curcumene, borneol); sedative (gingerols, shogaols); hypotensive (1,8-cineole, gingerols); hypertensive (shogaols); liver protectant (borneol); cardiostonic (gingerols); antipyretic (borneol, gingerols, shogaols); insect repellent (*p*-cymene, geraniol, myrcene); antibronchitic, antitussive, and expectorant (1,8-cineole);

nutrient (vitamins, minerals, amino acids); and others.<sup>1</sup> Under certain conditions or in specific dosage forms, ginger could indeed exert some of these effects. But to say that the spice ginger is narcotic or hypotensive is an oversimplification in interpretation.

This brings up one of the major challenges in natural products research, especially in Chinese herbs, which is to make sense out of their myriad of traditional uses. Some of the answers seem to lie in the complex chemical nature of these products. The bioavailability of these chemicals in a herbal formula or in an ingested herb is most likely very selective and dependent upon the physiological state of the individual consumer. This may be one of the major reasons why ginseng and other tonics have been used for so many centuries in China for so many different conditions, and yet despite extensive research over the past 30 years, generating thousands of research publications, ginseng has still not been "proven effective" by modern science. In our current state of specialization and advanced instrumentation and analytical and biological technology, it is very easy for a chemist to discover new chemicals or find known active chemicals in trace amounts in any plant material or for a pharmacologist to test the pharmacological activities of chemicals that are isolated only in traces from plant drugs, which would invariably result in publications that in turn would boost the political and financial status of the researchers involved. There is nothing wrong about such research. However, the challenge is to refrain from over-interpreting the results that are often blown out of context by proponents or opponents of the herbal drug as "preliminary evidence" to promote or restrict use of this particular herb.

There is also a general tendency to consider biomedical publications from Chinese sources as of inferior quality, which consequently should not be taken seriously. However, in my opinion, the most common flaw in publications on natural products, a good amount from "advanced" countries, is the failure of the investigators to identify correctly and quality control the material they are studying.

This leads to results that cannot be duplicated and contributes further to the overflow of misinformation or useless information in this field.

While use of natural ingredients in processed foods and cosmetics was at its peak when the first edition was published, use of these ingredients in drugs was on the decline. Now, the trend is reversed. More and more natural ingredients are being used in “herbal formulations” for the prevention and often the treatment of illnesses, most of which are related to side effects of our modern lifestyle or are common diseases that normally will resolve themselves with adjustment of lifestyle and without drug treatment. The former include obesity, hyperlipemia, and stress-related conditions, while the latter include some digestive problems, minor aches and pains, and the common cold and its related symptoms. Based on traditional consumption patterns and use history, many of these formulations contain ingredients that can truly be considered as food ingredients while others fall under the category of drugs, and still others can be considered as either food or drug, depending on usage. Most of the original entries in the first edition serve as ingredients in both foods and drugs in conventional usage, that is, processed foods and over-the-counter (OTC) drugs. In the second edition, I have added over 70 new entries and included a new category of usage called “**Health Food/Herb Teas.**” All food and drug uses of commercial products that do not fall under conventional processed foods or cosmetic or OTC drug categories are grouped under “**Health Food/Herb Teas.**” In this section, we simply report on perceived uses of individual ingredients in the health food/herb tea category. This information is not intended to confirm efficacy or safety for a given indication. Rather, it is meant only to indicate for what purposes consumers may be using these products.

The debate whether health foods or herbal teas should be classified legally as genuine foods/teas or as drugs still goes on. While health food and herbal tea companies consider their products as composed of food

ingredients, the medical and pharmaceutical industries generally view them or prefer to classify them as drugs requiring strict federal control. Although these opposing views are obviously dictated by economic and political considerations, the truth, in reality, lies somewhere in between. I expect this ongoing debate to continue for a long time. In the meantime, the new “**Health Food/Herb Teas**” category should be adequate in covering reported uses in these areas. However, the information reported here should in no way be construed to be an endorsement of the reported usages.

Also, the “**Folk Medicine**” category has been changed to “**Traditional Medicine**” to accommodate Chinese traditional medical usages of the new Chinese drug and cosmetic entries, as well as to recognize the role that traditional medicine now plays in primary health care delivery, particularly in developing countries. Since 1978, the World Health Organization (WHO) and dozens of collaborating institutions worldwide have sought to assess the value and extent of the use of plants in health care systems. WHO has estimated that as much as 80% of the world’s population rely chiefly on traditional medical systems, primarily in the form of plants, plant extracts, and active principles. Observing traditional, historic, folkloric, or ethnobotanical uses of plants is regarded as a useful approach for targeting research leads in the development of new drugs from plants. A recent survey of medicinal plants used in therapy worldwide found that 119 distinct chemical substances derived from 91 species are used as drugs in one or more countries. Of these plant-derived substances, 74% were discovered following chemical studies to determine the active compounds responsible for the use of the plant in traditional medicine.<sup>2</sup> While many traditional uses may not be validated as safe or efficacious by current scientific methodology, they can provide valuable leads for new or expanded utilization in the future.

Under “regulatory status,” information has been included on German regulatory monographs. German health authorities have

established a separate expert commission (“Commission E”) to develop standardized therapeutic monographs on herbal medicines. It has produced nearly 300 “Therapeutic Monographs on Medicinal Products for Human Use.” Each monograph, published in the German Federal Gazette (*Bundesanzeiger*), includes details on the name of the drug, constituents, indications (including those for the crude drug or preparations), contraindications (if any), side effects (if known), interactions with other drugs or agents (if known), details on dosage of the crude drug or preparations, the method of administration, and the general properties or therapeutic value of the herb or herb product. The German monograph system is considered to be the best governmental information source on medicinal plant usage produced by a Western industrialized nation.<sup>3</sup> It also serves as the model for the development of a European phytomedicine monograph system produced by the European Scientific Cooperative on Phytotherapy (ESCOP) for use by European Union member countries.

Since the publication of the first edition, use of natural ingredients in cosmetics had been slowly declining until more recently, when a new surge of interest in Chinese cosmetic ingredients prompted the introduction of a number of Chinese natural products into American cosmetics. Although used for centuries in China, these ingredients are new to most American cosmetic formulators. Some of these new ingredients can be found among the more than 24 main entries that I have included in this revision. Others (more than 22) can be found under the new section titled “**Chinese Cosmetic Ingredients.**” This section describes in brief some of the more commonly used natural ingredients in Asia, which may now be found in new cosmetic products on the domestic market.

Despite renewed talks in the herbal/botanical industry to standardize quality and to assure purity of herbal ingredients, trade practices in this industry have not changed significantly during the past decade. And irrespective of claims by individual suppliers, manufac-

turers, and associated trade groups on quality, no *meaningful* assay standards or quality assurance methods have been introduced to guarantee purity and quality of many natural ingredients. Thus, for example, the most commonly used ingredients, such as aloe vera and ginseng, still lack meaningful assay standards and are frequently adulterated. The practice of this intentional adulteration is implicitly encouraged by manufacturers who purchase only low priced ingredients and who will simply accept dubious “certificates of purity” from suppliers as the sole proof of quality and by the common practice of employing “label claims” in the cosmetic industry. Only a very small number of companies have their own programs to standardize and control the identity and purity of the herbal ingredients used in their products. In addition, due to ignorance, even some well-known herbs, especially in their powdered forms, are misidentified, yet distributed as genuine in the industry. These include echinacea, eleuthero, ginseng, and numerous Chinese herbs such as fo-ti. Thus, it is obvious that much remains to be done in assuring the identity and quality of natural ingredients in the health foods/herb teas field.

This adulteration/misidentification has caused a major problem in the research on commercial natural products. Due to the failure of researchers to recognize the importance of identifying the correct source of test materials, results of studies on unidentifiable commercial herbal products (e.g., “ginseng capsules” or “aloe vera”) are irreproducible and mostly worthless. Because of this problem, one should exercise extreme caution when quoting results of these studies. A well-publicized example is an uncontrolled study on ginseng (?) resulting in the so-called “ginseng abuse syndrome,” which was published in a reputable journal.<sup>4</sup> This study has been repeatedly quoted worldwide for the past 16 years both in scientific journals and in the lay press. None of the people who quoted this study seemed to have read the original publication, noticed, realized, or cared that the results of that study were based on uncontrolled test materials



that included not only Asian ginseng (identity and purity doubtful), but also American ginseng (?), Siberian ginseng (?), desert ginseng (canai-gre) (?), caffeinated drinks, other drugs the subjects happened to be taking, as well as other unidentified materials (could be anything) in commercial “ginseng” products! Unfortunately, this is not the only incidence of such publications or research by researchers and editors who lack expertise in the natural products area and who otherwise are eminent in their own fields. If such papers were submitted to journals of natural products such as the *HerbalGram*, *Planta Medica*, and *Journal of Natural Products*, they would be rejected outright. This clearly demonstrates the need for experts of other disciplines to be aware of the intricacies of natural products when investigating, reporting, and evaluating these products.

Another important point to remember when studying natural products is that it is sometimes not enough just to identify correctly the botanical source of the natural product to be studied, especially where Chinese herbs are concerned. While in most cases with Western medicinal plants it is sufficient to simply assure their botanical identity, it is not so with Chinese herbal materials. In addition to their correct botanical sources, Chinese herbal materials require further clarification, including plant parts used and whether or not the materials are simply cleaned and dried or are specially treated with other herbs and/or boiled in water or wine. Thus, simply identifying an herbal drug as *Ephedra sinica* Stapf can mean one of the at least two different drugs with distinctly different medicinal properties: *mahuang* (stem) is diaphoretic, among other properties, while *mahuanggen* (root) is antiperspirant. Another example is *Polygonum multiflorum* Thunb., from which at least three different herbal products are derived, each with distinct medicinal characteristics: stem, raw root tuber (*heshouwu*), and cured root tuber (*zhiheshouwu*). It is obvious the Western term for it, fo-ti, is meaningless. A voucher specimen of *Polygonum multiflorum* to go with fo-ti would further add to the

confusion and would not determine whether the fo-ti shipment in question is the laxative (raw root) or the tonic (cured root).

A recent trend in the herbal industry is to market the so-called standardized extracts, such as ginseng extract standardized to “ginsenosides” content or Siberian ginseng extract to “eleutherosides” content. However, as there is normally more than one (or one type of) active component in a natural product, standardization based on one particular type of chemical component is not representative of the total activity of the product. Consequently, these arbitrarily selected components can only be useful as a “marker” of product quality. And these “markers” are only valid for extracts that are total extractions of the herbs concerned. Extraction processes designed to extract these “markers” selectively would produce extracts that are not representative of the original herbs. Thus, a “standardized” ginseng or Siberian ginseng extract may be devoid of polysaccharides that are also biologically active. Also, the ginsenosides in a ginseng extract may not be from ginseng itself but rather from another much cheaper, non-ginseng source (see *ginseng*). To be fair to both traditional and modern science, one should not be overzealous in trying to equate a chemical constituent to a traditional herbal drug.

As more and more biological and toxicological research is performed on commercial natural products, it is increasingly apparent that scientific evaluation of individual purified components from these natural products has rarely produced results that are consistent with the property of the products *in toto*. Consequently, one should not be prematurely alarmed if one of numerous components in a long-used natural product is shown to have toxic effects in the laboratory, unless further research on the product in its complete form produces the same effects. Conversely, one should not be overoptimistic in claiming a particular herb or natural product as “cure” for a certain disease after studies have indicated that one of its numerous chemical components exhibits a positive effect on the disease. This is especially true if this component

is present only in minute quantities whose effect may be overshadowed by those of other compounds present, thus making the herb (in its original form) inactive as a cure for the disease. Oleanolic acid is a typical example. It is widely distributed in nature. A recent double-blind study involving 152 cancer patients demonstrated it to have immunomodulating effects (enhanced phagocytosis, E-rosette formation, and delayed hypersensitivity), improving the general condition in two-thirds of the patients. Preliminary studies have also indicated it to be effective against hepatitis and HIV.<sup>5</sup> However, all this does not mean eating cloves and olives, both containing oleanolic acid, will necessarily produce such an effect.

We are currently being literally choked by an overabundance of data on natural products, much of which either has not been evaluated or is of dubious value. In this second edition, as in the first edition, every effort has been made to evaluate all original publications available to assure that the research methods and findings are of decent quality. And I have paid particular attention to the identity and quality control of the test materials. Papers reporting on results of studies based on unidentified or unidentifiable test materials are not cited under the respective entries (e.g., the so-called "ginseng abuse syndrome" not cited under ginseng) for the same reason that results of research on an unidentified "yellow powder"

as due to riboflavin or curcumin would not be reported in a medical or pharmaceutical journal.

Appearing in the English literature mostly for the first time, the information on the new Chinese natural products in this second edition has been gathered from dozens of major Chinese classical and modern works and from over 50 Chinese journals on traditional and herbal medicine. I have tried my best to present a balanced view of the traditional and modern aspects of Chinese herb use. The new ingredients selected for this new edition generally reflect the trend in current commercial use of natural products in America. I hope this new edition will provide the readers with an accurate update on the original entries of the first edition as well as an overview of the huge resources in Chinese herbal ingredients.

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ALBERT Y. LEUNG

*Glen Rock, New Jersey  
July 1995*



# Preface to the First Edition

About 500 natural ingredients are currently used in commercial food, drug, and cosmetic products. These do not include antibiotics, vitamins, and many other natural substances that constitute prescription drugs nor medicinal herbs that are not readily available in commerce. Some of these ingredients are pure chemicals isolated from natural sources while others are extracts of botanicals. Our daily food, drug, and cosmetic items often contain these ingredients. Many of the substances used in foods are also used in drugs and cosmetics, where higher concentrations are involved.

Three major reasons have prompted me to compile this encyclopedia. First, no reference books are presently available that specifically and simultaneously deal with commonly used natural ingredients in processed foods, over-the-counter drugs, and cosmetics. Since many natural flavor ingredients and food additives are also drug and cosmetic ingredients when used in higher concentrations, there has been an acute need for a compact reference book that provides condensed and accurate information on these substances, saving the reader much time and effort that otherwise would have to be spent in consulting various handbooks and journals.

Second, most of the currently available technical reference books in the English language on food, drug, or cosmetic ingredients contain limited and out-of-date information regarding naturally derived substances. Many formerly official botanical drugs that are no longer official in the United States Pharmacopoeia (U.S.P. XIX) or the National Formulary (N.F. XIV) are still widely used in nonprescription pharmaceutical preparations and in food products. Yet they are largely neglected

or ignored by editors or authors of readily available handbooks. Presumably, when a botanical drug is deleted from a currently official compendium, there should no longer be any interest in it. Formerly official drugs such as arnica, chamomile, rhubarb, valerian, white pine, and witch hazel are still widely used today in foods, drugs, and cosmetics; so are many plants that have never been admitted as official drugs, examples of which are alfalfa herb, annatto seed, chicory root, fenugreek seed, ginseng root, and rose hips. There is still ongoing, active research on many of these natural products, particularly outside the United States. Since these botanicals are very much a part of our culture and daily life, information on them should be readily available. This encyclopedia is intended to furnish correct, up-to-date information on these materials.

Third, there is a general information gap regarding natural products between technologists of the botanical industry and those of the food, drug, and cosmetic industries, between members of the academic and research communities and those in industry, as well as between the consumer and the industry concerned. Information readily available to one group is often not available to the others. One of the objectives of this book is to try to bridge this gap by supplying information that would make different groups more aware of the practices and happenings outside of their own circle regarding the use of natural ingredients.

In this encyclopedia, each natural product is presented in alphabetical order according to its most common name, with each natural ingredient being cross-referenced with its