

## A Review on Stability Testing of Herbal Medicine: Tulsi (krishna)

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### ABSTRACT :

This review article discusses the medicinal and therapeutic benefits of the Tulsi plant, which is a member of the Lamiaceae family and is commonly used in traditional medicine. Tulsi is often used in Ayurvedic medicine to treat bronchitis, influenza, asthma, and other ailments. In addition, Tulsi leaves are frequently used to provide immediate relief for colds, sneezing, coughs, malaria, and dengue. The article highlights the biological effectiveness of Tulsi extracts and its bioorganic constituents in treating various diseases such as diabetes, hypertension, respiratory diseases, arthritis, and certain infections. Tulsi is also known for its antioxidant, anti-atherogenic, anti-aging, immune modulatory, anti-inflammatory, antistress, hepatoprotective, radioprotective, antihelmintic, repellent, and larvicidal activities. Further more, Tulsi's active ingredients can modulate both cellular and humoral immunity and possess anti-inflammatory properties. Tulsi has also been found to have healing properties for hepatic injury and gastric ulcer, as well as the ability to relieve stress and improve digestion and immunity.

Tulsi contains various bioactive compounds such as (-)-linalool, eugenol, methylchavicol, and gamma-caryophyllene, as well as minor oil constituents like (+)-delta-cadinene, 3-carene, alpha-humulene, citral, and (-)-trans-caryophyllene. Tulsi oil is high in alpha-linolenic acid, which is highly anti-inflammatory, and contains camphor, caryophyllene oxide, cineole, methyl eugenol, limonene, myrcene, and thymol, all of which are known insect repellents. The essential oil extracted from Tulsi can be used to deter the growth of mosquitoes and control malaria, making it an effective insect repellent against flies, mosquitoes, and other insects.

In conclusion, Tulsi is a valuable source of natural products, including phyto-constituents and essential oils that can be used to treat various human health problems and ailments. However, proper

composition and appropriate formulations must be developed before using Tulsi for medicinal purposes.

**Keyword: Antioxidant, Anti inflammatory, Anti bacterial, Cough and Cold, Tulsi**

Tulsi, Medicine, Ayurvedic medicine, health, disease, control, natural products, the etc.

### I. INTRODUCTION :

Herbal drugs constituents are of different kind and have many constituents. The finished products of herbal medicine generally have low concentration of active constituent(s). Stability testing of herbal drugs is a challenging task, because the entire herb or herbal product is regarded as the active matter, regardless of whether constituents with defined therapeutic activity are known. The most important aspect in the evaluation of the stability study of a product is its storage condition. The purpose of a stability testing is to provide proof on how the quality of the herbal products varies with the time under the influence of environmental factors such as temperature, light, oxygen, moisture, other ingredient or excipients in the dosage form, particle size of drug, microbial contamination, trace metal contamination, leaching from the container and to establish a recommended storage condition and shelf-life. Based on the climatic conditions only storage conditions can be determined[1].

Stability studies should be performed on at least three production batches of the herbal products for the proposed shelf-life, which is normally denoted as long term stability and is performed under natural atmospheric conditions. With the help of modern analytical techniques like spectrophotometer, HPLC, HPTLC and by employing proper guidelines it is possible to generate a sound stability data of herbal products and predict their shelf-life, which will help in improving global acceptability of herbal products[1].

**Tulsi:krishna**

Tulsi, also known as holy basil, is a herbaceous plant that belongs to the mint family Lamiaceae. It is native to the Indian subcontinent and has been used for its medicinal properties for centuries. In Hinduism, Tulsi is considered a sacred plant and is often grown in courtyards and gardens for its spiritual and medicinal benefits.

Tulsi has a long history of use in Ayurvedic medicine, where it is used to treat a variety of ailments such as respiratory infections, fever, digestive issues, and stress. It is also used as an adaptogen, which helps the body adapt to stress and promote overall wellness.

The plant has a strong, pungent aroma and flavor, and its leaves are used to make tea,

tinctures, and other herbal remedies. Tulsi contains a variety of beneficial compounds, including antioxidants, essential oils, and flavonoids, which contribute to its health benefits.

Tulsi was described as by Linnaeus and its taxonomic position is as follows:

- Kingdom :**Plantae
- Class:**magnoliopsida
- Subclass:**magnoliopsida
- Order:**lamiales
- Subfamily:**lamiaceae
- Tribe:**ocimeae
- Genus:**ocimum sanctum
- Species:**Tulsi



**Fig no 1:- type of Tulsi**

Tulsi a polyphenol, has been shown to target multiple signaling molecules while also demonstrating activity at the cellular level, which has helped to support its multiple health benefits.It

has been shown to benefit inflammatory conditions , metabolic syndrome , pain , and to help in the management of inflammatory and degenerative eye conditions [13].

**The Main Product of Tulsi:krishna[5]**

| S. No. | Brand name            | Key highlights                    |
|--------|-----------------------|-----------------------------------|
| 1      | Jeeva                 | Reduce allergic coughs            |
| 2      | Tulsi pearl           | Buld strong immunity              |
| 3      | Jolly Tulsi 51 drop   | Contain 5 types of Tulsi extracts |
| 4      | Health vit Tulsi drop | Improve the immune systems        |
| 5      | Dabur Tulsi brops     | Improve immunity and metabolism   |

**Stability Testing :**

Stability testing of pharmaceutical products is a complex set of procedures involving considerable cost, time consumption and scientific

expertise in order to build in quality, efficacy and safety in a drug formulation. Scientific and commercial success of a pharmaceutical product can only be ensured with the understanding of the

drug development process and the myriad tasks and milestones that are vital to a comprehensive development plan. The most important steps during the developmental stages include pharmaceutical analysis and stability studies that are required to determine and assure the identity, potency and purity of ingredients, as well as those of the formulated products. Stability of a pharmaceutical product may be defined as the capability of a particular formulation in a specific container/closure system to remain within its physical, chemical, microbiological, toxicological, protective and informational specifications [15].

#### **Stability Testing Methods :**

Stability testing is a routine procedure performed on drug substances and products and is employed at various stages of the product development. In early stages, accelerated stability testing (at relatively high temperatures and/or humidity) is used in order to determine the type of degradation products which may be found after long-term storage [15].

#### **Real-Time stability testing:**

Real-time stability testing is normally performed for longer duration of the test period in order to allow significant product degradation under recommended storage conditions. The period of the test depends upon the stability of the product which should be long enough to indicate clearly that no measurable degradation occurs and must permit one to distinguish degradation from inter-assay variation. During the testing, data is collected at an appropriate frequency such that a trend analysis is able to distinguish instability from day-to-day ambiguity. The reliability of data interpretation can be increased by including a single batch of reference material for which stability characteristics have already been established.

#### **Accelerated stability testing:**

In accelerated stability testing, a product is stressed at several high (warmer than ambient) temperatures and the amount of heat input required to cause product failure is determined. This is done to subject the product to a condition that accelerates degradation. This information is then projected to predict shelf life or used to compare the relative stability of alternative formulations. This usually provides an early indication of the product shelf life and thus shortening the development schedule [15].

#### **Stability Testing of Tulsi:**

##### **1. Chromatographic-based methods :**

##### **1.1 Thin layer chromatography (TLC) and (HPTLC) :**

Developed TLC methods could be used as a technique for quality control of Curcuma rhizomes. Some of the recent published researches related to the use of TLC coupled with high performance liquid chromatography (HPTLC) for analysis of curcumin.

##### **1.2 High performance liquid chromatography :**

HPLC [High Pressure Liquid Chromatography] techniques are usually the methods of choice for determination of Tulsi the most common detectors used are UV or PDA (as curcumin has absorbance in the visible range).

##### **1.3 Liquid chromatography coupled with mass spectrometry (LC/MS):**

(LC/MS). LC/MS can be used to detect even trace amounts of curcumin in biological fluids, food or in other complex matrices and provide fast and accurate analysis as an on-line technique. Moreover, it can be used to differentiate from other Curcuminoids. Furthermore it can be used not only to identify and quantify known Curcuminoids, but also to identify unknown Curcuminoids in extracts from turmeric or related plant material.

#### **2. Tulsi Degradation :**

##### **2.1. Oxidation of Tulsi:**

Tulsi, also known as holy basil, is a plant commonly used in Ayurvedic medicine and in traditional Indian cooking. Like many other plant materials, Tulsi can undergo oxidation, which is a chemical reaction that involves the loss of electrons. When Tulsi is exposed to air, it can undergo oxidation reactions that result in the degradation of some of its components. For example, the essential oils in Tulsi can be oxidized, resulting in changes in their aroma and flavor. This process can also lead to the formation of new compounds, some of which may have potential health benefits. In addition to changes in aroma and flavor, oxidation can also result in the loss of some of Tulsi's beneficial compounds, such as antioxidants. To minimize oxidation and preserve the quality of Tulsi, it is often stored in airtight containers and away from light and heat. Overall, while oxidation of Tulsi can result in changes in its properties, it can also lead to the formation of new compounds with potential health benefits. Proper storage can help to minimize oxidation and preserve the quality of the herb.

## 2.2 Degradation of Tulsi in buffered solutions :

The degradation of Tulsi (*Ocimum tenuiflorum*) in a buffered solution would depend on various factors such as the pH of the buffer, the temperature, the presence of enzymes or other reactive species, and the duration of exposure to the buffer.

Tulsi contains various active compounds such as phenolics, flavonoids, and terpenoids that can undergo degradation reactions in a buffered solution. For example, the phenolic compounds in Tulsi can undergo oxidation reactions in the presence of oxygen and metal ions, which can lead to the formation of reactive species such as superoxide and hydrogen peroxide. These reactive species can further react with other compounds in the solution, leading to the degradation of Tulsi. The pH of the buffer can also affect the degradation of Tulsi. Tulsi is known to contain several volatile compounds such as eugenol and methyl chavicol that can be influenced by pH. For example, eugenol can undergo hydrolysis and oxidation reactions under acidic conditions, leading to the formation of degradation products. Similarly, methyl chavicol can undergo oxidation reactions under alkaline conditions, leading to the formation of degradation products. The temperature of the buffered solution can also affect the degradation of Tulsi. Higher temperatures can accelerate the degradation of Tulsi by increasing the rate of chemical reactions. Enzymes present in the Tulsi plant can also continue to function in the buffered solution, leading to enzymatic degradation of the plant material.

## 2.3. Photo degradation of Tulsi:

Exposure to visible light inflicts more degradation than UV light. The photochemical degradation of solid state curcumin exposed to sunlight for 120 h yielded vanillin (34 %), ferulic aldehyde (0.5 %), ferulic acid (0.5 %), vanillic acid (0.5 %), phydroxybenzaldehyde, p-hydroxybenzoic acid 117,118. Curcumin was found to be more stable in the dried form against sunlight exposure than in solution

Besides the photo-sensitivity of curcumin, it is also self-degradable in the dark, this self-degradation process is enhanced in basic medium, and it was found that this process was fairly dependent on salt (NaCl) concentration.

## 2.4. Thermal degradation of Tulsi :

Curcumin is heat sensitive (however it is stable up to 70 °C<sup>121</sup>), current researches suggest

that curcumin undergoes thermal degradation due to roasting (heating at 180 °C up to 70 minutes) and its degradation products are vanillin, ferulic acid, and 4- vinyl guaiacol.<sup>122</sup> If curcumin was used as food coloring agent, the processing temperature of the food should not exceed 190 °C.<sup>123</sup> Around 27-53 % of curcumin was lost by heat processing of turmeric and major loss was observed by pressure cooking, with maximum loss in pressure cooking for 10 min.

## 3. Physical evaluation:

Each monograph contains detailed botanical, macroscopic and microscopic descriptions of the physical characteristics of each plant that can be used to ensure both identity and purity. Each description is accompanied by detailed illustrations and photographic images which provide visual documentation of accurately identified material.

## 4. Microscopic evaluation:

Full and accurate characterization of plant material requires a thorough physical examination. Microscopic analyses of plants are invaluable for assuring the identity of the material and as an initial screening test for impurities.

## II. CONCLUSION

Tulsi, also known as Holy Basil, is a highly revered herb in Ayurveda medicine and has been used for thousand so 5 years to promote health and well being. It has numerous medicinal properties, including antioxidant, anti-inflammatory, antiviral, and antibacterial, making it beneficial for a variety of conditions. Research has shown that Tulsi can help reduce stress and anxiety, improve cognitive function, lower blood sugar levels and enhance immune function. It may also have potential in the treatment of cancer, cardio vascular disease, and respiratory conditions. In conclusion, Tulsi is a valuable herb with many health benefits, and incorporating it in to your diet or taking it as a supplement may be a useful way to promote overall health and well-being. However, as with any supplement or herbal remedy, it is important to consult with a health care provider before use.

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