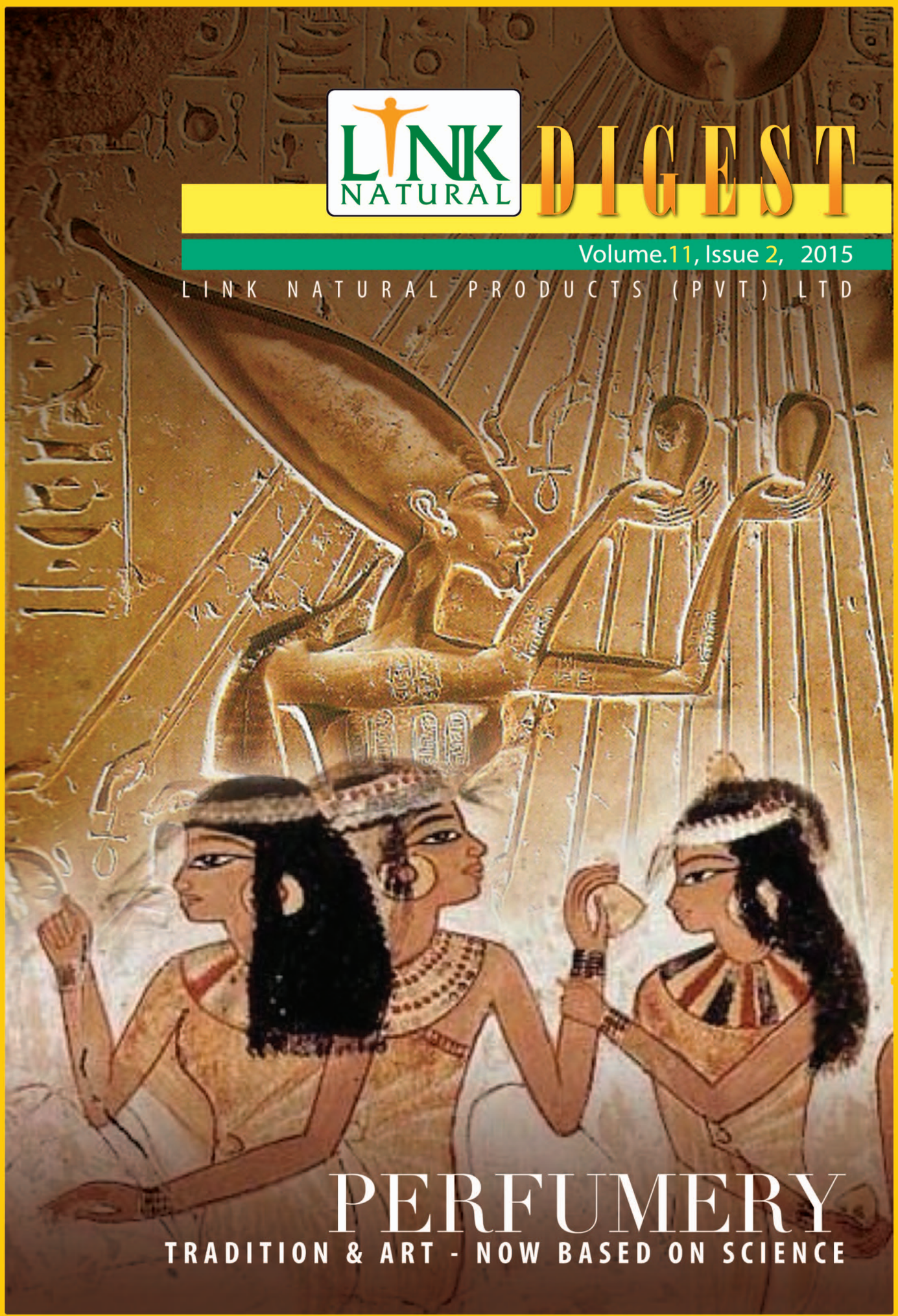

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PERFUMERY

TRADITION & ART - NOW BASED ON SCIENCE

LINK NATURAL DIGEST

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IN THE PAGES THAT FOLLOW.....

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EDITORIAL

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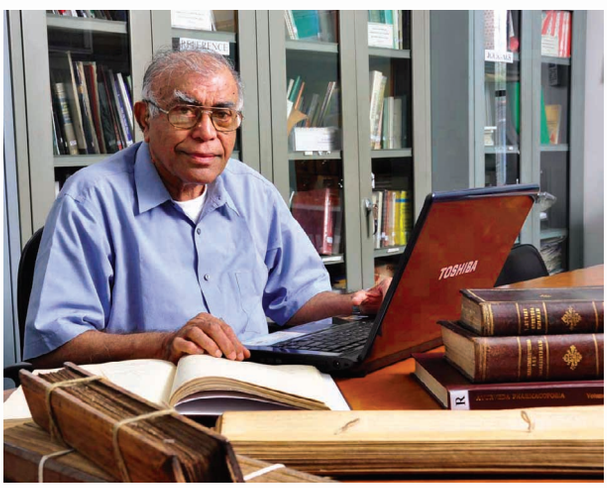

The global market has been for a long time now the driving force of the Fragrance & Flavour Industry as well as the Pharmaceutical Industry. The two industries are both billion dollar industries globally and are likely to be ascendant for the years to come. Both these industries which cater to the Wellness and Health of the global population see yet more opportunities in the ever changing macro-economic scenario. In the years just gone by the emerging new markets were identified as the growth engine of the industries. Presently a change in scenario is seen. The Asia-Pacific region and especially the huge market in China is challenged and maybe by an indigenous development and capability as well. On the other side the market of Eastern Europe has been negatively impacted by conflicts, and other difficult and obstructive conditions. However a new and welcome feature is developing in both these industries. This takes the form of collaborative efforts in developing features that strengthen the very base of these industries, and here one is speaking of the industries as they are dependent on the natural raw material base. Several large companies have taken the initiative of jointly strengthening the natural resource base and the supply chain and its vitality. Such initiatives have the multiple advantage of enhancing for the long term of the supply system, its maintenance, and benefitting the peoples who look after and derive benefits from a virile supply system, fortified with the latest in technological progress. We have known of the efforts to sustain the supply of such crops as Vanilla in Madagascar, Benzoin in Laos, Ylang ylang in Comoros, Vetiver from Haiti, Tonka bean from Venezuela, and even Sandalwood from Australia. And these not only enhance, and sustain the commodity and the industrial base, but also enrich the living standards of the people who sustain the base. It is a commendable initiative in global trade. These strategies have a long term dimension. This is referred to the now as: "Sustainable sourcing". The movement is commendable on the grounds that it is value sharing among those who exploit the natural resource both from the market standpoint and from the standpoint of their daily life. It must perforce benefit the two categories with the ensurement of sustenance of the resource and its further enhancement, as well as the sharing of the benefits.

R O B Wijesekera

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PERFUMERY – TRADITIONS & ART- NOW BASED ON SCIENCE

By R.O.B.Wijesekera

Introduction

Perfumery today is mostly an art. The perfumer uses a range of chemicals all or most of them with distinct and striking odours and uses them in combination to evolve a "fragrance" which is more attractive in odour than the individual chemicals used. It is a form of artistic expression characteristic of the style and preference, not to mention the skill of the perfumer.

Descriptions of this art form invokes terms that are characteristic of music such as, "notes" and " chords", but it is not a spectrum of frequencies of sound that we are dealing with here but a series of individual chemicals- mostly volatile molecules. A well designed fragrance is sometimes referred to as a perfumery accord; and it represents a blend of individual fragrant materials with common facets so that the overall result is one where there is a consonant single odour that is not characteristic or related to any of the constituent individual components of the blend. In a characteristic fragrance the individual components may be of natural origin or synthetically made. The art of the fragrance designer sees to it that in the final fragrance there is with time the emergence of a sequential perception of odours, first what is called the "top note' and then the "heart' of the fragrance, and finally the base note which persists long after the other notes have disappeared.

Role of the Chemist

The perfumer's skill sees to it what variations could be made with the range of chemicals that are available and it is the role of the chemist to provide an ever more increased range of them. That is the creative scientific role, for the synthetic or natural products chemist.

Another analogy that is frequently used is that of a painter using a range of colours to paint a painting. There is a similar situation where the scientist is the provider of the range of

colours and the painter the artist who creates the pictures. Here too the scientist is the provider of the range of chemicals and the perfumer constitutes them into a fragrance analogous to the painting.

Many great chemists have been associated in the history of perfumery in delivering and formulating the variety of chemicals into perfumes that have created history. Some of the great names include the following:

CHEMIST	ASSOCIATED FRAGRANCE COMPANY
Leopold Ruzicka	Firmenich
Ernst Geunther	Fritsche Dodge & Olcott
Paul – Jose Tesseire	Roure Bertrand Dupont
Gunther Ohloff	Firmenich
Ernst Theimer	IFF
Yves Rene Naves	Givaudan
Roman Kaiser	Givaudan

Perfumery and the creative challenge.

The naturally occurring volatile ingredients of plants were historically the earliest used constituents as perfumery agents. These volatile ingredients are found in almost every site in natural plant materials. They are in flowers as in roses, jasmines, lavender and ylang ylang, in roots as in vetiver, in woods as in sandalwood, in leaves as in citronella and geranium, in barks as in cinnamon, and in several plant exudates. They are obtained from the raw source in several ways such as the traditional method of enfluerage, the commonest being steam distillation, as well as extraction with organic solvents and in modern times, supercritical solvents.

Perfumery production in old times

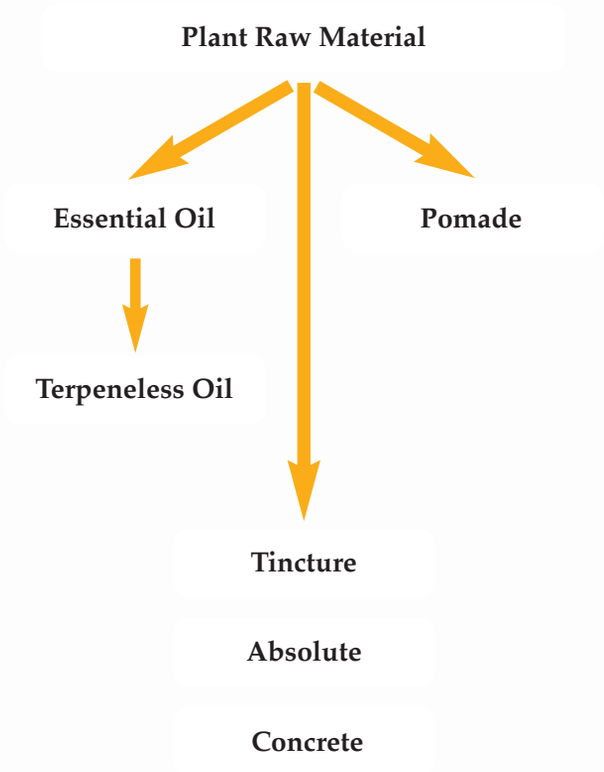
Lavender in the field a popular natural

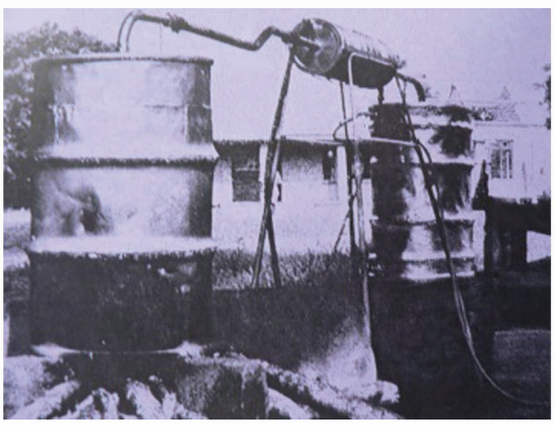
In the creation of perfumes it is logical to believe that the perfumer draws from his experience as that they are associated with some reminiscent odour characteristic. The odour of the fragrant blossoms one has encountered like the smell of jasmines, or the compelling smell of sandalwood, the odour of a fresh rainfall on dry parched earth, or the wind sweeping over a field of mana grass, or a field of lavender, these smells experienced early in life, and common though they may be, would certainly have left landmarks in the template of one's memory. A perfumer creates fragrances with different odour haracteristics but instinctively draws on his record of experience. The Chanel perfumes were created in the late nineteen twenties and there are those who attribute their characteristic jasmine and leather notes to the predominant smells at the time in the region of Grasse in France.

One perfumer, Christophe Laudamiel, has put it this way.: *"Scents are very much linked to memory. They are linked to remembering the past, but also learning from experience."*

Smells can be characteristic of a place and even that of an age. Some smells may even reveal a cultural story. Science and technology today can make deep insights into fragrances, making it possible to understand the fragrances in a living rain forest and the differences even in the rain forest canopy and the ground. The science enables us to study olfactory specimens of buried Egyptian mummies from ancient tombs, giving a new dimension to our understanding of the world of the past.

PERFUMERY PRODUCTS FROM AROMATIC PLANT RAW MATERIALS





Primitive still

Modern portable still

Modern factory

The fragrance within the plants can generally be extracted using the methods of yore namely extraction into oils and fats (enfluerage), and steam distillation.

The principle of steam distillation is quite simple. The passage of steam through the plant material causes the breakup of the cells that contain the oil and the released oil volatilises in the steam and distils over with the condensing vapour, which is collected in a receiver vessel. On cooling the oil separates from the aqueous medium as a separate layer.

There are many variations of the method of steam distillation ranging from the very primitive to the most sophisticated. (Vide Link Digest, Vol. 5, pages 24 -33) (Vide figures 1.-4.). Enfluerage is an even older method used originally to extract the essences from flower petals. Here the flower petals are laid upon layers of wax and after some time the wax is extracted with solvents which are volatile and could be

easily evaporated. This method had a large scale usage in old times until steam distillation and direct solvent extraction replaced it.

Why synthetic ingredients?

With an array of essential oils available, the question arises as to why synthetic chemicals ever came to be used in the fragrance industry. Essential oils by themselves do not form the unit "notes" that enable a perfumer to design a perfume; the notes that are generated by fractionating the essential oils into a variety of individual constituents also do not give rise to an even greater number of individual chemicals. More variety will generate a wider spectrum of options. So, synthetic materials have expanded the repertoire of the perfumer so that in the modern context synthetic fragrance ingredients have become the mainstay of the industry. The reasons are clearly these.:

- Products with superior performance in use can be formulated.
- Economic factors are more advantageous.
- Securities of supplies are better ensured.
- Safety factors and Regulatory requirements are easier served
- Product consistency is easier attained and maintained.

Essential oils and derived products from them are perhaps still the best for the fine fragrances. However the fragrance industry today thrives on a number of consumer products and the synthetic ingredients in use and these are generally more stable to the relatively varied mediums into which they are formulated. The perfumes have to maintain their potency under harsher conditions. Many of the components derived from essential oils are delicate from the stability point of view and do not survive in many consumer goods. Many essential oils contain esters of acetate and tend to undergo hydrolysis in the strong alkaline mediums of, for example, laundry soaps and detergents. So when the acetate group is synthetically replaced with a methyl group one generally gets a more stable product with similar fragrance characteristics, and more stable than the natural ester. Also such a synthetic modification can give a cheaper product as well. Other factors include compatibility with the consumer product into which the fragrance is incorporated. Fragrances are today an important ingredient in a large variety of household products, pesticide sprays, toilet materials, disinfectants, and many other commonly used consumer materials. The Fragrance industry depends as much or more on these commonly employed fragrances as it does on the highly prized perfumery scents. So the perfumer has to create scents that are attractive to the consumer and this is the selling criterion of the product. For example a household spray that smells like morning freshness will be a valuable asset to the fragrance company that makes the product and that is the challenge before the perfumer.

The Legacy of Kannauj -
Attars & the Deg-Bhapka system.

The ancient attars place the perfumery industry in a historical perspective. Attars are characteristic concentrates of flower and sandalwood perfumery derivatives used in historic times by Arabian peoples.

Traditional attar families were believed to have held the secrets of production of attars within themselves. Its intricacies apart it is quite simply a pure distillate extract of flowers in the distilled oil of sandalwood. During the process of distillation the fragrance of the flowers, for example rose, seems to merge with that of the sandalwood to form something quite different.

The Vallley of Taif, in Saudi Arabia near Jeddah is noted for its rose attar and rose water. Rose buds are traditionally picked before sunrise.. The distillation was done in copper pots after the buds are placed in it and allowed to simmer for some hours, after which the steam distillate was collected. The distillate contained the globules of the attar in the rose water. The separation was made on cooling with a device like a syringe.

Gender was never the criterion that dictated the variety of fragrances that developed into attars. Factors such as the season, the nature of the occasion, what was worn, and such criteria for both men and women dictated the trends. Originally, dignitaries such as kings, queens and Maharajas and even in more recent times Presidents and Prime Ministers used attars as their perfumes which were to give them confidence and feelings of wellbeing. The use by Maharajas, Maharanis, Nawabs, and oriental women of note, shifted the centre of their processing to the region of Kannauj, in India, where it eventually was to become a series of family businesses, maintaining the traditional methods and practises.

Kannauj a small town in Uttar Pradesh is now regarded as a historic Centre of the Perfumery Industry like Grasse in France, and Millitzer, near Dresden in Germany. Located near the confluence of the Ganges and Kali river, Kannauj is believed to be right on the routes that brought such goods as spices, perfumes, metals, gems and silks from the far east, and through India to the middle east. It reached the zenith of its glory in the 7th century AD, when it was the capital of the Empire led by Harsha Vardam.

The early documented use of attars is found in Abu Fazal's Aain-e-Akbari. Attars are now manufactured in traditional style in the city of Kannauj, in India and the traditions of this ancient centre of perfumery goes back to over five millennia.

The processing is done using a unique system now identified as the "Deg-Bhapka System". This is essentially a water - cum steam distillation system where the Deg or copper still body is heated from below with a furnace of wood fire and cattle dung. The Deg is preloaded with the distilled oil of sandalwood. There is no equivalent to a condenser as in the normal steam distillation and instead there is a long bamboo tube called a "chonga", which leads into the receiver vessel called "Bhapka".The Chonga is wrapped with a thick binding of cotton twine and serves as the condensing unit. The receiver vessel or Bhapka is placed in a cooling water tank called the"Gachchi". The process is monitored by skilled and experienced personnel known as "Dighaas" who are able to maintain the boiling of the liquid in the still at a level that matches the condensation in the receiver vessel. When the desired concentration of distillate is reached, the excess water is drained off from the receiver vessel and the concentrated attar is stored in vessels made from dried hide which are known as "Kuppis".

The kuppis are semi-permeable with respect to water and hence removes the last traces of moisture leaving the attars dry. The attars that are for purposes of perfumery are the floral attars, and they incorporate the fragrances of flowers such as *Rosa damascena, Pandanus odoratissimus, Jasminium sambac,. J. grandiflorum, Lawsonia inermis.* These Indian attars were utilised by the elitist classes of society while attars with the incorporation of spices were used in the processing of masalas for betel chewing.

Noorjehan, the Moghal empress was credited with the popularisation of attars in India. Kannauj now freely regarded as the perfume capital of India is renowned for the fragrant Sandalwood attars, and is an added attraction to the tourist. The discard liquors in the distillation of Sandalwood, for the manufacture of attars is used for bathing. It is well established that the waters with a trace of the sandalwood's constituent molecules has a potent disinfectant effect as well in addition to a persistent and long lasting alluring odour.

Rose petals for distillation

The Deg-Bhapka system

Stills in position for processing Mitti attars

Soils being loaded into the stills

Another innovation is the capture of the essence of nature in the form of for example the essence of new baked earth, known as Mitti attars. After a long hot summer the earth becomes parched and cracked. People pray for the rain and when it finally comes the earth seems to awaken and brings forth an irresistible characteristic aroma. That is the captured fragrance of mitti attar – a fragrance that is said to be of mother earth breathing and coming to life after a long drought. Mitti attar is regarded as a celebration of life and is worn on all occasions blended with the other attars. The selected soil is batched and loaded into the stills and distilled in the traditional manner. The mitti attars are socially popular.

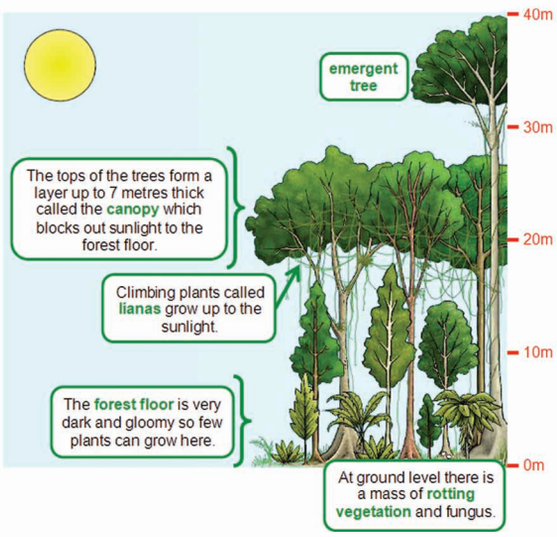
Recent scientific innovations

Smell is a unique among the senses in the manner in which it is processed by the brain. There are many scientific researches on going, as to the manner in which smell is received by the system and its effect on human behaviour. Scientists suggest that the manner in which smells are processed by the brain makes memories of smell strong and persistent. Notwithstanding, this smells are ephemeral being caused by volatile chemicals which themselves are subject to chemical changes.

Roman Kaiser, a Swiss fragrance chemist of the company Givaudan used the technique now known as head space analysis, to determine the chemical composition of the odoriferous space around a flower. This same method is used to determine the odoriferous chemicals that are in a spice for example.

Roman Kaiser

This technique has been used by scientists to trap the fragrance of live blossoms in a rain forest canopy by enclosing them around an airtight container fixed to the site of the blossoms itself and containing an adsorbent material which will trap the odour.



Rain Forest structure

A scientific hide-out in the canopy

Over the past decade Kaiser travelled the Globe to capture the scents of several rare wild flowers and has attempted to reconstitute the fragrances synthetically.

The odour is analysed by Gas Liquid Chromatography coupled with Mass Spectrometry (GC-MS), and the major odour giving chemical entities identified. Kaiser has been able to reconstitute synthetically a notable proportion of the fragrances of rare wild flowers. He outlines this in a recent book "Scent of the Vanishing Flora." His main idea was to display the "olfactory beauty in nature". He says that a plant's scent is an important component of its evolution and ecology. This is the scientific value and the records will ensure that it will be possible to reconstitute the scents long after the plants are extinct.

Preservation of scents

The Perfume industry is now embarking on the preservation of perfumes. An Institution called the "Osmotheque" in Versailles operates a collection of historically important perfumes – a sort of Library kept chilled in aluminium flasks albeit – in their original formulations.

The scents of yore are also being probed scientifically with a view to their reconstruction. This is done using information from many sources. The Osmotheque was recently able to reconstruct what was deemed to be a favourite cologne of Napoleon, when he was a prisoner in the island of Corsica.

The Osmotheque

Re-constituting the odours that have already passed into limbo constitutes another challenge. Historians and perfumers are finding strategies and methods to study these as well. Often as in the case of the Napoleon favourite, it commences with a detailed dossier regarding what is known about the lost fragrance. Using notes made by the valet of Napoleon the Osmotheque was able to construct the cologne specially made for him. Documenting the smells for future historians might reveal the preoccupations and desires of the times that other sensory information may not do, is the belief of James Mc Hugh a Professor of Religion at the University of Southern California. Researching in this area, McHugh found a wealth of olfactory information in the old Sanskrit texts, formulae of incense and

perfumes, instructions for their use as well as descriptions of odours of everyday life. McHugh was interested in turning this information into something substantial and together with perfumer Laudemiel, was able to re-generate a series of perfumes based on this ancient data.

Archaeologists are also embarking on more ambitious projects such as attempting to bring old scents to life. Techniques to analyse organic residues left behind on artefacts, have been used to study diets and cooking methods of ancient cultures. They have also begun the study of old fragrances derived from incense as described in ancient texts and the trend is captivating.

Scientists at the Bonn University Egyptian Museum have been working on analysing with a view to recreate the perfume from the tomb of Hatshepsut based on a residue from a bottle over 3,500 years old. Scientific probes into the past pose exciting prospects for the perfumery industry.

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This is like the Holy Grail of cancer medicine; vitamin D produced a drop in cancer rates greater than that for quitting smoking, or indeed any other countermeasure in existence.

~ Dennis Mangan,
clinical laboratory scientist.

Spring Awakening

In the 50 years since marine biologist Rachel Carson's Silent Spring was published the Environmental Protection Agency was born and the US has tightened its use and regulation of toxic chemicals. The 1962 classic focused on the pesticide DDT's alarming effects on wildlife and its longevity in the food chain Scientists blamed the dramatic decline of bald eagles on their consumption of DDT laden prey, which caused some bird species to produce ultrafragile eggs.

Silent Spring is often cited as the primary reason the EPA banned DDT in 1972. While Carson who died in 1964, urged more cautious use of pesticides, she didn't advocate specific policies says biographer Linda Lear. Environmental historian Thomas Dunlap notes the book prompted research that led to major policy shifts , such as increased oversight of federal projects and a 1972 overhaul of regulations on the sale and use of all pesriceis."She was the catalyst for the modern environmental mo ement'; says Dunlap. And in a sense we are all children of Carson

John Briley in National Geographic September 2012.

MANGOSTEEN – AN ENIGMATIC FRUIT OF ASIA

By Dilmani Warnasuriya and R.O.B.Wijesekera

Introduction

As one drives along the coastal roads, passing the southern town of Kalutara, 30 km south of the capital city, rows and rows of red and purple hued fruits strikingly arranged on makeshift racks and tables lined along the roads, will be a common sight. These fruits are the much valued Mangosteen, also known as the "Kalutara fruit" and is a delicacy relished by fruit lovers throughout Sri Lanka. It is a common seasonal fruit in the district of Kalutara, available during the months from July to September. How the fruit came to be located within the district is a mystery, but it is known since colonial times and the symbolic logo of the Kalutara Urban Council is the Mangosteen fruit. Although Kalutara is the hub of Mangosteen cultivation, the fruit is also grown in areas such as Kegalle, Kandy, Matale, Galle and Gampaha. The fruit is greatly valued for its delicate and juicy sweet and sour flavour, and nary does a traveller pass through the streets of Kalutara without tasting this delicacy and purchasing more for further delectation, in spite of the ever increasing price of the fruit. The fruit is often given the sobriquet of "Queen of Fruits" signifying the value with which it was held. The story goes that Queen Victoria was so enamoured with the fruit she even offered Knighthood to anyone who could bring her fresh supplies.

History of the plant

Mangosteen is a plant native to the Sunda islands and Moluccas in the Indonesian archipelago, but cultivated in Java, Sumatra, Southern Philippines and several areas of Southeast Asia including Western Sri Lanka and Southwest India, (Kerala being the most abundant producer), since ancient times. The early explorers who traversed the South East Asian region did not show much interest in exploiting this fruit, as they had other priorities to contend with such as spices, precious metals, gems, plant and animal pharmaceutical material, which brought more economic benefits. The fact that the fruit was difficult to transport, and the seeds lost their viability fast, were more reasons which failed to attract these explorers. It was after the fruit was introduced to English Greenhouses in 1855, that the cultivation spread to other tropical regions of the Western Hemisphere such as Puerto Rico, Hawaii and the West Indies, and later in the American mainland in Guatemala, Honduras, Panama, and Ecuador. The alleged health giving properties and the scientific facts behind them, have now attracted the Western markets, with the increasing popularity to 'go natural' to enhance their overall wellbeing, and one of the most popular ways to do this is to consume more fruits and vegetables. Many tend to look for exotic and appealing alternatives to the well-established fruits like the banana, citrus fruits, and apples and grapes, and the mangosteen has been found to be a popular choice.

It is interesting to note that Linnaeus included a description of Mangosteen in Species Plantarum as far back as 1753.

Interesting Features of Mangosteen fruit

Mangosteen is botanically identified as *Garcinia mangostana* L. and belongs to the family Clusiaceae. Formerly the family name was Guttiferae. When one talks of *Garcinia mangostana,* it is the purple variety which is referred to, as although there are lesser known mangosteens in the same genus, such as the button mangosteen, they are not widely known. The fruit appears as white or pale green, which gradually deepens to a darker green within two to three months. The exocarp, being the outermost layer of the fruit, expands in size to around 6-8 cm, while remaining hard. The ripening stage begins after the fruit has reached this maximum size, and takes around ten days, during which time the exocarp, changes in colour from green to red to purple. This outer tough rind is about 7-12 mm thick and contains bitter yellow latex that stains clothes black. Each tree bears several deep purple, round shaped fruits capped with light green calyx at the stem end. The inside of the fruit has 5 - 6 juicy, snowy white, soft fleshy triangular segments similar to that seen in citrus fruits, and constitutes the endocarp, or the inner layer of the ovary. One or two of the segments may have off white coloured seeds. The seeds are not edible and are bitter in taste, but the soft flesh is delicious, being sweet, juicy, tangy and fragrant, sharper than a peach or ripe mango, and possessing a compellingly acceptable flavour. The ripe fruit can be split open by pressing within the palms of both hands, and gently opening the encasement into the two sections.

Some traits of the mangosteen plant explain why the fruit is not widely and abundantly found. The seeds are said to be "recalcitrant" which means, that they are short-lived and lose viability quickly when drying.

There are other factors too that are not conducive to swift and easy growth, and so for the first six months of the germination period it is heavily dependent on the inherent nutrients of the seed itself. The seedling goes through what is termed a "juvenile period" for several years, when it needs stringent requirements in levels of water and light. This is a characteristic of many tropical trees when they emerge from the heavily laden forest floor as they reach for the open and towards the forest canopy upwards. However under ideal conditions, such as in well supervised plantations, the tree delivers fruit after about six to seven years. The tree grows from 6 to 25 m (or 20-80 ft) in height. The trees are extremely sensitive to climate and cannot tolerate temperatures below 40 °F or above 100 °F. All attempts at growing mangosteen trees in locations north of 20° latitude have failed. The tree grows in almost all types of soils with good drainage and organic matter.

Health and Nutritive Facts

Much interest is being shown, particularly in the Western countries where Mangosteen is in high demand, to study the nutritive value and health benefits of this fruit. In fact, after some studies it has even been evaluated as a fruit in the superclass category, but whether it merits this encomium is yet to be proven. A superclass fruit is expected to have a striking attractive taste and also high nutrient density, superior antioxidant quality, potential health benefits and no toxic or allergic reactions when consumed regularly.

Unlike other fruits such as pomegranate and citrus branded as Superfruits, , mangosteen does not possess an abundance of micro or macro-nutrient substances as do these fruits. It has good levels of carbohydrates and dietary fibre, but somewhat low levels of vitamins and minerals when compared to other fruits. However, as will be seen in the ensuing pages, it has other compelling properties which may

perhaps warrant the classification of being a superfruit.

Nutritive Values (per 100 g edible portion)	
Energy	60.0 k cal
Protein	0.5 g
Fat	0.1 g
Carbohydrates	14.3 g
Calcium	10.0 mg
Phosphorus	20.0 mg
Iron	0.2 mg

Chemistry and Health

Over the past decade more and more diseases have been shown to be the result of two major causes – inflammation and free radical damage. Free radical damage has the ability to damage and destroy organs, cells and even our DNA. Chronic inflammation, has been linked to numerous illnesses such as Alzheimer's, Parkinson's, allergies, heart disease, and Crohn's. Our immune system in turn, tries its best to keep the many millions of cells in our bodies protected from disease-causing toxins, free radicals, viruses, bacteria, fungi and other harmful agents. Sometimes, however, our immune system gets overwhelmed and the bodies get sick, often due to free radical damage.

To elucidate in more understandable terms, a free radical is an unstable atom with an unpaired electron. When a free radical comes in contact with a stable atom, it steals the electron it needs from the stable atom. This leaves the once stable atom irreparably damaged and susceptible to disease. To counteract the effect of these free radicals, are a group of chemicals known as Antioxidants, which have an extra electron which can be shared. They are thus able to mitigate the damage caused by free radicals, by sharing this electron with free radicals. Because of this ability, they are able to prevent free radicals from attacking healthy atoms or cells.

Where then does the mangosteen come in? Mangosteen has in its arsenal, an abundance of a class of compounds called Xanthones which are powerful antioxidant compounds and immune system boosters. What are these xanthones? Xanthones are a group of phytonutrients that are biologically active having dominant anti-inflammatory properties, and proven to possess a variety of potent medicinal properties. They have been shown to have more potent antioxidant activity than vitamin E, one of nature's most powerful known antioxidants. Several of the mangosteen's xanthones possess additional disease fighting properties active against infectious agents, cholesterol damage, cancer cells and more. Over 200 xanthones have been identified in nature. They are present in unpalatable inedible substrates such as wood, lichens and moss. Of these, 43 of them are in the mangosteen, 3 being in the edible pulp and 40 in the pericarp. It is noteworthy that the highest recorded amount of xanthones in any other substance is 2, which fact perhaps could justify the claim of being a superfruit. These xanthones are largely

6 of the 43 xanthones studied are scientifically proven to be effective in over 132 conditions, some of these are:

- **Anti-viral**
- **Anti-tumor**
- **Anti-bacterial**
- **Anti-inflammatory**
- **Skin Conditions**
- **Lowers cholesterol**
- **Increases energy**
- **Acid Reflux**
- **Hypertension**
- **Diabetes**
- **Immune System**
- **Stomach disorders**
- **Fibromyalgia**

responsible for the multifaceted health-promoting properties of the fruit.

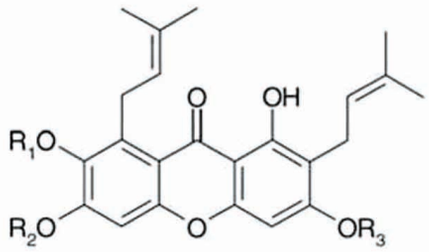
While all these Xanthones have similar molecular structures, each one has its own unique chemical composition that permits it to perform a specific function.

Alpha-mangostin, for example, is a very potent antioxidant. Gamma-mangostin is a powerful anti-inflammatory. Garcinone E is a strong anti-tumor agent. Together they provide a whole range of natural healing compounds addressing a variety of health issues.

What is perhaps not understood by most people, is that while mangosteen is extolled as being a superfruit with an abundance of xanthones, it is usually the inedible pericarp which contains these xanthones and not the white pulp which is usually eaten. It is therefore the preparations containing extracts of the pericarp which are antioxidant rich juices. Recent research reveals that many foods with intense colouring, displayed high scores of Oxygen Radical Absorbance Capacity (ORAC). This would naturally mean that the white edible fruit of the mangosteen would not be a great candidate with anti-oxidant properties but admixtured with the rich pigments of the pericarp would certainly make it so, making it an effective health food. An ORAC test for example, showed that an ounce of Mangosteen juice provides 20 to 30 times more capacity to absorb free radicals than an ounce of most fruits and vegetables.

The pericarp also contains several phytochemicals including the polyphenols garcinol and mangostin, which are biological

active and promises to be of great value as health giving compounds.



Chemical structure of mangostins
α-mangostin: R1 = CH3, R2 = R3 = H
β-mangostin: R1 = R3 = CH3, R2 = H
γ-mangostin: R1 = R2 = R3 = H

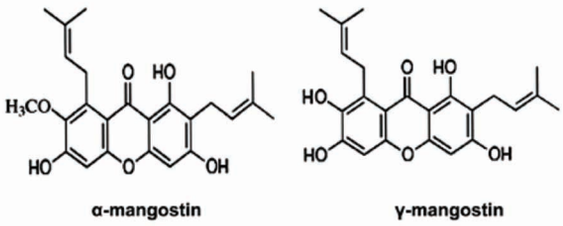


Figure 1 Chemical structure of α-mangostin and γ-mangostin, the main constituents of the G. mangostana xanthones extract.

Mangosteen also contains other potent natural compounds like catechins, polysaccharides, quinones, stilbenes, polyphenols, anthocyanidines and tannins.

Catechins were discovered to be five times more potent as antioxidants than vitamin C.

Polysaccharides are highly potent anti-cancer and anti-bacterial plant compounds. They help block a mutated cell's ability to stick to healthy cells to help stop the spread of cancer, and are specially effective against intracellular bacteria.

Quinones are known for their anti-bacterial properties and also are strong oxidants.

Stilbenes in plants defend these plants against fungi. Interestingly, stilbenes also maintain their anti-fungal properties even when ingested. They also are strong antioxidants.

Polyphenols were found to be far more potent as antioxidants than vitamin E, considered one of the most powerful known antioxidants.

Its content of tannins makes it a useful and potent agent for the tanning of leather too. The presence of the tannins explains why it has been traditionally used to treat dysentery, and as an astringent.

Mangosteen products in the Market

In the Western world, a number of food items are on the market with claims that they are xanthone-rich and hence health giving. These include juices, teas and pills with extracts of mangosteen fruit and pericarp. It can also be purchased as a supplement and available as a powder in pill form or as a liquid supplement. In pill form one should look for brands that contain the whole fruit including the rind to ensure that you are getting all the xanthones available. If buying a liquid supplement check, again check to make sure you are getting a whole fruit puree including the rind. Not something reconstituted from a powder extract or something that contains only the fruit itself without the rind. Ascertain that the whole fruit mangosteen puree is one of the primary ingredients. When the label has the words "unique mangosteen peel extract" or "Mangosteen Fruit & Pericarp Extract" these are powdered extracts only. Also be on the look out for products that say things such as "Alpha mangosteen". The Alpha is only one of the over forty xanthones available from the mangosteen fruit.

XanGo TM is one proprietary formula containing the fruit as a whole, (pulp and rind) enabling absorption of its numerous phytonutrients.

With the growing popularity of mangosteen botanical supplements, and their consumption, it is incumbent upon scientists and food technologists to expand their research to determine their actual health giving effects, particularly its role in prevention of chronic diseases.

As stated by J. Frederic Templeman, M.D., a primary care physician for more than 20 years and board certified in both the United States and Canada, *"Mangosteen provides powerful support for every organ system in the human body. This fact is being confirmed on a daily basis by clinical experience... I am convinced that Mangosteen will, without a doubt, be the most successful food supplement ever."*

Modern scientists and a growing number of health practitioners now agree on the medical benefits of Mangosteen. They have found that the fruit is helpful in preventing and possibly even stopping a wide range of diseases such as diabetes, heart disease, Alzheimer's disease, cancer and other chronic diseases.

Mangosteen used in Traditional medicine

It is an accepted fact that natural remedies provide health benefits without the harmful side-effects of drugs. Our forefathers had the unique ability to discern the value of all things natural. Mangosteen , as a tropical fruit has been used to treat a number of ailments. The hard leathery rind is ground into a powder, poultice or tea and used to treat diarrhea , dysentery, skin ailments, chronic pain, infection, fever and inflammation amongst others. The powder can be made into a cream and applied to the skin to treat eczema and other skin ailments. A decoction of the rind (boiled in water) is used to treat gonorrhoea, cystitis, diarrhea and gleet.

Commonly accepted Health benefits of Mangosteen

It is moderately low in calories (63 calories per 100 g) and contains no saturated fats or cholesterol. Nonetheless, it is rich in dietary fiber (100 g provides about 13% of RDA).

Mangosteen is good source of vitamin C and provides about 12% of RDA per 100 g. Vitamin-C is a powerful water soluble anti-oxidant. Consumption of fruits rich in vitamin-C helps human body develop resistance against viral-flu and help scavenge harmful, pro-inflammatory free-radicals.

Fresh fruit is a moderate source of B-complex vitamins such as thiamin, niacin and folates. These vitamins act as cofactors to help body metabolize carbohydrates, protein, and fats.

Further, it also contains a very good amount of minerals like copper, manganese and magnesium. Potassium is an important component of cell and body fluids and helps control heart rate, and blood pressure, thus, it offers protection against stroke and coronary heart diseases.

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THE STORY OF QUINGHASU AND THE NOBEL AWARD FOR MEDICINE 2015

By R.O.B.Wijesekera

It has been a rocky trail from the Chinese Traditional Medicine to an established globalised anti-malarial drug, but Quinghasu has made it. Today the Artimisinine group of drugs, originating from the plant *Artimisinine annua* or, Quinhasu, in Chinese, are regarded as the most efficacious and fast acting anti-malarial drugs known to mankind.

Some years ago, Dr. Tu Youyou, a Chinese phytochemist won the Lasker Award in Clinical Medicine- one of the most prestigious prizes in the world-, for her discovery and development of the of the antimalarial drug that has so far saved millions of lives. Now the modest lady scientist has won the highest of them all, the Nobel Prize for Medicine in 2015.

The research culminating in her discovery commenced during the Vietnam War, when the malaria parasite *Plasmodium falciparum*, began to develop widespread resistance to existing antimalarial drugs such as Chloroquine, and later mefloquine. The Vietnamese who were then at war with the western powers looked to their neighbour China, for assistance in combatting the malaria scourge which was decimating their armed forces. In response, China was to launch a secret project named Project 523, after the date of commencement which was May 23rd, which mobilised several research organisations and many scientists to develop an anti-malarial agent.

Writing about her discovery, Professor Tu, quoted Joseph L. Goldstein, Nobel Laureate and author of the celebrated work *"The Art of Science", who had stated that: "creation through invention, and, revelation through discovery, are two different routes to advancement in the biomedical sciences,"* In her work as a phytochemist, she had been fortunate to take both routes.

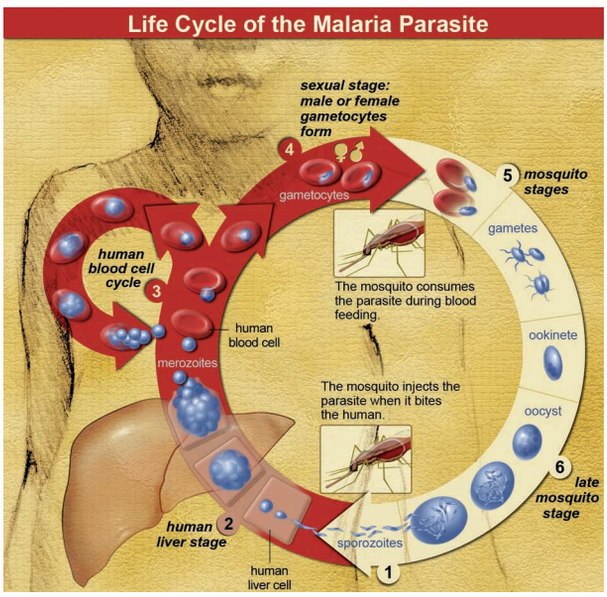
Nobel Laureate Yuoyou TU

Professor Tu was the selected head of the research team in Project 523. She has told her own story in her 2011 Albert Lasker Award presentation published in Nature Medicine.

Professor You you Tu, had graduated from the Beijing Medical School of Pharmacy in 1955, and researched at the China Academy of Chinese Medical Sciences then known as the Academy of Chinese Traditional Medicine. Her research was on Chinese Herbal Medicine. During the years 1959-62 she participated in a Training Course on Chinese Medicine which had been specially designed for professionals with backgrounds in Western Medicine. She observes that the training course was to guide her to the "wonderful treasure to be found in Chinese Traditional Medicine and towards understanding the beauty in the philosophical thinking that underlies a holistic view of human beings and the universe".

Malaria had been a scourge that not only threatened the lives of populations for thousands of years but had been the cause of major shifts in populations in various regions of the globe. Caused by the mosquito borne parasite *Plasmodium falciparum*, it had no counter until the discovery of the Peruvian bark (cinchona) in the nineteenth century. That was the initial instance

where a major counter to human disease of large proportions came from a traditionally used medicine.



By the 1950's all concerted international efforts to combat malaria had failed due to the emergence of parasites resistant to all the available antimalarials including quinine, synthetic analogues of quinine such as chloroqine. There was then a dire need for anti-malarial drugs globally. So it was that in 1967, the Chinese priority Project 523 was set up. It was a top secret project where Chinese premier Zhou Enlai had convinced Chairman Mao Zedong to set up this secret drug discovery project. Professor Tu upon joining the project was originally sent to Hainan, where she was to study patients already infected with malaria. During the time she spent there her husband was despatched to the countryside, which meant that her daughter was entrusted to a nursery in Beijing.

Professor Tu was made the leader of a malaria research group which comprised both phytochemists and pharmacologists. She recalls that the youthful team she led commenced research on the extraction and isolation of plant constituents which were perceived to possess anti-malarial properties, based on knowledge gathered from Chinese Traditional Medicine. During the initial phase the group investigated over 2000 herbal formulations used in Chinese traditional medicine, and identified 640 for further investigation in regard to their antimalarial potential. Besides, they made several extracts of herbals and evaluated them for antimalarial activity using a mouse-based model. The progress was short of favourable, until the plant *Artimesia annua,* showed a degree of inhibition of the parasite growth. They then had intensive recourse to the ancient literature but found that the only reference to the use of the plant - (called quinghau in Chinese) - for alleviating the symptoms of malaria appeared in a : Ge Hong's A Handbook of Prescriptions for Emergencies. The instructions in the handbook, stated that a handful of the leaves of Qinghai immersed in two litres of water the juice, extracted by squeezing, and consumed, was the effective methodology. This clue had given Professor Tu's research team the indication that their own extractions may have been faulty due to the use of heat which may have destroyed the active compound. Switching to lower temperatures of extraction gave more promising results relating to anti-malarial activity. Mme Tu has noted: "We subsequently separated the extract into acidic and neutral portions, and at long last on 4th October 1971 we obtained a non-toxic neutral extract that was 100% effective in mice infected with *Plasmodiun berghei* and in monkeys infected with *P. cynomolgi*. This finding represented the breakthrough in the discovery of artimisinin."

The staging of clinical trials in China during the Cultural Revolution was not a feasibility. So Mme Tu describes how she and her colleagues tested the extracts on themselves to ensure they were safe for human consumption. After that they went into Hainan province to test its clinical efficacy, carrying out antimalarial trials with patients infected with *Plasmodium vivax* as well as *P. falciparum.*

The results were encouraging and the patients treated with the extract experiencing rapid disappearance of the symptoms even as compared with those treated with chloroquine.

Mme Tu in her laboratory

The team then focussed on the isolation and purification of the components from *Artimesia annua*. By 1972 they had isolated and characterised a colourless crystalline compound with a molecular weight 282 and a formula of $C_{15}H_{22}O_5$, having a melting point of156-7 deg. C. which was the active component of the extract. They named it Artimisinin or in Chinese Qingha-su. Mme Tu adds that in keeping with Goldstein's view the discovery of artimisinin was the first step in their advancement, namely "the revelation". She added that her team had used the Artemisia species that was local to the Beijing region, and that this variety contained relatively small quantities of the active component. For the production of large scale quantities they urgently needed a species with a higher quantity of artimisinin. Her collaborators in the national project that was named Project 523 had discovered a species of *A. annua*, native to the Sichuan Province, that ideally met this requirement. This enabled them to extract larger quantities of artimisinin and to test different formulations such as tablets and capsules of the pure drug. She adds that then "the road leading to the creation of a new antimalarial drug had opened again". Her team had now overcome the problems of large scale production and formulation into drug form. Now they faced the problems in regard to communication of their findings to the scientific world. The unique chemical structure of artimisinine was identified as a sesquiterpene lactone. This was achieved with the collaboration of a team from the Institute of Biophysics of the Chinese Academy of Sciences, and published in 1977, albeit in Chinese journals. However in 1979 the Chinese National Committee of Science and Technology granted them a National Invention Certificate in respect of the discovery of artimisinin and its efficacy as an antimalarial drug.

The Fourth Meeting of the Scientific Working Group on the Chemotherapy of Malaria which was jointly sponsored by the WHO, the UNDP, and the World Bank, took place in 1981 and at that meeting Madame Tu, as the first speaker presented her findings as "Studies on the Chemistry of Quinghasu". Following this meeting the several research studies on the efficacy of artimisinin as a new antimalarial agent attracted the attention of the world scientific community. Looking beyond the molecule of artimisinin was indeed a logical pastime of the organic chemist, and Tu's team was to do this as their logical follow up of the success of the original natural molecule. They found that dihydro-artimisinin was more stable and more effective than artimisinin itself and proceeded to develop this into a drug form. In addition affixing a Hydroxyl group to the molecule followed by the synthesis of related esters were the other directions for the research chemists of her group who developed many related derivatives, which possessed anti-malarial effect. At the same time the group also proceeded with researching the efficacy of these derivatives for other diseases. Artimisinin and derivatives from then onwards became the gold standard for antimalarial drugs.

Their next step was to turn the natural molecule into a drug form –"the creation" As indicated earlier the Cultural Revolution was a period not conducive to conducting clinical trials, and so Professor Tu and her colleagues had to resort to the unique step of being volunteers in testing the efficacy and possible toxicity of the drug.

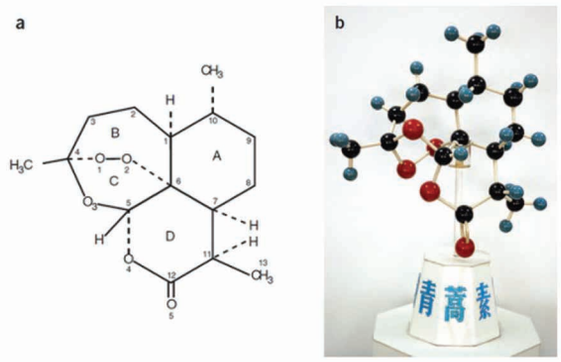
Professsor Tu characteristically became the first to serve as a human subject as she noted: "As Head of the research group I had the responsibility". Once certain that the drug was safe she proceeded to conduct further clinical trials with human patients. In 1981 she was to make a presentation of her research findings on artimisinin at a meeting sponsored by the World Health Organisation. The results of her team were also presented by the Chinese contingent at a

meeting in 1982 in Beijing organised by UNIDO and styled Modern-Traditional Medicine Pharmaceutical Workshop, at the which the present author was a UNIDO representative. When we asked on that occasion, as to the rationale that the Chinese were willing to give exposure to their findings, the response was that they were keen to display the fact that they were capable of drug development on their own, and they desired to grant the benefits of their discovery to the entire global community as malaria was a global scourge. The discovery of artimisinin had been the first stage and now Tu and her colleagues set about the task of accomplishing the next stage, that is, the stage of creation. They focussed on turning the natural material into a drug which could be used by many in combatting malaria. They had found that in the species Artimesia only *A. annua,* and its fresh leaves in the alabastrum stage contained an abundance of the constituent artimisinin. However for the purpose of drug development they needed a species that would contain a larger amount of the artimisinin as compared to the variety they had used. Her team were fortunate in finding such in the form of the variety of *A. annua,* native to the Sichuan province, which was rich in artimisinin, which they proceeded to use. Following trials with various forms of administering the drug, they were finally successful, with a capsule of pure artimisinin that had the desired clinical efficacy. Then the road leading to the creation of a new anti-malarial drug had opened wide. The derivatives proved the new age in combatting malaria.

In fact Mme Tu and her group recommended the use of combination therapy in reducinng the risk of recurrence and development of resistance. In 1985 they combined artemether, an ether derivative from the original artemisin, and lumefrantin, into a single tablet thereby creating the first artimisinin combination therapy (ACT).

In 1987, Guilin Pharmaceuticals Co developed an intravenous artesunate, for patients with severe malaria – this being the first ever drug developed entirely by an indigenous Chinese company.

It was only in 2005 that the WHO was to launch its strategic initiative in the form of a new approach with Artimisinin Combination Therapy. ACT's recommended by WHO combine an artimisinin derivative such as artemether, artesunate, or dihydro-artimisinin, with another effective antimalarial medicine..



The recognition in the Nobel Prize awarded to Professor Tu also underscores for the first time at this peak level of scientific recognition, the need for the world to concertedly explore the rich knowledge in Chinese Traditional Medicine as well as in our Ayurvedic heritage. It also emphasises the crucial need for the safeguard and sustenance of the flora from which the medicines are derived. Another factor is the need to banish the single bullet single target approach and research the multi-target multi-drug approach of Traditional Chinese and Ayurveda, Already this is accepted in Europe as pioneered by Professor Hildebert Wagner in Munchen and the European initiative to develop a new paradigm in the treatment of disease.

Professor Tu has an all-encompassing dream which she shares with the world community: She says" It is my dream that Chinese Medicine will help us conquer life-threatening diseases worldwide and the people across the globe will enjoy its benefits for health promotion." Let us hope that the world's wealth now squandered widely in conflicts scattered throughout the world, the consequent proliferation of armaments, and in global conferences with little results, be channelled to improve the health of the global population in the scientific research trail led by the Chinese and Professor Tu.

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Genesis 1:29 And God said, Behold, I have given you every herb bearing seed, which [is] upon the face of all the earth, and every tree, in the which [is] the fruit of a tree yielding seed; to you it shall be for meat.

"At the end of times the merchants of the world will deceive the nations through their Pharmacia."

(sorcery) - Rev. 18:23 -

"If we doctors threw all our medicines into the sea, it would be that much better for our patients and that much worse for the fishes."

Supreme Court Justice
Oliver Wendel Holmes, MD

Toxic Shark fins?

University of Miami neurologist Deborah Mash found an unsavoury ingredient in the fins of seven shark species : a neurotoxin with possible links to Parkinson's, Alzheimer's and Lou Gehrig's disease. Called beta-methylamino-L-alanine (BMAA) , the molecule is made by cyanobacteria, often called blue-green algae and can accumulate as it travels up the food chain. Previous research in Guam found that BMAA in bats eaten by locals was the likely cause of a neurodegenerative illness : the bats on the seeds of cycad trees with bacteria harbouring roots. Because the bacteria are ubiquitous in the ocean, Mash turned to marine species . Some controversy remains about BMAA detection methods, but Mash will be on the menu for sharks and possibly people too.

Elizabeth Preston in
National Geographic,
February 2013

Science is built up of facts, as a house is built of stones; but an accumulation of facts is no more a science than a heap of stones is a house.

~ Henri Poincaré, Science and Hypothesis, 1905

NOVEL DRUG DELIVERY SYSTEMS FOR HERBAL REMEDIES

by Chanika D Jayasinghe[1] & Preethi V Udagama[2]

Herbal remedies have a long standing history of use in traditional medicine, and are the sources of important drugs such as atropine, codeine, digoxin, morphine, quinine and vincristine used in allopathic medicine. During the past few decades, the enormous interest in safe and cost effective personalized medicine among the western world has led to a resurgence of interest in traditional herbal remedies. Hence, most of the synthetic medications are being gradually replaced by herbal therapeutics.

Despite the advantages, traditional herbal regimes have their limitations of instability at high pH, less bioavailability, low solubility and poor patient compliance. Importantly, most of the phytochemicals (such as flavonoids, tannins, terpenoids, etc.) exert poor bioavailability due to their large molecular size which cannot be absorbed by passive diffusion, or due to their poor lipid solubility.

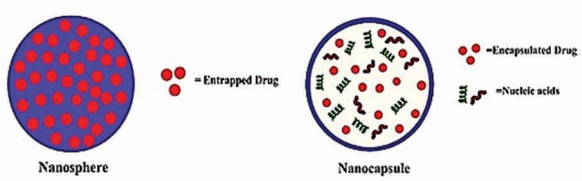
Novel drug delivery systems address these limitations and ensure the successful delivery to the targeted site. These formulations are reported to have remarkable advantages over conventional formulations of plant actives which include enhancement of solubility, bioavailability, protection from toxicity, enhancement of pharmacological activity, enhancement of stability. Thus, the application of this novel technology enabled the integration of traditional medicine into mainstream medicine.

Polymeric nanoparticles, nano-capsules, liposomes, phytosomes, nano-emulsions, microsphere, transferosomes, and ethosomes are the most common forms of carriers used in novel drug delivery systems. These formulations increase the efficiency of traditional remedies, with concurrent minimization of side effects of high dosages.

Nano particles

Nanoparticles are colloidal systems with particles size varying from1nm to 100 nm. These have relatively large surface area to volume ratio, which facilitates the binding absorbance and carrying the active constituents to the targeted site. Nanonization possesses many advantages, such as higher solubility, low toxic effect due to application of lower amounts of active compound and improved absorbency of herbal medicines. The composition of engineered nanoparticles may vary from biological origin like phospholipids, lipids, lactic acids, dextran, chitosan or carbon, silica or other metals. Priority has been given for biodegradable nanoparticle formulation as these show efficient drug release at the target site compared to the biological nano particles.

The nano-spheres consist of a matrix in which the active ingredients are dispersed throughout, whereas the nano-capsules have a polymeric membrane and an active ingredient is found inside a core.



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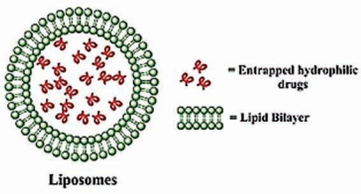
Liposomes

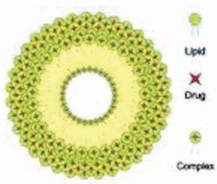


Liposomes

Liposomes are biodegradable and essentially non-toxic vehicles which has the capacity to encapsulate both hydrophilic and hydrophobic materials. Liposomes are easy to prepare and have high biocompatibility. These spherical particles encapsulate a fraction of the solvent, in which these freely diffuse into their interior. The chemically versatile nature of liposomes allows the loading of hydrophilic, amphiphilic, and lipophilic compounds.

Liposome based drug delivery systems offer the potential to enhance the therapeutic index of anti-cancer agents, either by increasing the drug concentration in tumor cells and/or by decreasing the exposure in normal tissues exploiting enhanced permeability and retention effect phenomenon and by the simple modulation of their pharmacokinetic properties by changing the chemical composition of the bilayer components. Silymarin the active constituent of Milk thistle *Sily bummarianum* has been incorporated into liposomal dosage to enhance the bioavailability.

Phytosome



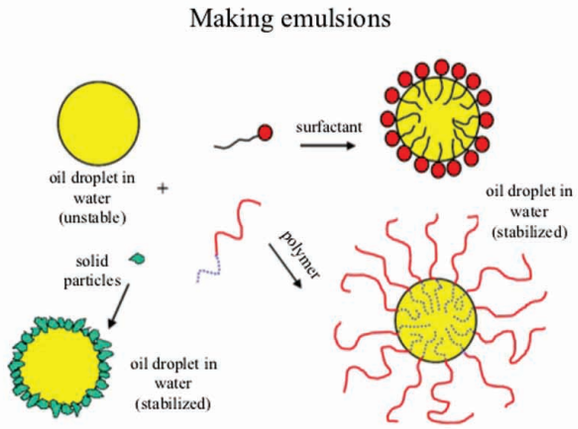
Phyto-phospholipid Complex

Phytosome is a phospholipid-based drug delivery system with efficient absorbance, pharmacokinetics and therapeutic index than conventional formulations. Phytosome is produced by binding individual components of herbal extracts to phosphatidyl choline. These structures protect herbal components from destruction in digestive secretions and gut bacteria by forming small cells. These are capable of being transferred from a hydrophilic environment into the lipid-friendly environment of the enterocyte cell membrane and finally reaching blood.

The phytosome process has also been applied to many popular herbal extracts including *Ginkgo biloba*, grape seed, hawthorn, milk thistle, green tea, and ginseng.

Emulsions

An Emulsion is a biphasic system in which one phase is intimately dispersed in the other phase in the form of minute droplets ranging in diameter from 0.1 μm to 100 μm. In an emulsion, one phase is aqueous while the other is organic . These produce targeted sustained release, improve the penetrability of drugs into the skin and mucous membranes, and reduce the drugs' stimulus to tissues. There are different forms of emulsions: micro-emulsions ornanoemulsions, sub–micro-emulsions or lipid emulsions.

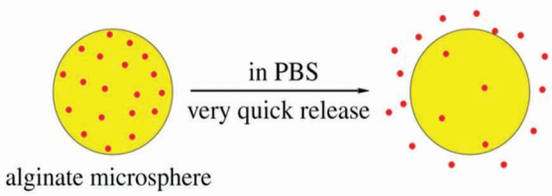


Emulsion drug delivery system is targeted or distributed well due to affinity to lymph. Micro-emulsions are solutions containing nanometer sized droplets of an immiscible liquid dispersed in an aqueous buffer. The droplets are coated with a surfactant to reduce the surface tension between the two liquid layers. Micro-emulsion is a clear, thermodynamically stable, isotropic mixture of oil, water and surfactant, frequently in combination with a co-surfactant.

Ethosomes

Ethosomes are phospholipid-based elastic nano-vesicles having a high content of ethanol (20%-45%) and which increases the efficiency of delivery of various drugs, mainly through the skin. Packed less tightly in comparison with conventional vesicles, but has equivalent stability. Ethosomes are preferred for the delivery of diverse groups of protein and peptide molecules,. Moreover, these allow the delivery of large amounts of diverse groups of drugs and when administered in semisolid form, result in improved patient compliance. *Sophoraalepecuroides* and Martrine are used in ethosome applications.

Microspheres



Microspheres can be employed to deliver an active constituent in a rate-controlled and targeted manner. Medication is released from a microsphere by drug leaching from the polymer or by degradation of the polymer matrix. So far, series of plant active ingredients, such as rutin, camptothecin,zedoary oil, tetrandrine, quercetine and Cynarascolymus extract has been made into microspheres. In addition, reports on immune microspheres and magnetic microspheres are also common in recent years.

Conclusions

Herbal drugs have enormous therapeutic potential against numerous human diseases. Despite having excellent bio-activities in in vitro experiments, these demonstrate less or no in vivo actions due to their poor lipid solubility or larger molecular size or both, resulting in poor bioavailability. Thus, novel drug delivery systems employ a much better absorption profile which enables these to cross biological membranes, resulting in enhanced bioavailability. Hence, higher amounts of active constituent will be available at the site of action (liver, brain, heart, kidney, etc.) at similar or less dose as compared to the conventional plant extract or active constituents. Over the years, several drug delivery systems have been incorporated into conventional formulations and these have been used successfully in therapeutic applications. Hence there is a great potential in the development of novel drug delivery systems for plant actives and extracts. However, more controlled toxicity studies of novel carriers including nano-particles are encouraged prior to routine clinical trials.

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"If this country is to survive, the best-fed-nation myth had better be recognized for what it is: propaganda designed to produce wealth but not health"

~ Adelle Davis

COMPARISON OF *Alpinia calcarata* (HEEN ARATTA) PLANTS GROWN IN DIFFERENT PARTS OF SRI LANKA

*By D.M.C.N.K. Senanayake & Lakshmi Arambewela**

INTRODUCTION

Alpinia calcarata occurs in tropical countries including Sri Lanka, India, Thailand and Malaysia. It is common in villages in Sri Lanka. This is a rhizomatous perennial herb with a non-tuberous rootstock; stems slender, about 75 cm tall; leaves simple, alternate, 25 -32 cm long and 2.5-5 cm broad; mature rhizomes are branched & dense with a light to dark brown in color. The medicinally important plant material of *A.calcarata* is the rhizome and official drugs are powdered rhizome, rhizome oil and extract of rhizome.[1]

In Sri Lanka traditional medicinal systems & folk medicine use *A.calcarata* to treat bronchitis, cough, respiratory ailments, diabetics, asthma, snake bites, skin diseases and arthritis. Some 18 volatile constituents have been identified in the essential oil (EO) of Sri Lankan grown *A.calcarata* rhizomes, of which 1,8-cineol (33.3%) is the major constituent. Apart from 1,8-cineol, ∝-pinene (3.1%), camphene (4.1%), β-pinene (9.3%), p-cymene (1.4%), and limonene (4.0%) are also

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present. [1,2,9,10] Experimentally, rhizomes of A.calcarata are shown to possess antibacterial, antifungal, anthelmintic, antinociceptive, antioxidant, aphrodisiac, analgesic, anthelmintic, anti-diabetes, insect repellent and gastro protective activities.[1.16]

The conditions of the soil, the weather conditions, age of the plant & various other factors affect the growth of plants & the composition of the constituents of the plants changes from place to place. The constituents of plants collected from different parts of Sri Lanka can differ. The main objective of this research work was to determine the contents and constituents of essential oils & extracts of *A. calcarata* growing in different areas in Sri Lanka & compare their physico chemical parameters & recommend suitable places to grow *A.calcarata* to obtain high quality products.

Materials and Methods

Plant material

Fresh *A. calcarata* rhizomes were collected from herbal gardens in Sri Lanka such as Haldummulla and Pallekelle and also from home gardens in Gampaha and Avissawella.

Preparation of the essential oil

Fresh rhizomes were distilled for 6h with water in a 5 L round bottom flask. A Clevenger-type oil arm was used to collect the oils of rhizomes. It was trapped in a mixture of pentane & hexane layer (2 ml). The oil was analyzed using a Gas Chromatograph GC 4000 FID employing a Inertcapwax column (60 m x 0.25 mm id.,0.25 μm film) The peaks were identified using retention time data, and by comparing their mass spectra with spectra in the data bank.

Determination of physico-chemical parameters of *A. calcarata* rhizomes

Physicochemical parameters of *A. calcarata* rhizomes were determined according to methods described in WHO guidelines.

Determination of ethanol and water extractable matter [1,9]

Plant material (4 g) was weighed to a glass-stoppered conical flask. Solvent (ethanol/water) 100 ml was added, weighed, shaken well and allowed to stand for 1h. It was then boiled for 1h and cooled. The weight was readjusted with specified solvent and filtered. Filtrate (25 ml) was taken, solvent was evaporated and oven dried at 105 ˚C for 6h, cooled in a desiccator and weighed.

Determination of total ash content [1,9]

Crushed air dried plant material (4 g) was accurately weighed and placed in a crucible (4 samples used). The material was spread in an even layer and ignited to a constant weight by gradually increasing the heat to 500 – 600 ˚C until it was white indicating the absence of carbon. The residual ash was allowed to cool in a desiccators and weighed.

Determination of acid insoluble ash content [1,9]

Hydrochloric acid was added to the crucible containing the total ash, covered with a watch glass and boiled gently for 5 min. The watch glass was rinsed with 5 ml hot water and the rinsed contents were added to the crucible. The acid insoluble matter was collected on an ashless filter paper and washed with hot water until the filtrate was neutral. The filter paper containing acid insoluble matter was transferred to the original crucible and ignited to a constant weight. (2 samples used)

Determination of water soluble ash content [1,9]

Water was added to the crucible containing total ash, covered with a watch glass and boiled gently for 5 min. The insoluble matter was collected on an ashless filter paper and washed with water. The filter paper containing the insoluble matter was transferred to the original crucible and ignited for 15 min. at a temperature not exceeding 450 ˚C. Water soluble ash is the calculated difference in weight between the total ash and the residue remaining after treatment of the total ash with water. (2 samples used)

Development of TLC for water & ethanol extracts of rhizomes

Absorbent - Silica gel GF 254

Spray reagent - Vanillin sulphate

For ethanol extract of rhizomes solvent system was Methanol :
Chloroform : Cyclohexane : Hexane (3 : 1: 1 : 1)

For water extract of rhizomes Ethyl acetate : Methanol : Chloroform (3 : 5 : 2) was used.

Results

Determination the yields of essential oils of *A.calcarata* in four areas of Sri Lanka

Table 1: The yields of essential oils of *A. calcarata* in four areas

Sample rhizomes	Weight of fresh rhizome	Dry of fresh	Weight of theoil wt. basis	% Yield dry
Haldummulla	1400 g	371 g	3.89 g	1.05
Pallekelle	1400 g	197.26 g	2.94 g	1.50
Gampaha	300 g	53.25 g	1.07 g	2.01
Avissawella	400 g	81 g	1.20 g	1.48

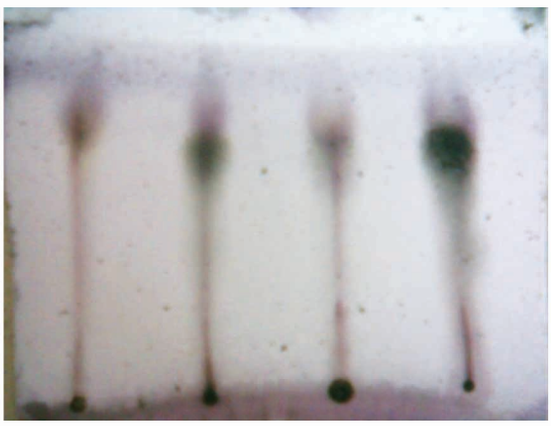
Determination of physicochemical parameters

Table 2 : Physicochemical parameters of four samples

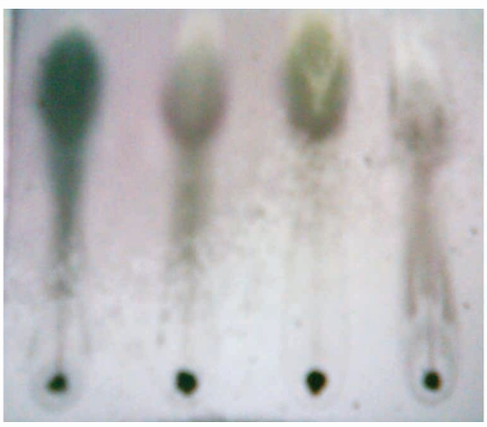
Physicochemical parameters.	**Haldummulla**	**Pallekelle**	**Gampaha**	**Avissawella**
Ethanol extractable matter	6.7 %	23.76 %	24.1 %	7.84 %
Water extractable matter	8.37 %	21.78 %	21.68 %	1.76 %
Total ash	4.60 - 5.03%	5.45 - 6.44%	4.44 - 5.85%	4.20 - 4.58%
Water soluble ash	1.67 %	1.09 - 2.13 %	2.46 – 2.52%	2.67 %
Acid insoluble ash	0.42 - 0.84%	1.14 - 2.43 %	1.05 – 1.17 %	0.38 %

Development of Thin Layer Chromatography for ethanol / water extracts of *A.calcarata*

TLC experiment was done only for the comparison of four samples.



Ethanol extract



Water extract

Table 3 :

RF values of ethanol extracts of *A.calcarata* rhizomes

Sample	RF value
Haldummulla	0.81
Pallekelle	0.77
Gampaha	0.75
Avissawella	0.72

Table 4 :

RF values of water extracts of *A.calcarata* rhizomes

Sample	RF value
Haldummulla	0.70
Pallekelle	0.74
Gampaha	0.75
Avissawella	0.77

"If this country is to survive, the best-fed-nation myth had better be recognized for what it is: propaganda designed to produce wealth but not health"

~ Adelle Davis

"Until man duplicates a blade of grass, nature can laugh at his so-called scientific knowledge. Remedies from chemicals will never stand in favour compared with the products of nature, the living cell of the plant, the final result of the rays of the sun, the mother of all life."

- T. A. Edison

Determination of the constituents of essential oils in four areas in Sri Lanka by Gas Chromatography

Figure 1:

Gas liquid chromatogram of *A.calcarata* rhizome oil of Haldummulla area

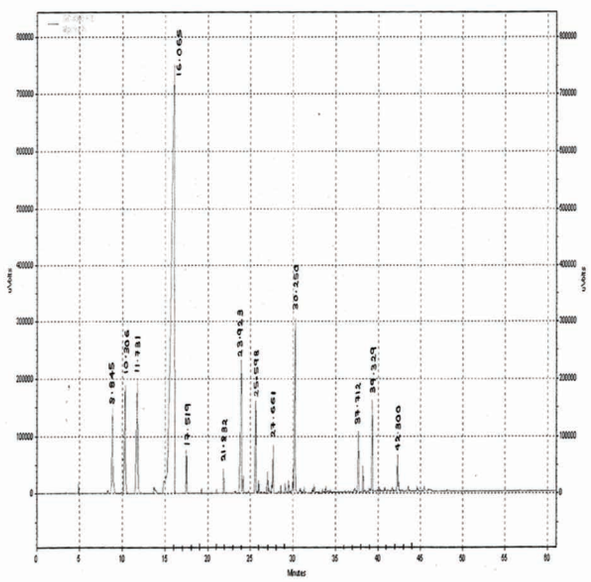


Figure 2:

Gas liquid chromatogram of *A.calcarata* rhizome oil of Pallekelle area

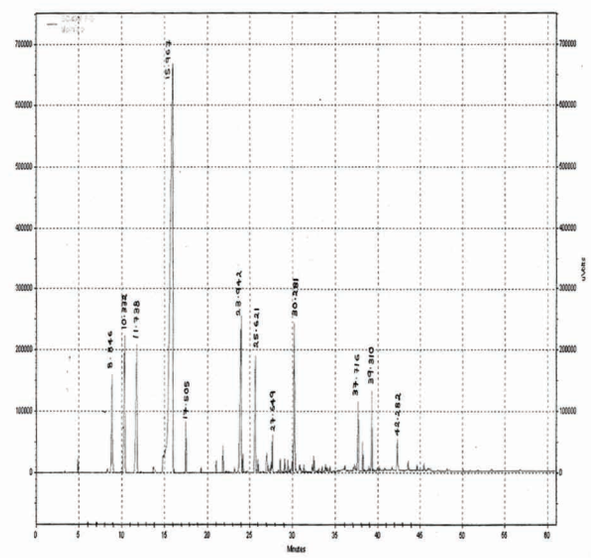


Figure 3:

Gas liquid chromatogram of *A.calcarata* rhizome oil of Gampaha area

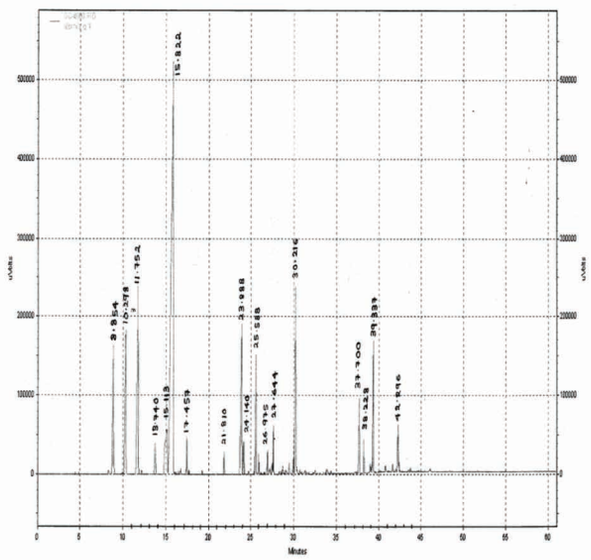
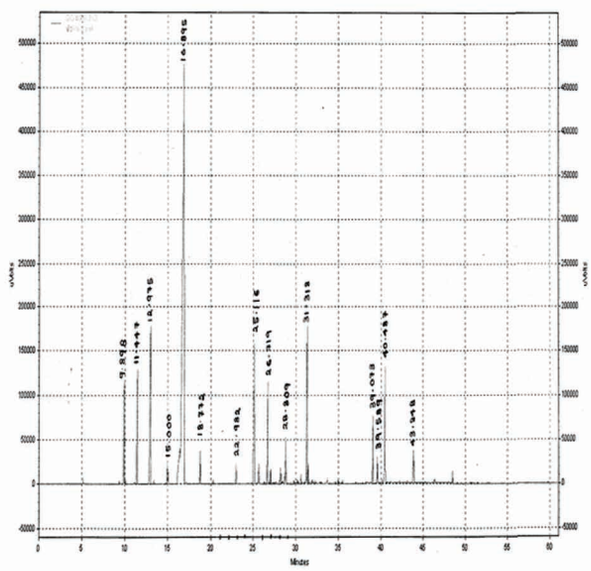


Figure 4:

Gas liquid chromatogr *A.calcarata* rhizome oil of Avissawella area



Comparison the chemical constituents of essential oils in four areas of Sri Lanka

Table 5:

Comparison of the chemical constituents of essential oils from four areas

Compound	*Haldummulla* Area %	*Pallekelle* Area %	*Gampaha* Area %	*Avissawella* Area %
α-Pinene	3.14	3.40	4.71	3.58
Camphene	4.31	5.28	5.42	4.28
β- Pinene	5.51	5.79	8.84	7.43
ρ- Cymene	0.41	0.35	1.43	0.97
Limonene	0.46	0.63	4.45	3.92
1,8- Cineole	52.63	45.03	37.02	43.15
Camphor	0.88	1.11	0.82	0.88
ɣ- Muurolene	5.65	7.09	6.27	6.45
Caratol	5.28	4.62	5.98	5.88
α- Eudesmol	1.60	1.92	2.12	2.29

Discussion

The sample from Gampaha gave the highest yield of the oil (2.01%) and Haldummulla sample gave the lowest yield (1.05%) (Table 1). The values were all calculated on dry weight basis.

Physico-chemical parameters of *A.calcarata* rhizomes were determined. Ethanol extractable matter & water extractable matter are important parameters. The sample from Gampaha gave the highest value (24.1%) for the ethanol extractable matter (Table 2). The results of the present study indicated a value of 21.78% for Pallekelle sample & Haldummulla sample had the lowest value (8.37%) for the water extractable matter.

TLC profiles of ethanol and water e xtracts showed similar patterns.

In the determination of the chemical constituents of the essential oils, the major compound was 1,8-Cineole in all four samples. Ten compounds were identified in all four samples with different area percentages, the differences in the retention data are due to slight alterations in the instrument. Highest area percentage of 1,8-Cineole was given by the Haldummulla sample. Gampaha sample had a good separation of all compounds with high concentrations.

The four samples obtained from different areas of Sri Lanka were not of the same age. There were practical difficulties in finding plants of the

same age group as there is no systematic cultivation of *A. calcarata* in Sri Lanka. Due to this reason the results cannot be compared accurately as compositions changes with the age of the plants When summarizing all the results, the four samples obtained from four areas of Sri Lanka were different from each other to a certain extent. Out of these four areas Gampaha is the best area to grow *A.calcarata* according to this study. This study also indicates the changes that can occur in plants due to geographical location

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"The doctor of the future will give no medicine, but will interest his patients in the care of the human frame, in diet, and in the cause and revention of disease."

-Thomas Edison, Inventor

Science is built up of facts, as a house is built of stones; but an accumulation of facts is no more a science than a heap of stones is a house.

~ Henri Poincaré, Science and Hypothesis, 1905

PROMINENT RESEARCHERS NO.14

Professor LESLIE GUNATILAKA INTERNATIONALLY RECOGNIZED SRI LANKAN ICON OF NATURAL PRODUCTS,

By Dilmani Warnasuriya

It is said in the bible that a prophet is not honoured in his own hometown, and this holds true to some extent in the case of Prof Leslie Gunatilaka, a Sri Lankan at birth, and a much renowned research scientist in the United States. It is true that Prof. Gunatilaka is much sought after by fellow researchers during his visits to his motherland, but our local media carries little or nothing about the pioneering work being carried out by him, particularly his research towards alleviating the scourge of cancer, and his forage into the world of drug-yielding medicinal plants.

Prof. Gunatilaka obtained an Honours degree in Chemistry from the University of Peradeniya, and his doctorate from the Imperial College, University of London, where he was fortunate to have as his advisor, Prof Sir Derek H.R. Barton, a celebrated Nobel Laureate. On his return to Sri Lanka he continued working at the University of Peradeniya, in the capacity of a Lecturer, and ended his career at his alma mater as Head of the Department of Chemistry and Professor of Organic Chemistry. During his tenure at the University, Prof Gunatilaka, displayed a keen interest in research relating to the chemistry of medicinal plants from his undergraduate to post graduate and post-doctoral periods. Prof Gunatilaka's natural aptitude for making inroads into elucidating the chemistry of a host of natural products, was further boosted by working with giants in the field such as Professors Barton, Carl Djerassi and David Kingston, during his sojourn outside the country. Here, he was able to gain hands on experience in natural product research which included biosynthesis, isolation, identification, synthesis and also their evaluation for potential

biological activity. He was able to productively make use of this knowledge upon his return to the country and his alma mater, the University of Peradeniya, where he immersed himself into research in the medicinal plant area. His efforts were rewarded when the natural products group he was working in was awarded the Presidential gold medal for creating a centre for excellence in natural products chemistry.

Recognition of his work led to his being sought after by many foreign research groups. He first had a stint at the National Cancer Cooperative Drug Discovery Group at Virginia Tech, USA and in 1997 joined the University of Arizona, his first independent appointment in the United States. He is currently a Professor at the School of Natural Resources and the Environment at the University of Arizona. In acknowledgement of his inspiring research efforts, he was appointed Director of the South West centre for Natural Products Research at the University in 2002, a post he still holds.

Prof Gunatilaka's research at the University of Arizona was centred around the plants growing in the Sonora desert and their associated microorganisms. Having observed and studied these plants, he was intrigued as to how some plants which did not display typical xerophytic characteristics were able to survive the adverse conditions prevalent in the desert, without any morphological modifications. Prof Gunatilaka postulated that it was the microorganisms living in symbiotic association with these plants which helped them to survive these hostile climatic conditions. Postulating further, he said that such microorganisms were probably endophytic and rhizosphere fungi which may produce small molecule natural products which could modulate stress or heat shock response in plants. Through further research conducted on microorganisms in his laboratory, his hypotheses was proven to be true. Having been greatly encouraged by these results, he was keen to discover whether these same compounds could also help cancers, such as breast and prostate cancers, to survive through stress conditions. These cancers are solid tumours which grow using the body's own supply of blood. As such no effective cure has been found through modern medicine. Prof Gunatilaka's laboratory has experimented with over 1000 fungi living in association with plants growing in the desert, isolated over hundred compounds and tested them for anti-tumour activity. The technique used involved bioassays to test the inhibitory properties of the extracts against heat-shock protein 90 (hsp90) which is a key factor in cancers. The team was aware that cancer cells are highly stressed and that heat-shock proteins help the cells to tolerate that stress. Logically, if the activity of this protein could be inhibited then it could significantly reduce the survival of cancer cells. Thus the proponents of this theory were jubilant when two compounds isolated from two desert plants were found to bind to the protein hsp90, and effectively reduce the proliferation of cancer cells in culture. The scientists were confident that with hsp90 inhibitory compounds, it may be possible to not just treat solid tumours, but to cure it! This project has now evolved into an international project with the participation of researchers from Brazil, China, Sri Lanka and the US. Prof Gunatilaka has received funding for his research from the U.S. National Cancer Institute and Arizona Biomedical Research Commission.

Yet another significant breakthrough made by Prof Gunatilaka and his centre is the development of an improved method for the production of natural products by an innovative method of plant cultivation. As Prof Gunatilaka stated "A lot of people think that drugs come out of test tubes, but over 70% of cancer drugs come from natural sources." Researching on the plant, *Withania somnifera* (Amukkara; Ashwagandha), the team isolated the compound withaferin A, a steroidal lactone, which was found to be effective in inhibiting the growth and spread of cancerous masses. This plant also grows in arid environments. It has been used in medicinal preparations for centuries in Ayurvedic medicine in India. The researchers demonstrated for the first time the mechanism by which withaferin A alters cytoskeletal architecture thereby demonstrating its role in inhibiting the growth of cancerous masses.

The major problem they encountered in furthering their research was obtaining sufficient

quantities of the compound. To quote from Prof Gunatilaka, "With natural products, the problem is availability. When conducting animal studies, gram quantities of the material are needed. That is why people like synthetic molecules because when it is synthesised you can scale it up. But when you collect material from nature it is hard to obtain large quantities without significant ecological destruction". In a bid to resolve this problem, Prof Gunatilaka and his team devised an aeroponic technique for growing the plant to produce large quantities of the natural product, which enabled them to carry out further studies on the biological activity of withaferin A and prepare over a hundred of its structural analogues. In the aeroponic technique, no soil is used, but the root of the plant is sprayed with water and nutrients. Thus there is some control of the environmental conditions. Plants grown aeroponically were about five times larger, and grew four times faster than those grown under natural conditions. In the case of *Withania somnifera,* the amount of withaferin A which is the active ingredient in anti-cancer studies, was also much more. Another interesting feature observed is that the plant produced an entirely new water soluble sulphate form of withaferin A, a prodrug which converts into withaferin A in cell cultures and animal models. Prof Gunatilaka is hopefully confident that the same phenomenon will occur in the human body as well. Prof Gunatilaka's breakthrough in producing this compound in larger quantities has enable him to supply it to research teams working on lung cancer, and neurodegenerative diseases such as Alzheimer's and Parkinson's diseases. He is hopeful that a withanolide analogue will emerge as a potent anticancer and/or an anti-neurodegenerative drug in due course, and is continuing his research towards this end in collaboration with U.S. National Cancer Institute and Whitehead Institute.

Much has been said about Prof Gunatilaka's contributions to research overseas. However, one must not forget the assistance he has rendered to Sri Lankan research teams both in the Universities and elsewhere, especially by providing research training and advice. Particular mention must be made to the support extended to Link Natural itself, where he provided his expertise and was also generous enough to supply rare chemicals when necessary. It is our earnest hope that Prof Gunatilaka will realize his dream of playing a significant role or in making a major contribution to alleviating human suffering through the discovery and development of anticancer and anti-neurodegenerative drugs, although he is cognizant of the fact that this process could take several years and cost about half a billion dollars. He is already half way through his journey, having obtained three published patents for his research and two pending patent applications. We wish him much success in his endeavours and take pride in the fact that he is a son of Sri Lanka.

(See also Link Digest, Vol. 8, No . 1, pp. 17-23)

"Eating a vegetarian diet,
walking (exercising) everyday, and
meditating is considered radical.
Allowing someone to slice your chest
open and graft your leg veins in your
heart is considered normal and
conservative."

- Dean Ornish,
author of Extreme Health:
The Nutrition Connection

TIME TESTED AYURVEDIC OILS FOR THE MODERN CONSUMER

By *Dr. R. Gamage and Isuru Chathramali Wijerathna*

Traditional Ayurvedha provides effective solutions to simple day to day issues that are faced by consumers. In the past some of these remedies were always present in every household and they were used as preliminary interventions before seeking further treatment. However over the years, with the evolution of the fast paced lifestyles of the modern being, passing down of the knowledge got curtailed. Today we seek over the counter, western remedies for even the slightest ailment, and most times are quite aware of the down side to this approach.

Link Natural Products Pvt (Ltd), known to effectively use traditional ayurvedha knowledge to serve today's needs, has reintroduced 6 such valuable traditional remedies, in convenient easy to use home packs with the intention of passing on this knowledge to the present day consumer. Thus the birth of "Link Essentials" range of oils. "Link Essentials" range of oils, has solutions for the most common ailments that can benefit from home remedies, delivering effective and safe healing. The ailments that are covered are joint pains (Mahanarayana), muscle cramp (Kendaperalumhara), discomforts due to phlegm (Kolashleshma), insect bites (Sarvavisadee), skin ailment (Pinda) and muscular pains (Siddhartha)

The range is offered as individual as well as a gift pack. The product range conforms to the highest quality standards prescribed in Ayurvedha and is endorsed by the Link Natural seal of quality.

Composite Pack

Kendaperalumhara, Siddhartha, Sarvavisadee, Pinda, Kolashleshma & Mahanarayana

"EARTH ESSENCE" EXPANDS ITS RETAIL PRESENCE

By Dilakshi Lansakara

'earth essence', the herbal personal care range of Link Natural, is in the process of expanding its retail presence with the objective of establishing 'earth essence' as one of the most sought after personal care brands in the island.

'earth essence' speaks to the consumers who look for a premium quality herbal beauty solution beyond normal cosmetic offerings. This consumer is aware of the goodness of Ayurveda & believes in the benefits of natural ingredients which can provide them with a long lasting beauty.

Fused with ancient Ayurvedic wisdom with modern science and technology, 'earth essence' products are made with an unique combination of herbal extracts to deliver a highly effective personal care products range.

Launched in 2010 'earth essence' operated a distribution model of being present only at our flagship store, but in order to ensure maximum reach of our target consumer in the journey of establishing 'earth essence' in the personal care market, a retail expansion project started in the second quarter of 2015/2016 financial year. The retail strategy is aimed at making 'earth essence' products available in key cities islandwide in selective modern trade, cosmetic, pharmacy and textile outlets in line with brand image.

Currently 'earth essence' beauty counters are present at Hyde Park Corner Arpico and Union Place Keells with Beauty Advisors to educate the consumers on 'earth essence' products. Further 'earth essence' products are available at selected Healthguard outlets, selected ODEL LUVSL outlets, selected cosmetics outlets, and on mystore.lk for online purchasing.

'earth essence' Herbal Face Care Range

'earth essence'
Herbal Bath & Body Care Range

'earth essence' Herbal Hair Care Range

'earth essence' Herbal Hand & Feet Care Range

'earth essence' Herbal
Special Skin Care Range

GLEANINGS FROM THE LITERATURE

INNOVATION DRIVES PINE CHEMICALS INDUSTRY

Biorenewable feedstocks have been used for a considerable length of time in the pine chemicals industry to produce the all important material which plays a key role in the flavours and fragrances industry. These feedstocks can be derived in two ways, one by tapping pine trees in the forest and the other from the paper making industry. The gum oleoresin, processed gum turpentine and crude sulphate turpentine (CST) obtained through both these sources is then separated through fractionation in bio refineries to produce pure terpene compounds. These compounds are the base from which a wide range of value added products used in flavours, fragrances, food and beverage industries are made.

Tapping of pine trees for resin is not new. Hundreds of years ago, pine tar was used to caulk ships. During the 1920a and 30s, collection of oleoresin has been done through a subsistence base model, individuals working in communally owned forests, sans any mechanisation of safety measures, for low remuneration. This has led to these collectors moving away to cities seeking better life conditions causing a labour shortage, and reduced productivity. This was further aggravated by inefficient forest management practices resulting in reduced resin production and leading even to the destruction of the forest. Industry players thus saw this as an awakening call, and set several strategies in motion to alleviate these problems and ensure sustainability of the industry and its growth. Hybrid pine trees yielding significantly better yields, mechanised collection of the gum base, improved tapping techniques are a welcome consequence. The industry has also set up living laboraties in forest plantations for more genetic studies aimed at increasing the yields of oleoresin.

These developments have led to the industry moving from a subsistence based model to an agribusiness model. Today, many companies have their own plantations with fast growing hybrid plants reaching maturity in one third the time of naturally growing trees. Nurseries supply these hybrids thus ensuring the sustainability of the forests. Former tappers have also been brought in with increased pay, better working conditions, training in modern tools and equipment leading to an accelerated growth of the industry around the world.

Apart from improved production, best practices and innovative methods adopted in bio refineries has given rise to efficient terpene production and more products. The industry is still growing through the spirit of innovation practiced throughout, and pine chemical manufacturers are poised and ready to meet the changing demands of the flavours and fragrance industry.

From Forests to Factories, Innovation drives Pine chemical industry. By Charles Morris, in IFIAT World July 2015

TRANS FAT BAN IMPOSED BY US FDA ON A THREE YEAR TIMELINE

US FDA in 2013 made a preliminary determination, that partially hydrogenated fats or PHOs were not considered GRAS (Generally recognized as safe) for use in foods. PHOs are the primary dietary source of artificial trans fats in processed foods. Following upon this, a public comment period was imposed , whereupon, several stakeholders upheld this view. Coupled with this and after extensive research into the effects of PHOs, the determination was finalised. Manufacturers have been given a time period of three years to remove PHOs from their food products. They could thus reformulate their products without PHOs or request FDA to permit specific uses of PHOs.

Consumers have been increasingly aware of the possible health hazards relating to trans fats in foods, and in fact from the years 2003 - 2012, the trans fat consumption decreased by 78% in the US. It is thought that this rapid reduction could have been brought about by the stringent labelling regulations and reformulation of foods. In 2006, it even became mandatory to declare the amount of trans fats in foods, in the Nutrition Facts label.

Perfumer & Flavorist, Vol. 40, No 9, 2015

A science is any discipline in which the fool of this generation can go beyond the point reached by the genius of the last generation.

~Max Gluckman,
Politics, Law and Ritual, 1965

"This large and expensive stock of drugs will be unnecessary.... The common resources of the lancet, a garden, a kitchen, fresh air, cool water, exercise, will be sufficient to cure all the diseases that are at present under the power of medicine."

- Dr. Benjamin Rush.

Sunlight is more powerful than any drug; it is safe, effective, and available free of charge. If it could be patented, it would be hyped as the greatest medical breakthrough in history. It's that good.

~ Mike Adams,
natural health researcher
and author.

A bodily disease, which we look upon as whole and entire within itself, may, after all, be but a symptom of some ailment in the spiritual past

~ Nathaniel Hawthorne

"LINKING" WITH PEOPLE AND SOCIETY

LINK SUDANTHA - LOCAL BRAND OF THE YEAR (BRONZE), SLIM BRAND EXCELLENCE 2015

By H.M.D.D.Dananja

Established as the fastest growing brand in the toothpaste category (LMRB H.H Panel – 2011-2014).

Link Sudantha a brand which has evolved to be a significant contender in the highly penetrated competitive category of Oral Care, was recognized and rewarded for it's achievements at the SLIM BRAND EXCELLENCE 2015 award ceremony.

Today the brand it is the fastest growing brand, in a relatively stagnant category, with strong consumer acceptance to the product and the claim to protect teeth and gums for life. Within a short span of 3-4 years the brand Link Sudantha grew significantly, and became the 3rd player in the toothpaste market. (from an original 5th postiton)

Being recognized as the "Local Brand of the Year" with a Bronze award at the SLIM Brand Excellence, has showcased the professional approach taken by the company Link Natural Products (Pvt) Ltd, and the strategic direction which has resulted in a significant impact.

LINK SUDANTHA TOOTHPASTE ACCEPTED BY THE GENERAL DENTAL PRACTITIONERS ASSOCIATION (GDPA)

K.U.Yogachandran

Another milestone in the effort to provide- "Teeth for Life"

Link Sudantha toothpaste has been embraced by millions of Sri Lankans over the past few years, because they have discovered the efficacy of the product through regular use. Link Sudantha enjoys the status of the fastest growing toothpaste in an almost static market (Source: LMRB HH Panel). Its credibility is based on the formula comprising time-tested Ayurvedic herbs, manufactured under stringent and scientific standards. This unique Ayurvedic formula offers a comprehensive solution for lasting oral health.

The efficacy of Link Sudantha toothpaste was scientifically established through, a randomized clinical trial, conducted by the Faculty of Dental Sciences, University of Peradeniya, which confirmed that this toothpaste significantly reduces harmful oral bacterial growth and dental plaque. Harmful bacteria and dental plaque are the causes for tooth decay and gum disease. .

Repeated dental screening performed by experienced dental surgeons at field level confirms that the regular use of Link Sudantha toothpaste enjoy better oral health.

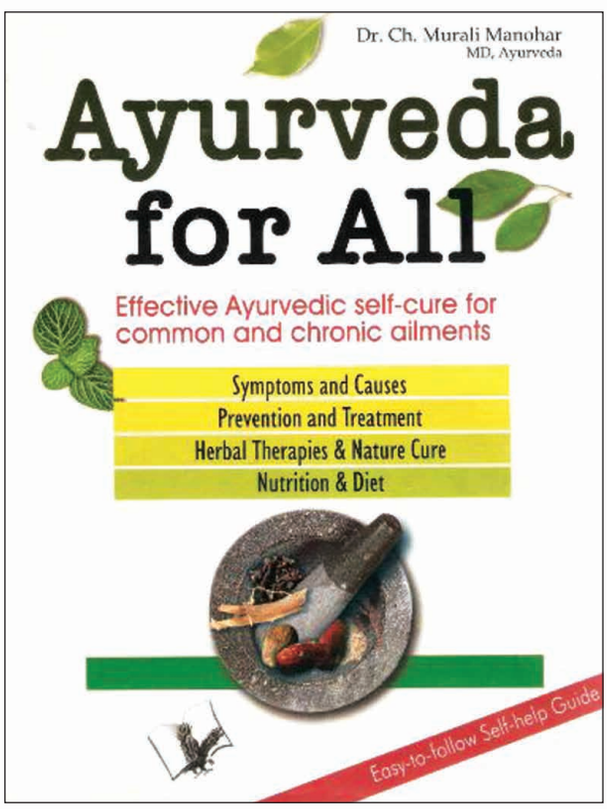
However given the competition in the category and the influence of the leading brands, convincing the Dental Profession was a challenge for the brand. Our break through was achieved with the persistence activity.

Link Sudantha brand is now has the acceptance of the prestigious General Dental Practitioners Association (GDPA). The dental profession plays a paramount role in educating and guiding the general public on the importance of good oral hygiene, which helps to protect the teeth and gums, throughout life. The value of teeth and the importance it plays in healthy living cannot be over-emphasised.

Acceptance by the GDPA, provides an additional support to Link Sudantha, to continue to provide "Total Oral care" to the people of Sri Lanka.

BOOK REVIEWS

AYURVEDA FOR ALL: EFFECTIVE AYURVEDIC SELF-CURE FOR COMMON AND CHRONIC AILMENTS



Author : *Dr.Ch. Murali Manohar*

ISBN : *978-93-813849-0-9*

Publisher : *V & S Publishers, Delhi*

Language : *English*

Ayurvedic medicine is one of the most popular and trusted body healing systems in the world. It is known for ensuring good health by reducing the imbalance in the three Doshas, which are ways of categorizing the body's three basic energy types: *Vatha, Pitha* and *Kapha.* Presently, there is a huge trend to maintain the good health by using Ayurvedic herbs, practices and recommendations including yoga and meditation.

This book Ayurveda for All, covers a wide range of information regarding the Ayurveda concepts, the role of diet and seasons in health and diseases, diseases of major systems in the human body, metabolic and joint diseases, diseases of the skin, hair and the skin.

It is really interesting to read different kinds of home (kitchen) remedies for diseases mentioned in the book and the author has included some queries & answers which will be really valuable to readers.

This book is recommended to anyone who is interested in Ayurveda/ folk medicine and the book elaborates on the central tenets of Ayurveda and the various benefits of Ayurvedic therapies. Conditions ranging from a minor stuffy nose to the potentially fatal brain stroke are all dealt with in simple, scientific and lucid language in this easy-to- follow self-help guide.

DIGEST MAIL BOX

Letter 1

Dear Sir/ Madam,

I happened to read volume 11, issue 1 of Link digest. It is really interesting especially article regarding the Durian fruit. I would like to receive the copy Link digest . My postal address is given below.

Thank you

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NOTE TO POTENTIAL CONTRIBUTORS

Link Natural Digest

The DIGEST is a popular publication, albeit a scientific one, dedicated to medicinal plants, herbal healthcare and personal care products, essential oils, aromatherapy, herbal therapy and Ayurveda, and related healthcare systems. It is published bi-annually.

The DIGEST welcomes contributions in English in the category of reviews, brief communications, ethno reports in brief, phytomedical and phytochemical communications, book reviews, and reports on safety and efficacy of phytomedicines.

Potential authors may consult the Editor-in-Chief prior to dispatch of communications, reports and reviews.

Authors may submit manuscripts by By email to :

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Please forward to the editor one original hard copy and a soft copy in the form of a PC compatible diskette (Microsoft Word).

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The Digest Mail Bag Welcomes Reader's Views & Ideas.