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FORMULATION DEVELOPMENT AND EVALUATION OF TABLETS PREPARED FROM *OCIMUM SANCTUM* AND *GLYCYRRHIZA GLABRA*

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ABSTRACT

This study describes the formulation and evaluation of Tulsi herbal tablets developed to improve therapeutic applicability and patient convenience. The tablets were prepared using both wet granulation and direct compression techniques. Prior to compression, the powder blend containing herbal extract and excipients was assessed for pre-compression parameters such as flowability and compressibility. Post-compression evaluation of the tablets was carried out to determine characteristics including hardness, friability, weight variation, thickness, and drug content uniformity. The prepared blends demonstrated satisfactory flow properties, indicating suitability for tablet manufacturing. Stability studies further confirmed that the formulations remained physically and chemically stable under specified storage conditions, suggesting their potential effectiveness and shelf stability as herbal tablet formulations.

Introduction :

Herbal medicines are increasingly being preferred worldwide because of their natural origin, therapeutic effectiveness, and comparatively lower incidence of adverse effects. This growing acceptance has encouraged extensive research into the development of advanced herbal dosage forms with improved stability, efficacy, and patient compliance. Among the medicinal herbs widely recognized in traditional systems of medicine, *Ocimum sanctum* (Tulsi/Holy Basil) and *Glycyrrhiza glabra* (Licorice) possess significant pharmacological importance[1].

Ocimum sanctum is traditionally valued for its immunomodulatory, antioxidant, anti-inflammatory, and adaptogenic activities. Bioactive constituents such as eugenol, ursolic acid, and rosmarinic acid contribute to its therapeutic effects and make it useful in managing stress-related disorders, respiratory conditions, and immune dysfunction. Similarly, *Glycyrrhiza glabra* is known for its expectorant, anti-inflammatory, antimicrobial, and hepatoprotective properties. Glycyrrhizin and flavonoids present in licorice are mainly responsible for its effectiveness in treating cough, sore throat, gastric irritation, and respiratory ailments[2].

Conventional herbal preparations such as syrups and decoctions often suffer from drawbacks including poor stability, shorter shelf life, inaccurate dosing, and the need for frequent administration. To overcome these limitations, sustained release (SR) tablet formulations have emerged as a promising approach. Sustained release systems are designed to release the active constituents gradually over an extended period, thereby maintaining therapeutic drug levels, improving bioavailability, reducing dosing frequency, and enhancing patient adherence to therapy. The combination of *Ocimum sanctum* and *Glycyrrhiza glabra* in a sustained release tablet may provide synergistic therapeutic benefits, particularly in the management of cough and other respiratory disorders. Cough acts as a natural defense mechanism that helps clear mucus and foreign particles from the respiratory tract. However, persistent cough associated with common cold and respiratory infections requires effective and prolonged treatment. Herbal matrix tablets offer an advantageous alternative by ensuring controlled release of active phytoconstituents, minimizing fluctuations in drug concentration, and prolonging therapeutic action. In the present formulation approach, herbal extracts are incorporated with suitable pharmaceutical excipients such as polymers, diluents, binders, lubricants, and fillers. Hydrophilic polymers like hydroxypropyl methylcellulose (HPMC) are commonly employed to control the drug release rate and improve tablet integrity. Tablets may be prepared by direct compression or wet granulation techniques depending on the flow and compressibility characteristics of the powder blend[3].

Before compression, preformulation studies such as angle of repose, bulk density, tapped density, Hausner ratio, and Carr's index are performed to evaluate the flow properties of the granules or powder mixture. After tablet compression, post-compression parameters including hardness, friability, thickness, weight variation, drug content uniformity, and dissolution profile are assessed according to pharmacopoeial standards. Stability studies are also conducted to ensure the formulation maintains its physical and chemical integrity during storage. The development of sustained release herbal tablets containing Tulsi and Licorice therefore represents a promising strategy for achieving prolonged therapeutic activity, improved patient convenience, and enhanced effectiveness of herbal treatment. Further research and clinical evaluation may support their wider application in modern herbal drug delivery systems[4].

Through ages, traditional Indian physicians were aware of diabetes mellitus, also known as Madhumeha . Diabetes is treated by Ayurvedic practitioners utilizing a multifaceted approach that includes yoga, breathing techniques, herbal remedies, Panchkarma, and diet modification. Many plants, such as shilajit, turmeric, neem, Ivy gourd, amalaki, triphala, bitter gourd, rose apple, bilva leaves, cinnamon, gymnema, fenugreek, bay leaf, and aloe vera, are used against diabetes. Among the powders (Churana) utilized are Naag Bhasma, Haldi powder, and

Amalaki Churna. Chandraprabhavati and VasantaKusumakar Ras, two Ayurvedic medicines, are thought to reduce blood sugar levels. Research has demonstrated that oral administration of *Ocimum sanctum* (OS) extract significantly lowers blood glucose levels in normal and glucose-fed hyperglycemic diabetic rats. In a crossover, single-blind, randomized, placebo-controlled clinical trial, fasting and postprandial blood glucose levels were reduced by 17.6% and 7.3%, respectively, accompanied by a similar reduction in urinary glucose levels. Additionally, OS exhibits aldose reductase inhibitory activity, which may contribute to mitigating the risk of diabetes-related complications such as cataracts and retinopathy[5].

Experimental Methodology:

Material and methods:

Fresh Tulsi (*Ocimum sanctum* Linn.) leaves were collected from the medicinal garden of Swami Vivekanand Sanstha College of Pharmacy. The leaves were separated from the stems, thoroughly washed with clean water, and shade-dried for seven days until complete removal of moisture was achieved. The dried leaves were then pulverized using an electric blender to obtain a fine and uniform powder.

The powdered plant material was subjected to cold extraction using different organic solvents, namely ethanol, hexane, and chloroform. Approximately 300 g of finely powdered *Ocimum sanctum* leaves was used for the extraction process to obtain the respective herbal extracts for further formulation studies[6].

1. **Preparation of Herbal Extracts :**
   1) Extraction: ♣*Ocimum sanctum*: Dried leaves were powdered and subjected to solvent extraction using ethanol (60%) for 48 hours. The extract was then filtered and concentrated. ♣ *Glycyrrhiza glabra*: Dried roots were powdered and extracted with a mixture of water and ethanol (1:1) for 48 hours. The extract was filtered, concentrated, and dried.
2. **Formulation of Sustained Release Tablets by Wet Granulation Method**
1. **Blending:**
   The herbal extracts were accurately weighed and mixed with microcrystalline cellulose, lactose, and other excipients using a suitable mixer to obtain a uniform powder blend.
2. **Preparation of Wet Mass:**
   A binder solution containing polyvinyl pyrrolidone (PVP) was prepared using an appropriate solvent such as ethanol. The binder solution was added gradually to the powder blend with continuous mixing until a coherent wet mass was formed.
3. **Granulation:**
   The prepared wet mass was passed through a sieve (No. 20) to produce uniform granules.
4. **Drying of Granules:**
   The granules were dried in a hot air oven maintained at 40–50°C until the moisture content was reduced to an acceptable limit, generally below 5%.
5. **Lubrication:**
   The dried granules were blended with lubricating agents such as magnesium stearate and talc to improve flow properties and prevent sticking during compression.
6. **Tablet Compression:**
   The lubricated granules were compressed using a rotary tablet compression machine. Compression parameters were adjusted appropriately to obtain tablets with the desired weight, hardness, and uniformity suitable for sustained release characteristics[7].

Evaluation of Tablets :

1) Physical Characteristics

A) Weight Variation • Weight variation test was done by weighing 20 tablets individually. • From this total weight and average weight of 20 tablets are calculated.

B) Hardness • Monsanto hardness tester. Here, tablet is put between moving jaw and fixed jaw. Moving jaw is moved and pressure is applied on tablet by means of screw knob. The point where tablet get break down, it is recorded by means of scale. The hardness is measured in Kg/cm^2.

C) Friability • The tablets should be carefully dedusted prior to testing. • Accurately weigh the tablet sample, and place the tablets in the

drum. • Rotate the drum 100 times, with a speed of 25 rpm and remove the tablets. • Remove any loose dust from the tablets as before, and accurately weigh.

D) Thickness and Diameter • Measured using a caliper for uniformity.

2) In-Vitro Release Studies

A) Dissolution Testing: Conducted using a USP type II dissolution apparatus, Two media were used: 0.1 N HCl for gastric conditions and pH 6.8 phosphate buffer for intestinal conditions. Samples were taken at predetermined time intervals (1, 2, 4, 6, 8, and 12 hours) and analyzed using UV spectrophotometry.

B) Disintegration Testing Depending on the formulation and regulatory requirements, Tablets should disintegrate within a specified time frame (e.g. within 15 minutes) ¬The procedure for an uncoated tablet disintegration test involves the following steps • Assemble the apparatus Add water: Add 2.5 liters of water to the cylindrical jar. Adjust the fluid level • Adjust the apparatus until the water level is at the Mid-line of the upper plastic plate. Maintain the temperature: Keep the water temperature at 37°C ± 2°C. • Place the tablets: Put one tablet in each tube of the basket-rack assembly. Insert the assembly • Put the assembly into the water and start the machine • At end of the 15 min time limit according to IP[8].

RESULT AND DISCUSSION:

The present study demonstrates that *Ocimum sanctum* is a valuable source of various phytochemical constituents possessing significant therapeutic potential. The antibacterial activity exhibited by Tulsi leaves suggests that the plant possesses strong antimicrobial properties against different microorganisms. Due to its widespread availability and traditional importance in India, *Ocimum sanctum* may serve as an effective, natural, and renewable alternative to synthetic antibacterial agents. Its use in herbal formulations could therefore provide safer and more economical therapeutic options for the management of microbial infections[9,10].

Table 1: Formulation of Tablets

Formulations	Hardness (Kg/cm)	Friability	Diameter (mm)	Thickness (mm)	Weight variation (%)	Disintegration (min)
A	3.26± 0.14	4.24 ±0.27	7.38± 0.003	4.57± 0.004	8.11 ±0.46	43.98±1.0
B	3.26± 0.14	4.24 ±0.27	7.38± 0.003	4.57± 0.004	8.11 ±0.46	43.98±1.0

CONCLUSION:

Antibacterial activity of different *Ocimum sanctum* extracts against *Staphylococcus aureus* (Gram negative bacteria) was studied. According to the results, all different types of extracts obtained from *Ocimum sanctum* leaves are shown to be with antibacterial activity against tested microbialpathogens.

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