Lecture synopsis Sub: Natural Drug Technology

Subject I/C: Mohini Upadhye

Lecture No: 1

Name of topic/lesson – Cultivation, Harvesting and Storage of Crude Drugs

Subtopic: Factors influencing level of plant metabolites

Objective: To study various Factors influencing level of plant metabolites

Topic Outcomes: At the end of topic you should be

1. Able to know various Factors influencing level of plant metabolites
2. Knowledge of the factors that determine the chemical variability and yield for each species

Several of the factors of influence have been studied, in particular for commercially important crops, to optimize the cultivation conditions and time of harvest and to obtain higher yields of high-quality essential oils that fit market requirements. In addition to the commercial importance of the variability in yield and composition, the possible changes are also important when the essential oils and volatiles are used as chemotaxonomic tools. Knowledge of the factors that determine the chemical variability and yield for each species are thus very important.

These include:

(a) physiological variations;

(b) environmental conditions;

(c) geographic variations;

(d) genetic factors and evolution;

(e) political/social conditions; and also

(f) amount of plant material/space and manual labour needs

References

1. Pharmacognosy by C. K. Kokate 55th edition, Nirali Prakashan.

2. Trease and Evans Pharmacognosy 16th Edition.

Lecture No: 2

Name of topic/lesson – Cultivation, Harvesting and Storage of Crude Drugs

Subtopic: method of cultivation, harvesting and storage

Objective: To study various methods of cultivation, harvesting and storage

Topic Outcomes: At the end of topic you should be

1. Able to study various methods of cultivation, harvesting and storage
2. Knowledge of the parameters considered for cultivation, harvesting and storage of crude drugs.

Cultivation of Crude Drugs:

Cultivation of medicinal plants requires intensive care and management. The conditions and duration of cultivation required vary depending on the quality of medicinal plant materials required.

Methods of Propagation:

Vegetative propagation

Seed Propagation

Microsporogenesis, Pollination, Microgametogenesis, Megasporogenesis,

Megagametogenesis, Fertilization, Embryogeny

Collection:

Medicinal plant materials should be collected during the appropriate season or time period to ensure the best possible quality of both source materials and finished products. It is well known that the quantitative concentration of biologically active constituents varies with the stage of plant growth and development.

Harvesting:

Medicinal plants should be harvested during the optimal season or time period to ensure the production of medicinal plant materials and finished herbal products of the best possible quality

Storage:

Storage facilities for medicinal material should be well aerated, dry and protected from light, and, when necessary, be supplied with air-conditioning and humidity control equipment as well as facilities to protect against rodents, insects and livestock.

References

1. Pharmacognosy by C. K. Kokate 55th edition, Nirali Prakashan.

2. Trease and Evans Pharmacognosy 16th Edition.

Lecture No: 3

Name of topic/lesson – Cultivation, Harvesting and Storage of Crude Drugs

Subtopic: Primary and secondary factors affecting on deterioration of crude drugs,

Objective: To study various primary and secondary factors affecting on deterioration of crude drugs,

Topic Outcomes: At the end of topic you should be

1. Able to study various primary and secondary factors affecting on deterioration of crude drugs,
2. Knowledge about preserving crude drugs against these deteriorations.

Deterioration of Herbal Drugs Besides being adulterated by different means, also the crude drugs are prone to deterioration on storage. The shelf-life of crude drugs are influenced by many factors which include not only the quality of storage conditions but also the stability of the secondary (2°) metabolites present therein. Several factors are to be considered for the detrimental effects on the stored products

Primary Factors causing deterioration

(a) light
(b) Moisture/Humidity
(c) Temperature
(d) Airic Oxidation

Secondary Factors causing deterioration

(a)Bacteria and Moulds
(b) Mites and Nematode Worms
(c) Insects/Moths
(d) Coleoptera or Beetles.

References

1. Pharmacognosy by C. K. Kokate 55th edition, Nirali Prakashan.
2. Trease and Evans Pharmacognosy 16th Edition.

Lecture No: 4

Name of topic/lesson – Cultivation, Harvesting and Storage of Crude Drugs

Subtopic: WHO guidelines for good agricultural and collection practices (GACP).

Objective: To study WHO guidelines for good agricultural and collection practices (GACP).

Topic Outcomes: At the end of topic you should be

1. Able to know WHO guidelines for good agricultural and collection practices (GACP).

Under the overall context of quality assurance and control of herbal medicines, WHO developed the Guidelines on good agricultural and collection practices (GACP) for medicinal plants, providing general technical guidance on obtaining medicinal plant materials of good quality for the sustainable production of herbal products classified as medicines. These guidelines are also related to WHO's work on the protection of medicinal plants, aiming promotion of sustainable use and cultivation of medicinal plants.

The main objectives of these guidelines are to:

1. contribute to the quality assurance of medicinal plant materials used as the source for herbal medicines to improve the quality, safety and efficacy of finished herbal products;

2. guide the formulation of national and/or regional GACP guidelines and GACP monographs for medicinal plants and related standard operating procedures; and

3. encourage and support the sustainable cultivation and collection of medicinal plants of good quality in ways that respect and support the conservation of medicinal plants and the environment in general.

These guidelines concern the cultivation and collection of medicinal plants and include certain post-harvest operations.

Good agricultural and collection practices for medicinal plants are the first step in quality assurance, on which the safety and efficacy of herbal medicinal products directly depend. These practices also play an important role in protection natural resources of medicinal plants for sustainable use.

References

GACP guidelines, WHO

Lecture No: 5

Name of topic/lesson – Plant Biotechnology

Subtopic: Applications of Plant Tissue Culture in production of secondary metabolites

Objective: To study Applications of Plant Tissue Culture in production of secondary metabolites

Topic Outcomes: At the end of topic you should be

1. Able to know Applications of Plant Tissue Culture in production of secondary metabolites
2. Successful examples for these techniques.

Production of Secondary Metabolites:

The process of in vitro culture of cells for the large scale production of secondary metabolites is complex, and involves the following aspects:

1. Selection of cell lines for high yield of secondary metabolites.
2. Large scale cultivation of plant cells.
3. Medium composition and effect of nutrients
4. Elicitor-induced production of secondary metabolites.
5. Effect of environmental factors.
6. Biotransformation using plant cell cultures.
7. Secondary metabolite release and analysis.

References

Biotechnology by u. Satyanarayan, 12th edition

Lecture No: 6

Name of topic/lesson – Plant Biotechnology

Subtopic: Production-Selection of cell lines for high yield of secondary metabolites

Objective: To study how to select cell lines for high yield of secondary metabolites

Topic Outcomes: At the end of topic you should be

1.Able to know method of selection of cell lines for high yield of secondary metabolites

2. Successful examples for these techniques.

Plant cell cultures represent a potential source of valuable secondary metabolites which can be used as food additives, nutraceuticals, and pharmaceuticals. The synthesisof phytochemicals by the cell cultures in contrast to these in plants is independent of environmental conditions and quality fluctuations. In many cases, the chemical synthesis ofmetabolites is not possible or economically feasible. Moreover, the natural food additivesare better accepted by consumers in contrast to those which are artificially produced.In this chapter, the process for obtaining the secondary metabolites from plant cellcultures is represented as a multi-stage strategy as according to specifications of cell cultures or products. For the establishing of high-producing and fast-growing cell lines, the parent plants should be selected. The expres-sion of synthetic pathways can be influenced by environmental conditions, the supply ofprecursors, and the application of elicitors, and it can be altered by special treatmentssuch as biotransformation and immobilization. The efficiency of bioprocessing can be in-creased by the simplification of methods for product recovery, based on the principle ofcontinuous product release into the cultivation media. This can be induced through influencing membrane permeability by chemical or physical factors, e.g., high electric fieldpulses.The combined research in the fields of establishment of in vitro cultures, targeting ofmetabolite synthesis, and development of technologies for product recovery can exploitthe potential of plant cells as sources of secondary metabolites

References

Biotechnology by u. Satyanarayan, 12th edition

Lecture No: 7

Name of topic/lesson – Plant Biotechnology

Subtopic: Elicitors induced production of secondary metabolites

Objective: To study Elicitors induced production of secondary metabolites

Topic Outcomes: At the end of topic you should be

1. Able to know Elicitors induced production of secondary metabolites
2. Successful examples for these techniques.

An 'elicitor' may be defined as a substance which, when introduced in small concentrations to a living cell system, initiates or improves the biosynthesis of specific compounds.

Elicitation is the induced or enhanced biosynthesis of metabolites due to addition of trace amounts of elicitors. Classification of Elicitors

Elicitors can be classified on the basis of their 'nature' like abiotic elicitors or biotic elicitors, or on the basis their 'origin' like exogenous elicitors and endogenous elicitors

Pharmaceutically significant secondary metabolites or phytopharmaceuticals include alkaloids, glycosides, flavonoids, volatile oils, tannins, resins etc. Currently, most of these secondary metabolites are isolated from wild or cultivated plants because their chemical synthesis is either extremely difficult or economically infeasible. Biotechnological production in plant cell cultures is an attractive alternative, but to date this has had only limited commercial success because of a lack of understanding of how these metabolites are synthesized. Plants and/or plant cells in vitro, show physiological and morphological responses to microbial, physical or chemical factors which are known as 'elicitors'. Elicitation is a process of induced or enhanced synthesis of secondary metabolites by the plants to ensure their survival, persistence and competitiveness. Here, we discuss the classification of elicitors, their mechanism of action, and applications for the production of phyto-pharmaceuticals from medicinal plants.

References

Biotechnology by u. Satyanarayan, 12th edition

Lecture No: 8

Name of topic/lesson – Plant Biotechnology

Subtopic: Biotransformation using Plant Cell Culture

Objective: To study Biotransformation using Plant Cell Culture

Topic Outcomes: At the end of topic you should be

1. Able to know Biotransformation using Plant Cell Culture
2. Successful examples for these techniques.

Biotransformation is chemical reactions catalyzed by cells, organs or enzymes. It is defined as a process through which the functional groups of organic compounds are modified by living cells to a chemically different product. Biotransformation explores the unique properties of biocatalysts, namely their stereo-and region-specificity and their ability to carry out reactions at no extreme pH values and temperatures. Biotransformation may be used to carry out specific conversions of complex substrates using plant, animal or microbial cells or purified enzymes as catalyst. Biotransformation is different from biosynthesis where complex products are assembled from simple substrates by whole cells, organs or organisms. They are also different from biodegradations in which complex substances are broken down to simple ones. Biotransformation has great potential to generate novel products or to produce known products more efficiently.

However, for a successful and viable process, the following prerequisites must be met

1. The culture must have the essential enzymes.
2. The substrate or precursor must not be toxic to the cell culture.
3. The substrate must reach the appropriate cellular compartment of the cell.
4. The rate of product formation must be faster than its further metabolism.

Peganum harmala cell culture converted geranyl acetate to geraniol and linalyl acetate to linalool and α-terpineol.

The alkaloid nitrosamine, which contains seven stereogenic centers, is present in *Nitraria schoberi*as a racemate. Isolation of a chiral metabolite might be due to spontaneous nonenzymatic reactions starting from an achiral precursor followed by enzyme-catalyzed metabolism of one of the enantiomers

Catharanthus roseus suspension cell cultures can oxidize the phenylsulphonyl group from completely synthetic molecules to phenylsulfonyl derivatives

References

Biotechnology by u. Satyanarayan, 12th edition

Lecture No: 9

Name of topic/lesson – Plant Biotechnology

Subtopic: Types of cultures, Transgenic plants, Gene Transfer

Objective: To study Types of cultures, Transgenic plants, Gene Transfer

Topic Outcomes: At the end of topic you should be

1. Able to know Types of cultures, Transgenic plants, Gene Transfer
2. Successful examples for these techniques.

Genetic transformation involves the integration of gene into genome by means other than fusion of gametes or somatic cells. The foreign gene (termed the "transgene") is incorporated into the host plant genome and stably inherited through future generations. This plant transformation approach is being used to generate plant processing trails, unachievable by conventional plant breeding, especially in case where there is no source of the desired trait in the gene pool.

Genetic transformation involves the integration of gene into genome by means other than fusion of gametes or somatic cells. The foreign gene (termed the "transgene") is incorporated into the host plant genome and stably inherited through future generations. This plant transformation approach is being used to generate plant processing trails, unachievable by conventional plant breeding, especially in case where there is no source of the desired trait in the gene pool.
1. Plasmids selection (creating a custom circular strand of DNA)
2. Plasmids replication (so that it can be easily worked with T-DNA)
3. T-DNA region (inserting the DNA into the *Agrobacterium*)

Co-integrate pTi vector
1. Binary vector
2. Cauliflower mosaic virus
3. Gemini viruses
4. Tobacco mosaic virus
5. Bromo mosaic virus

References

Biotechnology by u. Satyanarayan, 12th edition

Lecture No:10

Name of topic/lesson – In-vitro Screening Methods & its Applications for Natural Products

Subtopic: Anti-inflammatory activity- COX-I & COX-II assay

Objective: To study Anti-inflammatory activity- COX-I & COX-II assay

Topic Outcomes: At the end of topic you should be

1. Able to know COX-I & COX-II assay
2. Procedure and principle behind these assays

In terms of the molecular biology, *COX-1* and *COX-2* are of similar molecular weight, approximately 70 and 72 kDa, respectively, and having 65% amino acid sequence homology and near-identical catalytic sites. The most significant difference between the isoenzymes, which allows for selective inhibition, is the substitution of isoleucine at position 523 in *COX-1* with valine in *COX-2*. The smaller Val_{523} residue in *COX-2* allows access to a hydrophobic side-pocket in the enzyme (which Ile_{523} sterically hinders)

Cyclooxygenase (COX), officially known as prostaglandin-endoperoxide synthase (PTGS), is an enzyme (specifically, a family of isozymes) that is responsible for formation of prostanoids, including thromboxane and prostaglandins such as prostacyclin, from arachidonic acid.

Pharmaceutical inhibition of *COX* can provide relief from the symptoms of inflammation and pain. Nonsteroidal anti-inflammatory drugs (NSAIDs), such as aspirin and ibuprofen, exert their effects through inhibition of COX. Those that are specific to the COX-2 isozyme are called COX-2 inhibitors. The active metabolite (AM404) of paracetamol believed to provide most or all of its analgesic effects is a COX inhibitor and this is believed to provide part of its effect.

References

Different methods for testing potential cyclooxygenase-1 and cyclooxygenase-2 inhibitors, Methods Mol Biol. 2010; 644: 91-116.

Lecture No:11

Name of topic/lesson – In-vitro Screening Methods & its Applications for Natural Products

Subtopic: Anti-cancer activity- Sulphorhodamine-B assay (SRB)

Objective: To study Anti-cancer activity- Sulphorhodamine-B assay (SRB)

Topic Outcomes: At the end of topic you should be

1. Able to know Anti-cancer activity- Sulphorhodamine-B assay (SRB)
2. Procedure and principle behind these assays

The SRB assay has been widely used to investigate cytotoxicity in cell based studies and it is the method of choice for high cost-effective screenings.Since this method does not rely on measuring metabolic activity [*e.g.*, 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide, MTT], the steps required to optimize the protocol for a specific cell line are substantially simplified

The protocol described has been optimized for medium throughput screening of miRNAs with tumor suppressive properties in adherent lung cancer cells in 96-well format and 384-well format). Particularly the SRB assay in 384-well format offers the advantage of screening large number of miRNA mimics or compounds in a single plate (> 60 per plate, 6 replicates) using inexpensive equipment and reagents.

The SRB assay has been used since its development in 1990 to inexpensively conduct various screening assays to investigate cytotoxicity in cell based studies. This method relies on the property of SRB, which binds stoichiometrically to proteins under mild acidic conditions and then can be extracted using basic conditions; thus, the amount of bound dye can be used as a proxy for cell mass, which can then be extrapolated to measure cell proliferation.

References

Sulforhodamine B (SRB) Assay in Cell Culture to Investigate Cell Proliferation, J Natl Cancer Inst. 1990;82(13):1107–1112.

Lecture No:12

Name of topic/lesson – In-vitro Screening Methods & its Applications for Natural Products

Subtopic: MTT assay, Brine Shrimp lethality assay

Objective: To study MTT assay, Brine Shrimp lethality assay

Topic Outcomes: At the end of topic you should be

1. Able to know MTT assay, Brine shrimp lethality assay
2. Procedure and principle behind these assays

MTT assay

MCF7 cells were seeded in their respective culture medium (200 µl, 1 x 104cells/well) in a 96-well plate and incubated at 37 ˚C for 24 h with 5% CO2supply. After incubation, the control wells were replenished with fresh medium and the test wells were treated with 100, 250, 500 and 1000 µg/ml of extracts. The cells were further incubated for 48 h maintaining the same conditions. After the treatment incubation period, medium in each well was replenished with 200µl of fresh medium plus 20µl of MTT (0.5 mg/ml). The plate was then incubated for 4 h in the same conditions after which the absorbance was measured at 570 nm using ELISA reader. Percentage cytotoxicity was calculated by the following formula:

% Cytotoxicity = [(Ac-At)/Ac)] X 100

Where, Ac = mean absorbance of the control wells At = mean absorbance of the test wells

Brine Shrimp lethality assay

Brine shrimps (Artemia salina) were hatched using brine shrimp eggs in a conical shaped vessel (1 L), filled with sterile artificial seawater (prepared using sea salt 38 g/L and adjusted to pH 8.5 using 1N NaOH) under constant aeration for 48 h. After hatching, active nauplii free from egg shells were collected from brighter portion of the hatching chamber and used for the assay. Ten nauplii were drawn through a glass capillary and placed in each well containing 2.0 ml of brine solution. In each experiment, 0.5ml of the plant extract was added to 2.0 ml of brine solution and maintained at room temperature for 24 h under the light and surviving larvae were counted.

References Brine Shrimp Cytotoxicity, Anti-inflammatory and Analgesic Properties of *Woodfordia fruticosa* Kurz Flowers, Iran J Pharm Res. 2012 Summer; 11(3): 851–861.

Lecture synopsis Sub: Natural Drug Technology

Subject I/C: Mohini Upadhye

Lecture No:13

Name of topic/lesson – In-vitro Screening Methods & its Applications for Natural Products

Subtopic: Anti-oxidant activity-Free Radical Scavenging Activity (DPPH), Hydrogen Peroxide (H_2O_2) scavenging assay

Objective: To study Anti-oxidant activity-Free Radical Scavenging Activity (DPPH), Hydrogen Peroxide (H_2O_2) scavenging assay

Topic Outcomes: At the end of topic you should be

1. Able to know DPPH free radical scavenging activity and Hydrogen Peroxide (H2O2) scavenging assay
2. Procedure and principle behind these assays

1, 1 Diphenyl 2- Picryl Hydrazyl is a stable (in powder form) free radical with red color which turns yellow when scavenged. The DPPH assay uses this character to show free radical scavenging activity. The scavenging reaction between (DPPH) and an antioxidant (HA) can be written as,'

(DPPH) + (H-A) ▶ DPPH-H + (A) Antioxidants react with DPPH and reduce it to DPPH-H and as consequence the absorbance decreases. The degree of discoloration indicates the scavenging potential of the antioxidant compounds or extracts in terms of hydrogen donating ability

Hydroxyl radical scavenging activity Hydroxyl radical is one of the potent reactive oxygen species in the biological system. It reacts with polyunsaturated fatty acid moieties of cell membrane phospholipids and causes damage to cell . Principle HRS assay is used to find the scavenging activity of free hydroxyl radicals (which damage the body cells) like hydrogen peroxide in the presence of different concentrations of plant sample. The model used is ascorbic acid-iron-EDTA model of hydroxyl radical generating system. This is a totally aqueous system in which ascorbic acid, iron and EDTA conspire with each other to generate hydroxyl radicals.

References

Review onin vivoandin vitromethods evaluationof antioxidant activity, Saudi Pharmaceutical Journal, 2013 (21), 143-152.

Lecture synopsis Sub: Natural Drug Technology

Subject I/C: Mohini Upadhye

Lecture No:14

Name of topic/lesson – In-vitro Screening Methods & its Applications for Natural Products

Subtopic: Nitric oxide Scavenging Activity, Reducing Power method.

Objective: To study Nitric oxide Scavenging Activity, Reducing Power method

Topic Outcomes: At the end of topic you should be

1. Able to know Nitric oxide Scavenging Activity, Reducing Power method
2. Procedure and principle behind these assays

Nitric oxide (NO) and reactive nitrogen species (RNS) are free radicals that are derived from the interaction of NO with oxygen or reactive oxygen species.

Sodium nitroprusside in aqueous solution at physiological pH spontaneously generates Nitrite oxide which interacts with oxygen to produce Nitrite ions, which can be measured at 550nm by spectrophotometer in the presence of Griess reagent.

Plant extract was dissolved in distilled water for this quantification. Sodium Nitroprusside (5mM) in standard phosphate buffer saline (0.025m, pH 7.4) was incubated with different concentration (100-400µg/ml) of methanol extract and tubes were incubated at 29oC for 3 hours. Control experiment without the test compounds but with equivalent amount of buffer was conducted in an identical manner. After 3 hours incubated samples were diluted with 1 ml of Griess reagents. The absorbance of the colour developed during diazotization of Nitrite with sulphanilamide and its subsequent coupling with Napthylethylenediaminehydrochloride was observed at 550nm on spectrophotometer. Same procedure was done with ascorbic acid which was standard in comparison to methanol extract. Calculated the % inhibition by formula and plot graph in compared to standard.

Formula: % inhibition = [O.D.of control - O.D. of Test/O.D. of control] X 100

References

Review onin vivoandin vitromethods evaluationof antioxidant activity, Saudi Pharmaceutical Journal, 2013 (21), 143-152.

Lecture No: 15

Name of topic/lesson – Traditional systems of medicine (AYUSH)

Subtopic: Basic principles of therapy in traditional system of medicine like Ayurveda

Objective: To study Basic principles of therapy in traditional system of medicine like Ayurveda

Topic Outcomes: At the end of topic you should be
1. Able to know Basic principles of therapy in traditional system of medicine like Ayurveda
2. Treatments, diagnosis and treatment in Ayurveda.

Ayurveda, Ancient Indian System of Medicines deals with knowledge that can define the quality and quantum of social and personal health status and ways to restore, maintain and upgrade it based on certain principles. The word "Ayurveda" is derived from the word Ayus meaning "life," and the word veda, which refers to "system of knowledge". Thus "Ayurveda" roughly translates as the "knowledge or science of life"

Ayurveda deals elaborately with measures of healthful living during the entire span of life and its various phases. Besides dealing with principles for maintenance of health, it has also developed a wide range of therapeutic measures to combat illness. These principles of positive health and therapeutic measures related to physical, mental, social and spiritual welfare of human beings. Thus Ayurveda became one of the oldest system of medicine dealing with both the preventive and curative aspects of life in a most comprehensive way. Life in Ayurveda is conceived as the union of body, senses, mind and soul. The living man is a conglomeration of three humours (Vata, Pitta Kapha), seven basic tissues (Rasa, Rakta, Mansa, Meda, Asthi, Majja & Shukra) and the waste products of the body.

Seasonal abnormalities, improper exercise or erratic application of sense organs and incompatible actions of the body and mind can also result in creating disturbance of the existing normal balance. The treatment consists of restoring the balance of disturbed body-mind matrix through regulating diet, correcting life-routine and behaviour, administration of drugs and resorting to preventive Panchkarma and Rasayana therapy.

References

Pharmacognosy and Phytochemistry, Dr. Vinod Rangari, Career publications.

Lecture No: 16

Name of topic/lesson – Traditional systems of medicine (AYUSH)

Subtopic: Basic principles of therapy in traditional system of medicine like Unani

Objective: To study Basic principles of therapy in traditional system of medicine like Unani

Topic Outcomes: At the end of topic you should be
1. Able to know Basic principles of therapy in traditional system of medicine like Unani
2. Treatments, diagnosis and treatment in Unani.

Unani System of medicine is one of the oldest traditional system of medicine which has strived through ages in the prevention and treatment of various medical conditions. Unani is the Arabic word for Ionian, or Greek for which popularly Unani medicine is also known as Unani Tibb or Graeco-Arab Medicine, as Arabs have developed and refined it through systematic experiment prominently by Avicenna.

According to the Unani Medicine, the pathological changes in an organ are caused mainly by derangement in the temperament and quantity of humours which leads to the accumulation of mawad-e-fasida (morbid material). So therapeutic measures aim at, restoring the equilibrium of various elements by counteracting the effect of pathological temperament existing at the time of disease with medicines and diet, supported with Ilaj bittadbeer (regimenal therapy) and then expulsion of raddi akhlat (morbid humours) by istafraag (evacuation) from the body. This helps in restoring the normal homeostasis of humours viz. body.

Following modes of treating an ailment are available in Unani system of medicine which depends upon the nature of the ailment and its causes.

a) Ilaj-bil-Tadabeer (Regimental therapy) and Ilaj-bilGhiza/ Ilaj bil-Taghziya (Dietotherapy)

b) Ilaj-bil-Dawa (Pharmacotherapy)

c) Ilaj-bil-Yad (Surgery)

References

Pharmacognosy and Phytochemistry, Dr. Vinod Rangari, Career publications.

Lecture No: 17

Name of topic/lesson – Traditional systems of medicine (AYUSH)

Subtopic: Basic principles of therapy in traditional system of medicine like Siddha and Homeopathy

Objective: To study Basic principles of therapy in traditional system of medicine like Siddha and Homeopathy

Topic Outcomes: At the end of topic you should be

1. Able to know Basic principles of therapy in traditional system of medicine like Siddha and Homeopathy
2. Treatments, diagnosis and treatment in Siddha and Homeopathy.

Unani system of medicine is a comprehensive medical system, which provides preventive, promotive, curative and rehabilitative health care. The system is holistic in nature and takes into account the whole personality of an individual rather than taking a reductionist approach towards disease. The fundamentals, diagnosis and treatment modalities of the system are based on scientific principles. The basic framework of this system is based on the Hippocratic theory of four Humours, according to which any disturbance in the equilibrium of humours causes disease and therefore the treatment aims at restoring the humoral equilibrium. The system also believes that Medicatrix Naturae (Tabiat Mudabbira-i Badan) is the supreme power, which controls all the physiological functions of the body, provides resistance against diseases and helps in healing naturally. Temperament (Mizaj) of a patient is given great importance both in diagnosis and treatment of diseases. It is also taken into consideration for identifying the most suitable diet and lifestyle for promoting the health of a particular individual.

"Homoeopathy" was introduced as a scientific system of drug therapeutics by a German Physician, Dr. Christian Frederick Samuel Hahnemann in 1805. While translating a medical treatise by Scottish physician and chemist, William Cullen, from English to German, in 1790, he came across a foot note under Cinchona that attributed its fever curing property to the astringent (decongestant) qualities of the drug. Being sceptical of Cullen's remarks concerning the effect of Cinchona for curing malaria, Hahnemann experimented its effect on himself by taking repeated doses of cinchona tincture and experienced fever, shivering and joint pains: symptoms similar to those of malarial fever. After series of experiments, Hahnemann concluded that a drug that could produce certain symptoms in healthy individuals could also cure similar disease symptoms, in accordance with some hidden, natural laws of similars as had been vaguely perceived by ancient physicians. This led to the coining of the word "homoeo-pathy" (which comes from the Greek: ὅμοιος hómoios, "-like" and πάθος páthos, "suffering"). Based on this, Hahnemann postulated the key principle of Homoeopathy, the Law of Similars, logically evolving it as an experimental science, according to the method of inductive reasoning after exact observation, correct interpretation, rational explanation and scientific construction.

References

Pharmacognosy and Phytochemistry, Dr. Vinod Rangari, Career publications.

Lecture No: 18

Name of topic/lesson – Traditional systems of medicine (AYUSH)

Subtopic: Ayurvedic dosage forms, Method of preparation and evaluation of Asava, Arishta

Objective: To study Method of preparation and evaluation of Asava, Arishta

Topic Outcomes: At the end of topic you should be
1. Able to know Method of preparation of Asava, Arishta
2. Able to know Method of evaluation of Asava, Arishta

The method of preparing asava arishtas is known as sandhana kalpana in ayurveda. General methods used in the extraction of medicinal plants in asava and arishta are infusion and decoction.

1. Decoction
2. Infusion
3. Collection of plant material and preparation before fermentation
4. Inoculum
5. Fermentation process
6. Transformation of chemical compounds during self fermentation

Arishta and asava are considered as best formulation in ayurveda because they posses better keeping quality, which is likely due to the contribution of fermentation to preservation. The microbes involved in this process mediate this process; enhanced therapeutic properties, which may be due to the microbial biotransformation of the initial ingredients of arishta and asava into more effective therapeutics as end products, alcohol-aqueous milieu, which is also produced by microbes; improvement in drug delivery in the body is also increases due to alcohol-aqueous milieu. These products in general possess preservative properties, potentization of drug due to biotransformation mediated by native microbes.

References

Ayurvedic Pharmacopoeia

Lecture No: 19

Name of topic/lesson – Traditional systems of medicine (AYUSH)

Subtopic: Ayurvedic dosage forms, Method of preparation and evaluation of Taila, Ras-Rasayana, Avaleha, Bhasma

Objective: To study Method of preparation and evaluation of Taila, Ras-Rasayana, Avaleha, Bhasma

Topic Outcomes: At the end of topic you should be

1. Able to know Method of preparation of Taila, Ras-Rasayana, Avaleha, Bhasma

2. Able to know Method of evaluation of Taila, Ras-Rasayana, Avaleha, Bhasma

Ayurvedic compound formulations are mainly divided into two groups viz. (1) Kasthausadhi (predominantly plant drugs) and (2). Rasausadhi (predominantly metals and minerals). There are several categories of Kasthausadhi formulations such as Asavaristra, Avleha, Grafa Churena, Taila etc. and of Rasausadhis such as Bhasma, Pisti, Lauha, Kapibadkva, Rasayana etc. The Ayurvedic drugs are derived from vegetable sources from the various parts of the plant like root, leaf, flower, fruit extrude or plant as a whole.

Rasa Rasayan Ayurvedic medicines containing mineral drugs as main ingredients are called Rasa rasayan or Ras-yoga. They are in pill form or in powder form/ forest, minerals such as Anrala, Swarna, Rajata, Tamra etc. and sulphur impurified state are used to convert bhasma form, called kajuali then other drugs are added in small quantities, mixed well and grounded to form fine powder.

Avaleha Madak Paak Avaleha or lehya is a semi-solid preparation of drugs. These are prepared by the additon of jagger sugar or sugar dandy and boiled with prescribed drug juices decoction, Honey, if required, is added when the preparation is cold and mixed well.

Taila Tailas are prepared by boiling prescribed kasyas (decoction) and kalkas of drugs in oils according to the AYURVEDIC MEDICINE FORMULATIONS 25 formula prescribed in Ayurvedic formulary.

References

Ayurvedic Pharmacopoeia

.

Lecture No: 20

Name of topic/lesson – Traditional systems of medicine (AYUSH)

Subtopic: Ayurvedic dosage forms, Method of preparation and evaluation of Churna and Vatika

Objective: To study Method of preparation and evaluation of Churna and Vatika

Topic Outcomes: At the end of topic you should be

1. Able to know Method of preparation of Churna and Vatika

2. Able to know Method of evaluation of Churna and Vatika

The Ayurveda term Gutika and Vatika implies medicinal formulation in form of tablets. Although Gutika and Vatika are used as synonyms there is a slight difference as per their appearance. Gutika generally confine themself to circular structures while Vatika are elongated in shape. The primary reason for elongated shape of Vatika is their administration method. Vatika are generally rubbed in water/plant juice/ decoction and the paste is administered sub-lingual (lick) to facilitate absorption. Hence formulation which contain heavy metals like Gold, Silver are generally rolled into Vatika. On the other hand the general purpose of Gutika is to swallow and hence formulation with herbal dominance are generally rolled into Gutika. Hence Vatika medication are quick acting as the process of digestion is not required due to their subliungual absorption while Gutika have to go through process of digestion which takes a time to show result. However Gutika medication due to resaons mentioned have a controlled action over the body as compared to Vatika which may show variable results

Vati or Gutika Medicines prepared in the form of tablets or pills are kown as vati or gutika, these are made of one or more drugs of plant, animal or mineral origin.

Churna

Churna is a fine powder form of drugs. All these herbs and other active ingredients are cleaned, dried and powdered together by mechanical means to the fineness of at least 80 mesh.

References

Ayurvedic Pharmacopoeia

Lecture No: 21

Name of topic/lesson – Overview of novel drug delivery systems for herbal drugs.

Subtopic: Introduction, Novel drug delivery approaches, Potentials of Novel DrugDelivery for Herbal drugs.

Objective: To study Introduction, Novel drug delivery approaches, Potentials of Novel Drug Delivery for Herbal drugs.

Topic Outcomes: At the end of topic you should be
1. Able to know Introduction, Novel drug delivery approaches, Potentials of Novel Drug Delivery for Herbal drugs.

Herbal medicines have been widely used around the world since ancient times. The use of 'herbs' in the treatment of various diseases with fewer side effects has significantly increased.Phytoconstituents are the plant constituents used in herbal medicines which are responsible for the biological action. Since the biological activity of the plant varies from batch to batch and thus, desirable effects are not achieved. Phytoconstituents are also required for standardization of herbal molecules. It depends on the age of the plant, time of collection, environmental condition, etc.

Types of herbal nanoparticles used

- Liposomal Drug Delivery Systems
- Phytosomal Drug Delivery Systems
- Microspheres Drug Delivery Systems
- Microemulsions systems
- Tranfersomal Drug Delivery Systems
- Ethosomal Drug Delivery Systems
- Solid-Lipid Nanoparticles systems

References

Herbal Novel Drug Delivery : A Review, World Journal Of Pharmacy And Pharmaceutical Sciences 5(8) · July 2016

Lecture No: 22

Name of topic/lesson – Overview of novel drug delivery systems for herbal drugs.

Subtopic: Liposomes & Phytosomes

Objective: To study Liposomes & Phytosomes

Topic Outcomes: At the end of topic you should be

1. Able to Liposomes & Phytosomes
2. Formulations and evaluations of Liposomes & Phytosomes

Due to poor solubility in lipids, many of bioactive components (Nutraceutical materials) show less bioactivity than optimal state in water solution. Phytosomes improve absorption and bioavailability of biomaterials. Liposomes, spherical shaped nanocarriers, were discovered in the 1960s by bangham. Due to their composition, variability and structural properties, liposomes and phytosomes are extremely versatile, leading to a large number of applications including pharmaceutical, cosmetics and food industrial fields. They are advanced forms of herbal formulations containing the bioactive phytoconstituents of herb extracts such as flavonoids, glycosides and terpenoids, which have good ability to transit from a hydrophilic environment into the lipid friendly environment of the outer cell membrane. They have better bioavailability and actions than the conventional herbal extracts containing dosage. Phytosome technology has increasing effect on the bioavailability of herbal extracts including ginkgo biloba, grape seed, green tea, milk thistle, ginseng, etc., and can be developed for various therapeutic uses or dietary supplements. Liposomes are composed of bilayer membranes, which are made of lipid molecules. They form when phospholipids are dispersed in aqueous media and exposed to high shear rates by using micro-fluidization or colloid mill. The mechanism for formation of liposomes is mainly the hydrophilichydrophobic interactions between phospholipids and water molecules. Here, we attempt to review the features of phytosomes and liposomes as well as their preparation methods and capacity in food and drug applications. Generally, it is believed that phytosomes and liposomes are suitable delivery systems for nutraceuticals, and can be widely used in food industry.

References

Herbal Novel Drug Delivery : A Review, World Journal Of Pharmacy And Pharmaceutical Sciences 5(8) · July 2016

Lecture No: 23

Name of topic/lesson – Overview of novel drug delivery systems for herbal drugs.

Subtopic: Nanoparticals

Objective: To study Nanoparticals

Topic Outcomes: At the end of topic you should be

1. Able to know Nanoparticals
2. Formulations and evaluations of Nanoparticals

Nanoparticles are particles between 1 and 100 nanometres (nm) in size with a surrounding interfacial layer. The interfacial layer is an integral part of nanoscale matter, fundamentally affecting all of its properties. The interfacial layer typically consists of ions, inorganic and organic molecules. Organic molecules coating inorganic nanoparticles are known as stabilizers, capping and surface ligands, or passivating agents.In nanotechnology, a particle is defined as a small object that behaves as a whole unit with respect to its transport and properties.Particles are further classified according to diameter.

According to ISO Technical Specification 80004, a nanoparticle is defined as a nano-object with all three external dimensions in the nanoscale, whose longest and shortest axes do not differ significantly, with a significant difference typically being a factor of at least 3.

The terms colloid and nanoparticle are not interchangeable. A colloid is a mixture which has solid particles dispersed in a liquid medium. The term applies only if the particles are larger than atomic dimensions but small enough to exhibit Brownian motion, with the critical size range (or particle diameter) typically ranging from nanometers (10^{-9} m) to micrometers (10^{-6} m). Colloids can contain particles too large to be nanoparticles, and nanoparticles can exist in non-colloidal form, for examples as a powder or in a solid matrix.

References

Herbal Novel Drug Delivery : A Review, World Journal Of Pharmacy And Pharmaceutical Sciences 5(8) · July 2016

Lecture No: 24

Name of topic/lesson – Overview of novel drug delivery systems for herbal drugs.

Subtopic: Novel Vesicular Herbal Formulations

Objective: To study Novel Vesicular Herbal Formulations

Topic Outcomes: At the end of topic you should be

1. Able to know Novel Vesicular Herbal Formulations
2. Formulations and evaluations of Novel Vesicular Herbal Formulations

Herbal treatment for skin disorders has been used for thousands of years. Herbal novel drug delivery systems for dermatological disorders result in manifold increase in activity as compared with conventional formulations. Included in this review of novel herbal delivery system for dermatological disorders are common herbs found to be useful in the treatment of dermatologic disorders, brief about different novel delivery systems available for carrying herbal drugs with emphasis on skin disorders and methods of characterization of vesicular systems. Disease of the skin offer special opportunities to the clinician. In particular, the topical administration route is especially appropriate for skin diseases, although some dermatologic diseases respond as well or better to drugs administered systemically or reaches to systemic circulation after transdermal application. The novel carriers have been exploited through almost all the routes of administration. However, the topical route has been adjudged as one of the most relevant to treat dermatological disorders more effectively. In contrast to the conventional formulations based on creams and ointments, these novel dermatological systems are different in their composition and constructs including their exterior and interior design. Topical medication usually consists of active ingredients incorporated in a vehicle that facilitates cutaneous application.

References

Herbal Novel Drug Delivery : A Review, World Journal Of Pharmacy And Pharmaceutical Sciences 5(8) · July 2016

Lecture No: 25

Name of topic/lesson – Cosmecuticals.

Subtopic: Skin care products: Cold cream, vanishing cream, moisturizer, lipbalm, lipstick

Objective: To study Skin care products: Cold cream, vanishing cream, moisturizer, libalm, lipstick

Topic Outcomes: At the end of topic you should be

1. Able to know Skin care products: Cold cream, vanishing cream, moisturizer, lipbalm, lipstick
2. Formulations and evaluations of Skin care products: Cold cream, vanishing cream, moisturizer, lipbalm, lipstick

Cold Creams: These types of creams are water-in-oil type of emulsion. They produce cooling sensation by the evaporation of water, after application of cream to the skin. Hence, they are known as cream. They should possess emollient action and the layer left on the skin after application should be non-occlusive.
Vanishing Creams: They are oil in water type of emulsion. When applied on the surface of skin, they spread as thin oil less film which is not visible to the naked eye. Hence, they are called as vanishing creams. They are used to hold powder on the skin as well as to improve adhesion.
Properties:
• It should have high melting point.
• It should be pure white in colour.
• It should possess very little odour.
• It should have less number of iodine.

Lip balm or lip salve is a wax-like substance applied topically to the lips to moisturize and relievechapped or dry lips, angular cheilitis, stomatitis, or cold sores. Lip balm often contains beeswax orcarnauba wax, camphor, cetyl alcohol, lanolin, paraffin, and petrolatum, among other ingredients. Some varieties contain dyes, flavor, fragrance, phenol, salicylic acid, and sunscreens.
The primary purpose of lip balm is to provide an occlusive layer on the lip surface to seal moisture in lips and protect them from external exposure. Dry air, cold temperatures, and wind all have a drying effect on skin by drawing moisture away from the body. Lips are particularly vulnerable because the skin is so thin, and thus they are often the first to present signs of dryness. Occlusive materials like waxes and petroleum jelly prevent moisture loss and maintain lip comfort while flavorants, colorants, sunscreens, and various medicaments can provide additional, specific benefits.

References

1. Herbal Cosmetics: Used for Skin and Hair, Inventi jounals
2.Experimental Phytopharmacognosy, Dr. S. S. Khadabadi, Nirali Prakashan

Lecture No: 26

Name of topic/lesson – Cosmecuticals.

Subtopic: Skin care products: sunscreen lotion/cream, anti-acne, anti-wrinkle cream

Objective: To study Skin care products: sunscreen lotion/cream, anti-acne, anti-wrinkle cream

Topic Outcomes: At the end of topic you should be

1. Able to know Skin care products: sunscreen lotion/cream, anti-acne, anti-wrinkle cream
2. Formulations and evaluations of Skin care products: sunscreen lotion/cream, anti-acne, anti-wrinkle cream

Sunscreen, also known as sunblock, or suntan lotion, is a lotion, spray, gel, foam (such as an expanded foam lotion or whipped lotion), stick or other topical product that absorbs or reflects some of the sun's ultraviolet (UV) radiation and thus helps protect against sunburn. Diligent use of sunscreen can also slow or temporarily prevent the development of wrinkles, moles and sagging skin.

Depending on the mode of action, sunscreens can be classified into physical sunscreens (i.e., those that reflect the sunlight) or chemical sunscreens (i.e., those that absorb the UV light).

To provide a better indication of their ability to protect against skin cancer and other diseases associated with UVA radiation (such as phytophotodermatitis), the use of broad-spectrum (UVA/UVB) sunscreens has been recommended. The use of the term "Broad Spectrum" on the label sunscreen products is regulated by the U.S. Food and Drug Administration.

Anti acne medication is used to treat mild to moderate acne. It may be used in combination with other acne treatments. When applied to the skin,benzoyl peroxide works by reducing the amount of acne-causing bacteria and by causing the skin to dry and peel.

Anti-aging creams are predominantly moisturiser-based cosmeceutical skin care products marketed with the promise of making the consumer look younger by reducing, masking or preventing signs of skin aging. These signs are laxity (sagging), rhytids (wrinkles), andphotoaging, which includes erythema (redness), dyspigmentation (brown discolorations), solar elastosis (yellowing), keratoses (abnormal growths), and poor texture.

References

1. Herbal Cosmetics: Used for Skin and Hair, Inventi jounals
2.Experimental Phytopharmacognosy, Dr. S. S. Khadabadi, Nirali Prakashan

Lecture No: 27

Name of topic/lesson – Cosmecuticals.

Subtopic: Hair care products: Shampoo, Conditioner, Dyes

Objective: To study Hair care products: Shampoo, Conditioner, Dyes

Topic Outcomes: At the end of topic you should be

1. Able to know Hair care products: Shampoo, Conditioner, Dyes
2. Formulations and evaluations of Hair care products: Shampoo, Conditioner, Dyes

Shampoo is a hair care product, typically in the form of a viscous liquid, that is used for cleaning hair. Less commonly, shampoo is available in bar form, like a bar of soap. Shampoo is used by applying it to wet hair, massaging the product into the hair, and then rinsing it out. Some users may follow a shampooing with the use of hair conditioner.

The typical reason of using shampoo is to remove the unwanted build-up of sebum in the hair without stripping out so much as to make hair unmanageable. Shampoo is generally made by combining a surfactant, most often sodium lauryl sulfate or sodium laureth sulfate, with a co-surfactant, most often cocamidopropyl betaine in water.

Hair conditioner is a hair care product used to improve the feel, appearance and manageability ofhair. Its main purpose of is to reduce friction between strands of hair to allow easier brushing or combing, which might otherwise cause damage to the scalp.Various other benefits are often advertised, such as hair repair, strengthening, or a reduction in split-ends.

Conditioners are available in a wide range of forms including viscous liquids, gels and creams as well as thinner lotions and sprays.

A dye is a coloured substance that chemically bonds to the substrate to which it is being applied, this distinguishes dyes from pigments which do not chemically bind to the material they colour. The dye is generally applied in an aqueous solution, and may require a mordant to improve the fastness of the dye on the fiber

References

1. Herbal Cosmetics: Used for Skin and Hair, Inventi jounals
2.Experimental Phytopharmacognosy, Dr. S. S. Khadabadi, Nirali Prakashan

Lecture No: 28

Name of topic/lesson – Cosmecuticals.

Subtopic: Hair care products: Colorants, Styling gel.

Objective: To study Hair care products: Colorants, Styling gel.

Topic Outcomes: At the end of topic you should be

Able to know

1. Hair care products: Colorants, Stylinggel.
2. Formulations and evaluations of Hair care products: Colorants, Styling gel.

A colourant/colour additive (British spelling) or colorant/color additive (American spelling) is a substance that is added or applied in order to change the colour of a material or surface. Colourants can be used for many purposes including printing, painting, and for colouring many types of materials such as foods and plastics. Colourants work by absorbing varying amounts of light at different wavelengths (orfrequencies) of its spectrum, transmitting (if translucent) or reflecting the remaining light in straight lines or scattered.

Most colourants can be classified as dyes or pigments, or containing some combination of these. Typical dyes are formulated as solutions, while pigments are made up of solid particles suspended and are generally suspended in a vehicle (e.g., linseed oil). The color a colorant imparts to a substance is mediated by other ingredients it is mixed with such as binders and fillers are added, for example in paints andinks. In addition, some colourants impart colour through reactions with other substances.

Colourants, or their constituent compounds, may be classified chemically as inorganic (often from a mineral source) and organic (often from a biological source).

Hair gel is a hairstyling product that is used to harden hair into a particular hairstyle.
More complicated polymer formulas exist; i.e., a copolymer of vinylpyrrolidone, methacrylamide, and N-vinylimidazole.

References

1. Herbal Cosmetics: Used for Skin and Hair, Inventi jounals
2.Experimental Phytopharmacognosy, Dr. S. S. Khadabadi, Nirali Prakashan

Lecture No: 29

Name of topic/lesson – Overview of means & methods used in structural elucidation of natural products

Subtopic: Physical methods of characterization: M.P./B.P.,
Objective: To study Physical methods of characterization: M.P./B.P.,
Topic Outcomes: At the end of topic you should be

Able to know

1. Physical methods of characterization: M.P./B.P.,.
2. Method of determination and significance of the same.

What is Boiling Point?

The boiling point is the temperature at which the vapour pressure of the liquid is equal to the atmospheric pressure of the liquid and the liquid is converted to vapour. The boiling point of the liquid depends upon the pressure of the surrounding. When the liquid is at high pressure, it has higher boiling point than the boiling point at normal atmospheric pressure. The boiling point of different liquids is different for a given pressure. In 1982 IUPAC, definedstandard boiling point which is the temperature at which liquid boils under the pressure of 1 bar. The boiling point changes with altitude and that's why when we go to mountain areas i.e. at higher altitudes cooking food takes more time because the pressure decreases and therefore because of this it takes more time in cooking food at hilly areas.

What is Melting Point?

The temperature at which solid changes its state to liquid at an atmospheric pressure is called the melting point of that liquid. This is the point at which both liquid and solid phase exists at equilibrium. The melting point of the substance also varies with pressure and is specified at standard pressure.

Another term is freezing point which is just reverse of melting point which is the temperature at which liquid is converted to solid. Technically, you can say that melting point and freezing point are not same because a substance can be supercooled below itsfreezing point without forming solid.

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 30

Name of topic/lesson – Overview of means & methods used in structural elucidation of natural products

Subtopic: Physical methods of characterization: rotation,Refractive index

Objective: To study Physical methods of characterization: rotation,Refractive index

Topic Outcomes: At the end of topic you should be able to know

1. Physical methods of characterization: rotation,Refractive index
2. Method of determination and significance of the same.

In optics, the refractive index or index of refraction of a material is a dimensionless number that describes how fast light propagates through the material. It is defined as

$n = c/v$

where c is the speed of light in vacuum and v is the phase velocity of light in the medium. For example, the refractive index of water is 1.333, meaning that light travels 1.333 times as fast in vacuum as in water.

While the refractive index affects wavelength, it depends on frequency, color and energy so the resulting difference in the bending angle causes white light to split into its constituent colors. This is called dispersion. It can be observed in prismsand rainbows, and chromatic aberration in lenses. Light propagation in absorbing materials can be described using a complex-valued refractive index.

Optical rotation or optical activity (sometimes referred to as rotary polarization) is the rotation of the orientation of the plane of polarization about the optical axis of linearly polarized light as it travels through certain materials. Optical activity occurs only in chiral materials, those lacking microscopic mirror symmetry. Unlike other sources of birefringence which alter a beam's state of polarization, optical activity can be observed in fluids. This can include gases or solutions of chiral molecules such as sugars, molecules with helical secondary structure such as some proteins, and also chiral liquid crystals. It can also be observed in chiral solids such as certain crystals with a rotation between adjacent crystal planes (such as quartz) or metamaterials.

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 31

Name of topic/lesson – Overview of means & methods used in structural elucidation of natural products

Subtopic: Analytical methods of characterization:Elementalcomposition,

Objective: To study Analytical methods of characterization:Elementalcomposition,

Topic Outcomes: At the end of topic you should be able to know

1. Analytical methods ofcharacterization:Elementalcomposition,
2. Method of determination and significance of the same.

Elemental analysis is a process where a sample of some material (e.g., soil, waste or drinking water, bodily fluids, minerals, chemical compounds) is analyzed for its elemental and sometimesisotopic composition.[*citation needed*] Elemental analysis can be qualitative (determining what elements are present), and it can be quantitative (determining how much of each are present). Elemental analysis falls within the ambit of analytical chemistry.

The most common form of elemental analysis, CHNS analysis, is accomplished by combustion analysis. In this technique, a sample is burned in an excess of oxygen and various traps, collecting the combustion products: carbon dioxide, water, and nitric oxide. The masses of these combustion products can be used to calculate the composition of the unknown sample. Modern elemental analyzers are also capable of simultaneous determination of sulfur along with CHN in the same measurement run.

Other quantitative methods include gravimetry, optical atomic spectroscopy, and neutron activation analysis.

Gravimetry is where the sample is dissolved and then the element of interest is precipitated and its mass measured or the element of interest is volatilized and the mass loss is measured.

Optical atomic spectroscopy includes flame atomic absorption, graphite furnace atomic absorption, and inductively coupled plasma atomic emission spectroscopy, which probe the outer electronic structure of atoms.

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 32

Name of topic/lesson – Overview of means & methods used in structural elucidation of natural products

Subtopic: Chromatographic methods of characterization

Objective: To study Chromatographic methods of characterization

Topic Outcomes: At the end of topic you should be able to know

1. Chromatographic methods of characterization
2. Method of determination and significance of the same.

Chromatography is a laboratory technique for the separation of a mixture. The mixture is dissolved in a fluid called the*mobile phase,* which carries it through a structure holding another material called the *stationary phase*. The various constituents of the mixture travel at different speeds, causing them to separate. The separation is based on differential partitioning between the mobile and stationary phases. Subtle differences in a compound's partition coefficient result in differential retention on the stationary phase and thus affect the separation.

- The *analyte* is the substance to be separated during chromatography. It is also normally what is needed from the mixture.
- *Analytical chromatography* is used to determine the existence and possibly also the concentration of analyte(s) in a sample.
- A *bonded phase* is a stationary phase that is covalently bonded to the support particles or to the inside wall of the column tubing.
- A *chromatogram* is the visual output of the chromatograph. In the case of an optimal separation, different peaks or patterns on the chromatogram correspond to different components of the separated mixture.

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 33

Name of topic/lesson – Overview of means & methods used in structural elucidation of natural products

Subtopic: constants derived fromTLC/HPTLC

Objective: To study constants derived fromTLC/HPTLC

Topic Outcomes: At the end of topic you should be able to know

1. Constants derived fromTLC/HPTLC
1. Method of determination and significance of the same.

Thin-layer chromatography (TLC) is a chromatography technique used to separate non-volatile mixtures. Thin-layer chromatography is performed on a sheet of glass, plastic, or aluminium foil, which is coated with a thin layer of adsorbent material, usually silica gel,aluminium oxide (alumina), or cellulose. This layer of adsorbent is known as the stationary phase.

High-performance thin-layer chromatography (HPTLC) is an enhanced form of thin-layer chromatography (TLC). A number of enhancements can be made to the basic method of thin-layer chromatography to automate the different steps, to increase the resolution achieved and to allow more accurate quantitative measurements.

Automation is useful to overcome the uncertainty in droplet size and position when the sample is applied to the TLC plate by hand. One recent approach to automation has been the use of piezoelectric devices and inkjet printers for applying the sample.

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 34

Name of topic/lesson – Overview of means & methods used in structural elucidation of natural products

Subtopic: Spectroscopic methods of characterization: UV, IR,

Objective: To study Spectroscopic methods of characterization: UV, IR,

Topic Outcomes: At the end of topic you should be able to know

1.Spectroscopic methods of characterization: UV, IR,

2. Method of determination and significance of the same.

UV refers to absorption spectroscopy or reflectance spectroscopy in part of the ultravioletand the full, adjacent visible spectral regions. This means it uses light in the visible and adjacent ranges. The absorption or reflectance in the visible range directly affects the perceivedcolor of the chemicals involved. In this region of the electromagnetic spectrum, atoms andmolecules undergo electronic transitions.

Molecules containing bonding and non-bonding electrons (n-electrons) can absorb energy in the form of ultraviolet or visible light to excite these electrons to higher anti-bonding molecular orbitals.[2] The more easily excited the electrons (i.e. lower energy gap between theHOMO and the LUMO), the longer the wavelength of light it can absorb. There are four possible types of transitions (π–π*, n–π*, σ–σ*, and n–σ*), and they can be ordered as follows: σ–σ* > n–σ* > π–π* > n–π*

nfrared spectroscopy (IR spectroscopy or vibrational spectroscopy) involves the interaction ofinfrared radiation with matter. It covers a range of techniques, mostly based on absorption spectroscopy. As with all spectroscopic techniques, it can be used to identify and study chemicals. Samples may be solid, liquid, or gas. The method or technique of infrared spectroscopy is conducted with an instrument called an infrared spectrometer (or spectrophotometer) to produce an infrared spectrum. An IR spectrum can be visualized in a graph of infrared light absorbance (ortransmittance) on the vertical axis vs. frequency or wavelength on the horizontal axis. Typical unitsof frequency used in IR spectra are reciprocal centimeters (sometimes called wave numbers), with the symbol cm^{-1}.

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 35

Name of topic/lesson – Overview of means & methods used in structural elucidation of natural products

Subtopic: Proton NMR spectrum.
Objective: To study Proton NMR spectrum

Topic Outcomes: At the end of topic you should be able to know

1. Proton NMR spectrum

2. Method of determination and significance of the same.

Nuclear magnetic resonance spectroscopy, most commonly known as NMR spectroscopyor magnetic resonance spectroscopy (MRS), is a spectroscopic technique to observe local magnetic fields around atomic nuclei. The sample is placed in a magnetic field and the NMR signal is produced by excitation of the nuclei sample with radio waves into nuclear magnetic resonance, which is detected with sensitive radio receivers. The intramolecular magnetic field around an atom in a molecule changes the resonance frequency, thus giving access to details of the electronic structure of a molecule and its individual functional groups. As the fields are unique or highly characteristic to individual compounds, in modern organic chemistry practice, NMR spectroscopy is the definitive method to identify monomolecular organic compounds. Similarly, biochemists use NMR to identify proteins and other complex molecules.

1. It helps to determine the chemical properties of functional groups in biomacromolecules .
2. It directly detects the hydrogen bonding interactions of chemical products .
3. It is used for research purposes in subjects like physics and chemistry .
4. It defines the atomic resolution structure in biomacromolecules.

NMR is also used in developement of medicines , gathering of information that are dynamic in nature , in testing of RNA and DNA and variety of protiens , computation of quantums and research in chemistry

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 36

Name of topic/lesson – Overview of means & methods used in structural elucidation of natural products

Subtopic: Mass Spectrometry.

Objective: To study Mass Spectrometry.

Topic Outcomes: At the end of topic you should be able to know

1. Mass Spectrometry.
2. Method of determination and significance of the same.

Mass spectrometry (MS) is an analytical technique that measures the mass-to-charge ratio of ions. The results are typically presented as a mass spectrum, a plot of intensity as a function of the mass-to-charge ratio. Mass spectrometry is used in many different fields and is applied to pure samples as well as complex mixtures.

A mass spectrum is a plot of the ion signal as a function of the mass-to-charge ratio. These spectra are used to determine the elemental or isotopic signature of a sample, the masses of particles and of molecules, and to elucidate the chemical identity or structure of molecules and other chemical compounds.

Components

The instrument consists of three major components:

1. Ion Source: For producing gaseous ions from the substance being studied.
2. Analyzer: For resolving the ions into their characteristics mass components according to their mass-to-charge ratio.
3. Detector System: For detecting the ions and recording the relative abundance of each of the resolved ionic species.

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 37

Name of topic/lesson – Structural elucidation of following Phytoconstituents by chemical and spectroscopical methods (UV, IR, NMR & Mass)

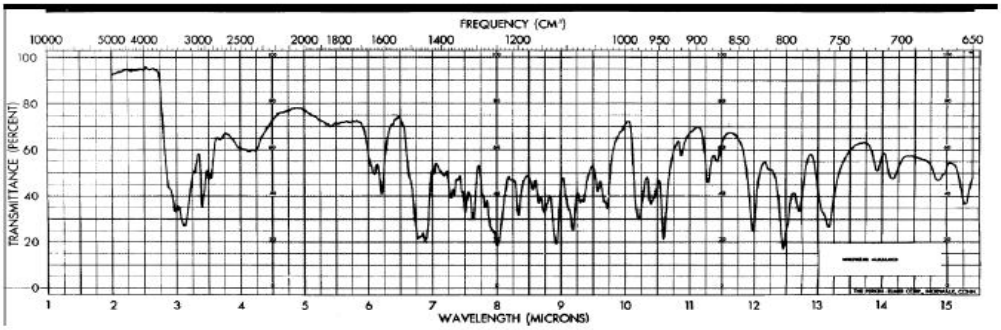
Subtopic: Morphine

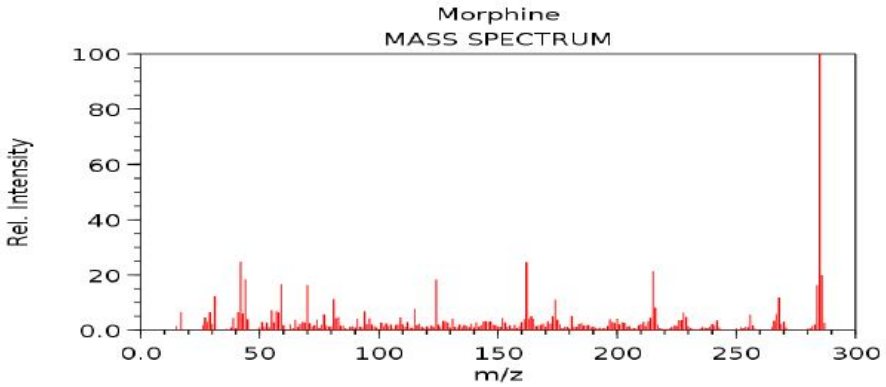
Objective: To study Morphine

Topic Outcomes: At the end of topic you should be able to know

1. Morphine.
2. UV, IR, NMR & Mass

Morphine, an alkaloid isolated from opium, is generally considered to be the most valuable of all pain relieving drugs. It is widely used to relieve moderate to severe pain associated with acute and chronic disorders, to provide analgesia during diagnostic and orthopedic procedures and as a preoperative medication before surgery. Morphine is variably absorbed from the gastro intestinal tract after oral ingestion





References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 38

Name of topic/lesson – Structural elucidation of following Phytoconstituents by chemical and spectroscopical methods (UV, IR, NMR & Mass)

Subtopic: Atropine

Objective: To study Atropine

Topic Outcomes: At the end of topic you should be able to know

1. Atropine
2. UV, IR, NMR & Mass

Atropine is a medication used to treat certain types of nerve agent and pesticide poisoningsas well as some types of slow heart rate and to decrease saliva production during surgery.

The intravenous solution usually begins working within a minute and lasts half an hour to an hour.

Atropine is an enantiomeric mixture of *d*-hyoscyamine and *l*-hyoscyamine, with most of its physiological effects due to *l*-hyoscyamine. Its pharmacological effects are due to binding to muscarinic acetylcholine receptors. It is an antimuscarinic agent. Significant levels are achieved in the CNS within 30 minutes to 1 hour and disappears rapidly from the blood with a half-life of 2 hours. About 60% is excreted unchanged in the urine, most of the rest appears in urine as hydrolysis and conjugation products. Noratropine (24%), atropine-N-oxide (15%), tropine (2%) and tropic acid (3%) appear to be the major metabolites, while 50% of the administered dose is excreted as apparently unchanged atropine. No conjugates were detectable. Evidence that atropine is present as (+)-hyoscyamine was found, suggesting that stereoselective metabolism of atropine probably occurs.

The biosynthesis of atropine starting from *l*-phenylalanine first undergoes a transamination formingphenylpyruvic acid which is then reduced to phenyl-lactic acid. Coenzyme A then couples phenyl-lactic acid with tropine forming littorine, which then undergoes a radical rearrangement initiated with a P450 enzyme forming hyoscyamine aldehyde. A dehydrogenase then reduces the aldehyde to a primary alcohol making (−)-hyoscyamine, which upon racemization forms atropine.

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture synopsis Sub: Natural Drug Technology

Subject I/C: Mohini Upadhye

Lecture synopsis Sub: Natural Drug Technology

Subject I/C: Mohini Upadhye

Lecture No: 39

Name of topic/lesson – Structural elucidation of following Phytoconstituents by chemical and spectroscopical methods (UV, IR, NMR & Mass)

Subtopic: Caffeine

Objective: To study Caffeine

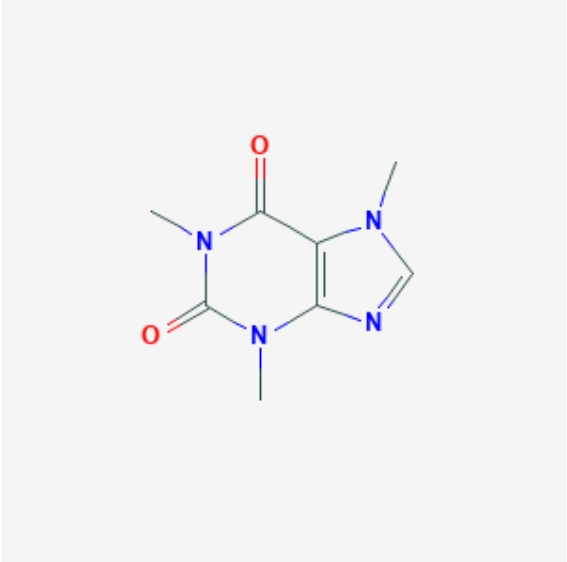
Topic Outcomes: At the end of topic you should be able to know

1. Caffeine
2. UV, IR, NMR & Mass

Molecular Formula: $C_8H_{10}N_4O_2$

caffeine
58-08-2
1,3,7-Trimethylxanthine
Guaranine
Thein

methylxanthine naturally occurring in some beverages and also used as a pharmacological agent. Caffeine's most notable pharmacological effect is as a central nervous system stimulant, increasing alertness and producing agitation. It also relaxes SMOOTH MUSCLE, stimulates CARDIAC MUSCLE, stimulates DIURESIS, and appears to be useful in the treatment of some types of headache. Several cellular actions of caffeine have been observed, but it is not entirely clear how each contributes to its pharmacological profile. Among the most important are inhibition of cyclic nucleotide PHOSPHODIESTERASES, antagonism of ADENOSINE RECEPTORS, and modulation of intracellular calcium handling.



References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 40

Name of topic/lesson – Structural elucidation of following Phytoconstituents by chemical and spectroscopical methods (UV, IR, NMR & Mass)

Subtopic: Ephedrine

Objective: To study Ephedrine

Topic Outcomes: At the end of topic you should be able to know

1. Ephedrine
2. UV, IR, NMR & Mass

Both ephedrine and pseudoephedrine increase blood pressure and act as bronchodilators, with pseudoephedrine having considerably less effect.

Ephedrine may decrease motion sickness, but it has mainly been used to decrease the sedating effects of other medications used for motion sickness.

Ephedrine exhibits optical isomerism and has two chiral centres, giving rise to four stereoisomers. By convention, the pair of enantiomerswith the stereochemistry (1*R*,2*S*) and (1*S*,2*R*) is designated ephedrine, while the pair of enantiomers with the stereochemistry (1*R*,2*R*) and (1*S*,2*S*) is called pseudoephedrine. Ephedrine is a substituted amphetamine and a structural methamphetamine analogue. It differs from methamphetamine only by the presence of a hydroxyl group (—OH).

The isomer which is marketed is (−)-(1*R*,2*S*)-ephedrine. Ephedrine hydrochloride has a melting point of 187−188 °C. In the outdated D/L system (+)-ephedrine is also referred to as L-ephedrine and (−)-ephedrine as D-ephedrine (in which case, in the Fisher projection, the phenyl ring is drawn at the bottom).[28][30]

Often, the D/L system (with small caps) and the d/l system (with lower-case) are confused. The result is that the levorotary l-ephedrine is wrongly named L-ephedrine and the dextrorotary d-pseudoephedrine (the diastereomer) wrongly D-pseudoephedrine.

The IUPAC names of the two enantiomers are (1*R*,2*S*)- respectively (1*S*,2*R*)-2-methylamino-1-phenylpropan-1-ol. A synonym is *erythro*-ephedrine.

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 41

Name of topic/lesson – Structural elucidation of following Phytoconstituents by chemical and spectroscopical methods (UV, IR, NMR & Mass)

Subtopic: Digoxin

Objective: To study Digoxin

Topic Outcomes: At the end of topic you should be able to know

1. Digoxin
2. UV, IR, NMR & Mass

A cardiotonic glycoside obtained mainly from Digitalis lanata; it consists of three sugars and the aglycone DIGOXIGENIN. Digoxin has positive inotropic and negative chronotropic activity. It is used to control ventricular rate in ATRIAL FIBRILLATION and in the management of congestive heart failure with atrial fibrillation. Its use in congestive heart failure and sinus rhythm is less certain. The margin between toxic and therapeutic doses is small.

Molecular Weight:	780.949 g/mol
MS Category	Experimental
MS Type	Chromatography identified as LC-MS
MS Level	MS1
Instrument	ZQ, Waters
Instrument Type	LC-ESI-Q
Ionization	ESI
Ionization Mode	positive
Retention Time	13.810 min

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 42

Name of topic/lesson – Structural elucidation of following Phytoconstituents by chemical and spectroscopical methods (UV, IR, NMR & Mass)

Subtopic: Sennosides,

Objective: To study Sennosides,

Topic Outcomes: At the end of topic you should be able to know

1. Sennosides,
2. UV, IR, NMR & Mass

Sennoside A is a member of the class of sennosides that is rel-(9R,9'R)-9,9',10,10'-tetrahydro-9,9'-bianthracene-2,2'-dicarboxylic acid which is substituted by hydroxy groups at positions 4 and 4', by beta-D-glucopyranosyloxy groups at positions 5 and 5', and by oxo groups at positions 10 and 10'. The exact stereochemisty at positions 9 and 9' is not known - it may be R,R (as shown) or S,S. It is a member of sennosides and an oxo dicarboxylic acid.

Molecular Weight:	862.746 g/mol
MoNA ID	CCMSLIB00000848790
MS Category	Experimental
MS Type	Chromatography identified as LC-MS
MS Level	MS2
Precursor Type	[M+NH4]+
precursor m/z	880.23
Instrument	Maxis II HD Q-TOF Bruker
Ionization Mode	positive

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 43

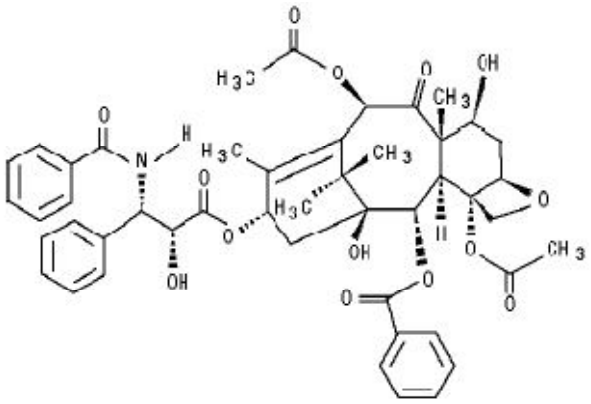
Name of topic/lesson – Structural elucidation of following Phytoconstituents by chemical and spectroscopical methods (UV, IR, NMR & Mass)

Subtopic: Taxol,

Objective: To study Taxol

Topic Outcomes: At the end of topic you should be able to know

1. Taxol,,
2. UV, IR, NMR & Mass



Paclitaxel is a natural product with antitumor activity. TAXOL (paclitaxel) is obtained via a semi-synthetic process from *Taxus baccata*. The chemical name for paclitaxel is 5β,20-Epoxy-1,2α,4,7β,10β,13α-hexahydroxytax-11-en-9-one 4,10-diacetate 2-benzoate 13-ester with (2*R*,3*S*)-*N*-benzoyl-3-phenylisoserine.

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 44

Name of topic/lesson – Structural elucidation of following Phytoconstituents by chemical and spectroscopical methods (UV, IR, NMR & Mass)

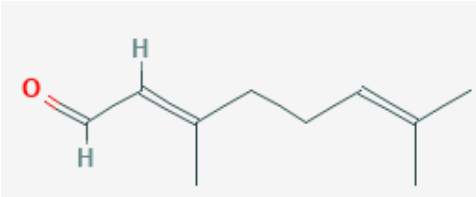
Subtopic: Citral,

Objective: To study Citral

Topic Outcomes: At the end of topic you should be able to know

1. Citral,
2. UV, IR, NMR & Mass

Citral is an enal that consists of octa-2,6-dienal bearing methyl substituents at positions 3 and 7. A mixture of the two geometric isomers geranial and neral, it is the major constituent (75-85%) of oil of lemon grass, the volatile oil of Cymbopogon citratus, or of C. flexuosus. It also occurs in oils of verbena, lemon, and orange. It has a role as a flavouring agent, a fragrance, an insecticide, an EC 1.2.3.1 (aldehyde oxidase) inhibitor and a metabolite. It contains a geranial and aneral.



MS Category	Experimental
MS Type	Chromatography identified as GC-MS
MS Level	MS1
Instrument	HITACHI RMU-6M
Instrument Type	EI-B
Ionization Mode	positive

References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture No: 45

Name of topic/lesson – Structural elucidation of following Phytoconstituents by chemical and spectroscopical methods (UV, IR, NMR & Mass)

Subtopic: Quercetin,

Objective: To study Quercetin

Topic Outcomes: At the end of topic you should be able to know

1. Quercetin,
2. UV, IR, NMR & Mass

UV λmax MeOH (nm): 253, 368

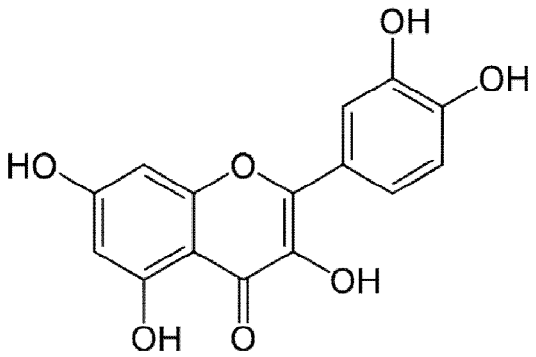
IR γmax cm-1: 3392, 3369,1654,1609,1558,1508,1458,1429

1 HNMR: δ 7.15 (CH), 6.93(CH), 6.72(CH), 6.25(CH), 5.94(CH), 11.85(OH), 10.68(OH), 10.29(OH), 9.48(OH)

13CNMR: δ 136.5(C), 146.9(C) 146.5(C). 145.9(C), 158.8 (C) 161.8(C) 166.4(C), 122.8(C) 115.3 (CH), 104.5 (C) 117.2 (CH), 176.1 (C), 98.3(CH), 94.0(CH), 121.8(CH)

FAB-MS: pso. lons 303 [M - H]

Quercetin is a plant pigment (flavonoid). It is found in many plants and foods, such as red wine, onions, green tea, apples, berries, Ginkgo biloba, St. John's wort, American elder, and others. Buckwheat tea has a large amount of quercetin. People use quercetin as a medicine.



References

1.Natural Product Chemistry, R. R. Wadekar, Everest Publishing House
2.Chemistry of Natural Products, Jaswant Kaur, PV books.

Lecture synopsis Sub: Natural Drug Technology

Subject I/C: Mohini Upadhye