Chapter 1

AYURVEDA

1.1 INTRODUCTION

Ayurveda is one of the most ancient medical sciences of the world. The word Ayurveda\(^1\) is a Sanskrit term meaning “Science of Life”. Ayu means “life” or “daily living”, and veda is “knowing”. Ayurveda was first recorded in the Vedas, the world’s oldest extant literature. It is the common belief that Ayurveda is eternal. This does not refer to the work of any particular author. Ayurveda is the collection of the principles of life that took birth with the world itself and is not liable to change at any time or in any part of the world. It is also believed that these principles were discovered by Brahma, the Creator himself and compiled into a large volume. This original work came to be called “Ayurveda”. Ayurveda is deeply related to the Indian cultural heritage.

Ayurveda is a simple, practical science of life whose principles are universally applicable to each individual’s daily existence. The science of Ayurveda\(^2\) is based not on constantly changing research data, but on the eternal wisdom of the rishis who received this science, expressive of the perfect wholeness of cosmic consciousness, through religious introspection and meditation.

Ayurveda is concerned with eight principle branches of medicine\(^1\): pediatrics, gynecology, obstetrics, ophthalmology, geriatrics, otolaryngology, general medicine and surgery. Each of these medical specialists is addressed according to theories of the five elements (Ether, Air, Fire, Water, Earth); the tridosha, or three bodily humors (Kapha, Pitta, Vata); the seven dhatus, or body tissues (Plasma, Blood, Muscle, Fat, Bone, Nerves, Reproductive tissues); three malas (Urine, Stools, Sweat); and the trinity of life: body, mind and spiritual awareness. The wisdom of Ayurveda is recorded in Sanskrit, the ancient language of India. Ayurveda, Yoga and Tantra are the ancient life-disciplines that have been practiced in India for centuries. Ayurveda is the science of life; Yoga is the science of union with the Divine, with Truth; and Tantra is the most direct method of controlling the energy that creates the ultimate union with Truth.
1.2 PRINCIPLES OF AYURVEDA
1.2.1 TRIDOSHAS

Human body is made up of the five principles\(^1,4,5,6\) (Panca-mahabuthas) viz. Akasa (air), vayu (vital force), Tejas (some minerals, acids, alkalis etc), jala (water) and prthvi (organic substances and earthly matter not included in others). Any part of the body, how so ever minute, is an inseparable combinations of these principles. In Ayurveda, combinations of these principles are classified into three, viz. Vayu or Vata, Mayu or pitta and Valasa or Kapha. Of these the first is a combination of Akasa and Vayu, the second is Tejas, and the third is a combination of Prthvi and Jala. These three mage-divisions of the body particles are called the Tridoshas. These not only build and sustain all parts of the body but also fulfill all biological function when alive. These cannot be detected in their original form in any parts of the body. We must identify these with those parts of the body, where they predominate. Accordingly, Valasa is a combination of the materials used for structuring and sustaining the body, Mayu is a combination of the materials that digest the food and transform it into body constituents, and Vayu is that body-constituent that generates power and motivity. Besides, Vayu includes that body-constituent that carries oxygen to the part of the body for activating their bio-functions.

These three elements – vata, pitta and kapha govern all the biological, psychological and psychopathological functions of the body, mind and consciousness. They act as basic constituents and protective barriers for the body in its normal physiological condition; when out of balance, they contribute to disease processes.

1.2.2 DHATUS

The human body consists of seven basic and vital tissues called dhatus\(^1,5\). The Sanskrit word dhatu means, “constructing element”. These seven are responsible for the entire structure of the body. The dhatus maintain the functions of the different organs, systems and vital parts of the body. They play a very important role in the development and nourishment of the body.

The dhatus are also part of the biological protective mechanism. With the help of agni, they are responsible for the immune mechanism. When one dhatu is defective, it affects the successive dhatu, as each dhatu receives its nourishment from the previous dhatu. The following are the seven most important dhatus in serial order:
1. **Rasa** (plasma) contains nutrients from digested food and nourishes all the tissues, organs and systems.

2. **Rakta** (blood) governs oxygenation in all tissues and vital organs and maintains life.

3. **Mamsa** (muscle) covers the delicate vital organs, performs the movements of the joints and maintains the physical strength of the body.

4. **Meda** (fat) maintains the lubrication and oiliness of all the tissues.

5. **Asthi** (bone) gives support to the body structure.

6. **Majja** (marrow and nerves) fills up the bony spaces and carries motor and sensory impulses.

7. **Shukar and Artav** (reproductive tissues) contain the ingredients of all tissues and are responsible for reproduction.

The seven dhatus are understood in a natural, biological, serial order of manifestation. The post-digestion of food, called ‘nutrient plasma,’ ahara rasa, contains the nutrition for all the dhatus. This ‘nutrient plasma’ is transformed and nourished with the help of heat, called dhatu agni, of each respective dhatu.

Rasa is transformed into rakta, which is further manifested into mamsa, meda, etc. This transformation results from three basic actions: irrigation (nutrients are carried to the seven dhatus through the blood vessels); selectivity (each dhatu extracts the nutrients it requires in order to perform its physiological functions); and direct transformation (as the nutritional substances pass through each dhatu, the food for the formation of each subsequent dhatu is produced). These three processes—irrigation, selectivity and transformation—operate simultaneously in the formation of the seven dhatus. The dhatus are nourished and transformed in order to maintain the normal physiological functions of the different tissues, organs and systems.

### 1.2.3 TRIMALAS

Imbalances in other bodily systems, such as the waste systems, also may result in disease. The body produces three waste products, or malas\(^1\): feces, which are solid; and urine and sweat, which are liquid. The production and elimination of these is absolutely vital to health. Urine and feces are formed during the digestive process in the large intestine, where assimilation, absorption and discrimination between essential and nonessential substances take place. Faces are carried to the rectum for
evacuation; urine is carried to the kidneys for filtration and then stored in the bladder for elimination; and sweat is eliminated through the pores of the skin.

Though they are considered bodily waste products, the urine and feces are not strictly waste. They are, in fact, to some extent essential to the physiological functioning of their respective organs. For example, feces supply nutrition through intestinal tissues: many nutrients remain in the feces after digestion. Later, after these are absorbed, the feces are eliminated.

Feces also give strength to the large intestine and maintain its tone. If a person has no feces, the intestine will collapse. A person who suffers from constipation lives longer than one who suffers from diarrhea. If diarrhea continues for fifteen days, death will follow. However, one can experience prolonged constipation and live, though it will cause problems in the bodily systems. Constipation creates distention and discomfort, flatulence and pains in the body, headache and bad breath.

The urinary system removes the water, salt and nitrogenous wastes of the body. Urine is formed in the large intestine. This waste product helps to maintain the normal concentration of water electrolytes within the body fluids. The functioning of this mala depends upon the water intake, diet, environmental temperature, mental state and physical condition of the individual.

The color of the urine depends upon the diet. If the patient has a fever, which is a pitta disorder, the urine will become darkish yellow or brownish. Jaundice, which is also a pitta disorder, causes dark yellow urine. Bile pigmentation may give the urine a greenish color. Excess pitta may create high acidity in the urine. The substances that stimulate urination, such as tea, coffee and alcohol, also aggravate pitta.

If the body retains water, the urine will be scanty and this water will accumulate in the tissues. This condition, in turn, will affect the blood and increase the blood pressure. So, balanced urine production is important for the maintenance of blood pressure and volume.

1.3 KEY TO HEALTH OR DISEASE

Agni is the biological fire that governs metabolism. It is similar in its function to pitta and can be considered an integral part of the pitta system in the body, functioning as a catalytic agent in digestion and metabolism. Pitta contains heat-
energy, which helps digestion. This heat-energy is agni. Pitta and agni are essentially the same with this subtle difference: pitta is the container and agni is the content.

Pitta manifests in the stomach as the gastric fire, agni. Agni is acidic in nature and its action breaks down food and stimulates digestion. Agni is also subtly related to the movement of vata because bodily air enkindles bodily fire. In every tissue and cell, agni is present and necessary for maintaining the nutrition of the tissues and the maintenance of the autoimmune mechanism. Agni destroys micro-organisms, foreign bacteria and toxins in the stomach and small and large intestines. In this way, it protects the flora in these organs.

Longevity depends upon agni. Intelligence, understanding, perception and comprehension are also the functions of agni. Agni maintains the color of the skin, and the enzyme system and metabolism totally depend upon Agni. As long as agni is functioning properly, the processes of breaking down food and adsorbing and assimilating it into the body will operate smoothly.

When agni becomes impaired because of an imbalance in the tridosha, the metabolism is drastically affected. The body's resistance and immune system are impaired. Food components remain undigested and unabsorbed. They accumulate in the large intestine turning into a heterogeneous, foul-smelling, sticky substance. This material, which is called ama, clogs the intestines and other channels, such as capillaries and blood vessels. It eventually undergoes many chemical changes, which create toxins. These toxins are absorbed into the blood and enter the general circulation. They eventually accumulate in the weaker parts of the body, where they create contraction, clogging, stagnation and weakness of the organs and reduce the immune mechanism of the respective tissues. Finally, a disease condition manifests in the affected organs and is identified as arthritis, diabetes, heart disease and so on.

The root of all disease is ama. There are many causes for the development of ama. For example, whenever incompatible foods are ingested, agni will be directly affected as a result of the toxins, or ama, created from these poorly digested foods. If the tongue is coated with a white film, this symptom indicates that ama exists in the large intestine, small intestine or stomach, depending upon which part of the tongue is coated.

Ama develops when agni's function is retarded; however, overactive agni is also detrimental. When agni becomes hyperactive, the digestive process burns away,
through over combustion, the normal biological nutrients in the food and emaciation results. This condition also lowers the body’s immunity.

1.4 AYURVEDIC MEDICINES

The pharmacology of Ayurveda is a vast science including thousands of medicines, many of them herbal preparations. In addition to these herbal cures, the use of the healing properties of gems, metals and colors are recommended. The classic Ayurvedic texts state that all substances found in nature have medicinal value when used in proper manner. Ayurveda is a very practical science and the advice that follows, suggesting simple treatments for minor ailments and utilizing herbs commonly found in the kitchen, is straightforward and effective.

Ayurvedic Medicines includes different plants, minerals and materials of animal and marine origin. However, these substances cannot be used as they are since they are not ‘Assimilable’ (Satmya) to the body, and they have to be processed indifferent ways. Refining by pounding of sifting, brewing, extracting fresh juice, are all primary steps after which different kinds of ‘Kalpak’ (Formulation) are made, from them. In short, pure and useful products (that are ‘Satmya’) to the body are prepared from raw materials and this may called as production of medicines or ‘Aushadhi Nirman’.

Any ‘Kalpa’ is made only after the primary steps like squeezing out the juice from the material, refining the material, crushing it, letting it brew in water, mixing its coarse particles with hot water and straining it etc. e.g. Making the material fine, mixing it with particular medicines while making ‘guti-vati’ or boiling the crushed material and then combining it while making ‘Asava-arishta’ an elementary procedures.

The ‘Shodhan’ process reduces the harmfulness of some materials, some need to be purified. Toxic substances are diluted to make them usable to the body. Certain substances mixed with the material as its source, can also be removed by the ‘Shodhan’ activity.

Choorna – selected, well-dried material is chopped into pieces, powdered mechanically and then sifted finely. Choorna may be made from a single plant (Ekeri). If made from more plants, it is called ‘Mishra choorna’.
Guti Vati-materials are turned into a fine ‘choorna’ treated with particular medicinal juices or quath (decoction) dried and made into pills or tablets mechanically.

When ‘guggul’ is used to produce medicines according to the above procedure, it is called ‘Guggul kalpa’. When ‘Suvarna – bhasma’ is mixed with other medicines, they are called ‘Suvarna – yukta gutika’ (tablets containing gold bhasma). For e.g. Suvarna malini vasant, gold compound etc. Big, longish pills made this way grated in water or some suitable medium. e.g. – lepaguti. ‘Siddha’ oil or ghee – medicinal materials are used to enrich ghee, oil etc. or fatty substances is medicinally reduced to useful forms. Such fortified oils may be used for ‘Abhyanga’, massage, gargling rubbing the head, ear – drops or nose – drops. Enriched ghee is used internally. Avaleha or Lehya is a semisolid preparation of drugs, prepared with the addition of jaggery, sugar candy and boiled with prescribed drug juice or decoction e.g. Chyavanprash.

Pravahi Avaleha (Syrup) – The materials are boiled, sugar is added to make a syrup. Ghanasar –(thick pulpy mass) –The decoctions is boiled and thickened. Such a ‘Ghanasar’ is made while producing Asanad.

‘Paak- Kalpana’- when the main medicinal material is juicy, it may be shredded or made into a kalpha then steamed or roasted with ghee to remove its liquid content. If dry, the material is powdered, cooked in milk etc., to form a mass that is mixed with a thick sugar syrup along with the other components and then diced. For e.g. Erandapak

Asava- Arishta- Quatha-The juice or extract of medicinal plants is mixed with jaggery, sugar, honey or other sweeteners and ‘Kinwa’ (fermentation) or equivalent material, brewed for a period for 2-3 months after which a ‘Kalpa’ is produced from it. All the three material can yield alcohol. This ‘Kapla’ can be easily absorbed by the body, is curative and lasts long.

Malam (ointment)- Base material like Ghee, Vaseline, is mixed with medicinal material to prepare ointments or ‘malam kalpa’.

Prapati- prapati is rasa (mercury) preparation. The name is derived from the method by which flakes of the compound are obtained.

Pishti- Drug is triturated with the specified liquids and exposing to the sun or moonlight.
Bhasma (Clax)- Medicinal material is roasted in fire after purification. This heating is repeated after treatment; metals like iron and gold or materials like coral, conches etc. are made ‘Satmay’ by this process.

Kupi-pakwa rasayan- Metallic mercury is processed with other medicines and heated well. A glass bottle covered with layers of cloth and earth are used for this. This is called ‘Kupi-pakwa’ (bottle-heated) because the medicines and mercury are heated in a special bottle. Such products are very potent.

Arka- when useful content of some material is volatile, it has to be extracted by a different method, in ‘Arka’ form. e.g. ‘Ova’ arka.

1.5 ASAVA

A variety of medicinal\textsuperscript{3,5,7} herbs and their leaves, flowers, fruits, peels, roots, gum and resins; gems, metals and colors are used. The Sanskrit names of medicinal plants and metals have been used to indicate the standard names of asava. For example, the basic medicinal plant used in the production of Arvindasava is Lotus. The Sanskrit name of Lotus is Arvind.

The juice or extract of medicinal plants is mixed with jaggery, sugar, honey or other sweeteners and ‘Kinwa’ (fermentation) or equivalent material, brewed for a period of 2-3 months after which an ‘Asava’ is produced from it. Asava (herbal wines) is a self generated alcoholic preparation or fermented liquids. This ‘Asava’ can be easily absorbed by the body, is curative and lasts long.

The commonly used medicinal plants\textsuperscript{3,7,9,11}, gems and metals are Lotus (Arvindasava), Sandalwood (Chandanasava), Java long pepper (Chavikasava), Black raisins (Drakshasava), Beetle killer, Thorn Apple (Kanakasava), Loh, Casia, Nut grass (Lodhrasava), Dry ginger, Ajowan (Lohasava), Turmeric, Clove, Betel nut (Pippalyasava), Castor oil plant, Margosa (Punarnavasava), Jaman, Banyan, Velvet, Lotus, Cashmere, Cuscuta grass (Uhsirasava), Cinnamon Bark, Mesua, Cubeb (Vasakasava) etc.

The cell of living plants\textsuperscript{7,8,9} consists of chemical compounds like carbohydrates, proteins, fats etc. Human utilizes these compounds as food matter. There are other compounds like alkaloids\textsuperscript{19}, tannins, glycosides etc. and these compounds exert physiological effects and used as therapeutic agents. These
compounds are of chemical origin and are used as crude or the production of extraction.

**CARBOHYDRATES**

Carbohydrates\textsuperscript{16,17} are the first group of bioorganic compounds found in biological systems. Carbohydrates are important constituents of all living organisms, and have a variety of different functions. Some are important structural components of cells and some act as recognition sites on cell surfaces. Other serve as a major source of metabolic energy. For example, the leaves, fruits, seeds, and roots of plants contain carbohydrates that plants use for their own metabolic needs and that serve the metabolic needs of the animals that eat them.

There are two classes of carbohydrates – simple carbohydrates and complex carbohydrates. Simple carbohydrates are monosaccharides (single sugar), whereas complex carbohydrates contain two or more sugar units linked together. Monosaccharides contain alcohol and aldehyde functional groups. If the hemiacetal group of a monosaccharide forms an acetyl by reacting with an alcohol group of another monosaccharide, the glycoside that is formed is a disaccharide. Deoxy sugars are sugars in which one of the OH groups is replaced by hydrogen. Ribose is the sugar component of RNA, while 2-deoxyribose is the sugar component of DNA. In amino sugars an amino group replaces one of the OH groups. The antibiotics contain amino sugars. Glucose is the major source of energy for the brain.

Blood type (A, B, or O) is determined by the nature of the sugar bound to the protein on the outer surface of red blood cells. Each type of blood is associated with a different carbohydrate structure. Type AB blood has the carbohydrate structure of both type A and B. Antibodies are proteins that are synthesized by the body in response to a foreign substance, called an antigen. The immune system of type A people recognizes the blood from type B people as being foreign and vice versa. The immune system of people with type A, B, or AB blood does not recognize type O blood as being foreign, because the carbohydrates in type O blood is also a component of types A, B, and AB blood. Thus, anyone can accept type O blood - people with type O blood are universal donors. Type AB people can accept types A, B, and O blood – people with type AB blood are universal acceptors.
PROTEINS

The three kinds of polymers prevalent in nature are polysaccharides\(^{15,16}\), proteins and nucleic acids. Peptides and proteins are polymers of amino acids linked together by amide bonds. Hair, horns, hoofs, feathers, fur, and the tough outer layer of skin are all composed largely of a protein called keratin. Keratin is a structural protein. Collagen, another structural protein, is a major component of bones, muscles, and tendons. Some protect have other protective functions. Snake venoms and plant toxins, for example, protect their owners from other species, blood-clotting proteins protect the vascular system when it is injured, and antibodies and protein antibiotics protect us from disease. A group of proteins called enzymes catalyze the chemical reactions that occur in living organisms, and some of the hormones that regulate these reactions are peptides. Proteins are also responsible for many physiological functions such as the transport and storage of oxygen in the body and the contraction of muscles. An enzyme that has a tightly bound metal ion (\(\text{Co}^{2+}, \text{Cu}^{2+}, \text{Fe}^{2+}, \text{Mo}^{2+}, \text{Zn}^{2+}\)) is known as a metalloenzyme. Cofactors that are organic molecules are called coenzymes. Coenzymes are derived from organic compounds that are commonly known as vitamins.

A vitamin is a substance that is needed in small amounts for normal body function that the body cannot synthesize. Vitamins are divided into two classes—water-soluble vitamins and water-insoluble vitamins. Vitamins A, D, E, and K are water-insoluble. Vitamin K is the only water-insoluble vitamin currently recognized to function as a coenzyme. Vitamin A is required for proper vision, vitamin D regulates calcium and phosphate metabolism, and vitamin E is an antioxidant.

FATS

Fats\(^{16,17}\) and oils are naturally occurring mixture of triacylglycerols. They differ in their fats are solids at room temperature while oils are liquids. Fats have a main function as energy storage. Carbohydrates serve as a source of readily available energy. Hydrolysis of fats yields glycerol and long-chain fatty acids. Fatty acids are characterized by the presence of a carboxyl group at the end of the chain. The fats are found, we said, in storage fat cells of plants and animals.

The body is composed of a wide variety of tissues, and medicines have a different affinity for each of them. One of greater importance is the degree of medicine distribution between fat and blood.
ALKALOIDS

Alkaloids\textsuperscript{16,19} are natural products containing one or more nitrogen heteroatoms that are found in the leaves, bark, roots, or seeds of plants. Examples include caffeine (found in tea leaves, coffee beans, and cola nuts) and nicotine (found in tobacco leaves). Morphine is an alkaloid obtained from opium, the juice derived from a species of poppy. Morphine is 50 times stronger than aspirin as an analgesic, but it is addictive and suppresses respiration. Heroin is a synthetic compound that is made by acetylation of morphine. Alkaloids have the general properties of amines.

ETHANOL

The ethanol\textsuperscript{15,17} (C\textsubscript{2}H\textsubscript{5}OH) and water (H\textsubscript{2}O) are highly polar protic solvents. They have hydroxyl (-OH) group that allow them to form hydrogen bonds. The intermolecular hydrogen bonds are strong enough to impose a relatively high degree of structural order on systems in which they are possible. The highly electronegative oxygen atom tends to withdraw the single electrons from the hydrogen atoms, leading to its electrical asymmetry (dipole moment) and the ability of the molecule to act as proton donors to form hydrogen bonds with other molecules. The ethanol can also form hydrogen bond with other proton donor or acceptor chemical groups, such as the amino, carboxyl, carbonyl and cyanide groups. The hydrogen bonds being made and broken about 10\textsuperscript{11} times a second in liquid provide the strong intermolecular attractive forces that give rise to the extraordinary physical and electrical properties. The molecular structure of ethanol and water molecules is as shown in fig.1.1 and 1.2 respectively.

Ethanol (C\textsubscript{2}H\textsubscript{5}OH)

\begin{itemize}
  \item Molecular weight : 46.07
  \item Density : 0.7893 gm/cc
  \item Dipole moment $\mu$ : 1.69 D
  \item Melting point : -117.3\degree C
  \item Boiling point : 78.5\degree C
  \item Refractive index : 1.3611
  \item Static Permittivity : 24.30 at 25\degree C
  \item Solubility : Wat,Eth,Ace,Bz
  \item Chemical Properties: Hygroscopic
  \item CAS No. : 64-17-5
\end{itemize}

\textbf{Fig.1.1} Physical parameters and molecular structure of Ethanol.
Water (H₂O)

- Molecular weight: 18.0153
- Density: 1.00 gm/cc
- Dipole moment μ: 1.85 D
- Melting point: 0°C
- Boiling point: 100°C
- Refractive index: 1.3330
- Static Permittivity: 78.23 at 25°C
- Solubility: Good solvent
- Chemical Properties: Colourless liquid

Fig. 1.2 Physical parameters and molecular structure of Water.

1.6 OUTLINE OF THE THESIS

CHAPTER 1: This chapter covers the brief discussion of Ayurveda, Principles of Ayurveda, Ayurvedic medicines and ASAVA Ayurvedic medicines.

CHAPTER 2: This chapter covers the brief discussion of Dielectric polarization, Dielectric relaxation, Areas of dielectric study, Dielectric spectroscopy, Literature survey and Introduction to problem with list of systems presented in thesis.

CHAPTER 3: The explanation of different dielectric relaxation theories and theoretical models to predict molecular interactions in binary mixtures are given in this chapter.

CHAPTER 4: This chapter deals with experimental setup and method of data analysis used in present work. The mathematical equations used for determination of different dielectric parameters are also given in this chapter.

CHAPTER 5 & 6: This chapter gives detail explanation of dielectric relaxation behavior of Ayurvedic medicines “ASAVA” in ethanol at four different temperatures. The correlation between different dielectric parameters and molecular interactions for all systems are discussed in this chapter.

CHAPTER 7: The conclusions together with comparative discussions are presented in this chapter.
REFERENCES