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PHYTOCHEMICAL SCREENING AND STANDARDIZATION OF ST TABLET: AN AYURVEDIC POLYHERBAL LAXATIVE FORMULATION

Anju Antony[1], Greeshma K. M.[1], Bijeshmon P. P.[1] and Sibi Narayanan[2*]

[1]Quality Control Division, Sitaram Ayurveda Pvt. Ltd., PO Nedupuzha, Thrissur, Kerala, India – 680007.
[2]Quality Assurance Division, Sitaram Ayurveda Pvt. Ltd., PO Nedupuzha, Thrissur, Kerala, India – 680007.

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***Corresponding author:**
Sibi Narayanan
Quality Assurance Division, Sitaram Ayurveda Pvt. Ltd., PO Nedupuzha, Thrissur, Kerala, India – 680007.

ABSTRACT

ST Tablet is a polyherbal Ayurvedic formulation composed of Senna (*Cassia angustifolia*), Triphala (a combination of *Terminalia chebula*, *Terminalia bellirica* and *Emblica officinalis*), Trivrit (*Operculina turpethum*) and Yashtimadhu (*Glycyrrhiza glabra*), widely indicated in the management of constipation and irregular bowel habits. Constipation is a prevalent gastrointestinal disorder characterized by infrequent bowel movements, difficulty in defecation, or passage of hard stools, often associated with dietary, lifestyle, and pharmacological factors. In Ayurveda, it is described as Vibandha, primarily caused by the vitiation of Vata dosha, particularly dysfunction of Apana Vayu at the level of Pakwashaya (colon). The present study aims to standardize ST Tablet through organoleptic evaluation, physicochemical analysis, preliminary phytochemical screening, and chromatographic fingerprinting. Organoleptic parameters confirmed characteristic brown-coloured tablets with a bitter taste. Physicochemical parameters such as hardness, friability, loss on drying, and ash values were assessed to ensure quality and stability. Phytochemical analysis revealed the presence of glycosides, flavonoids, phenols, tannins, and saponins, which are responsible for the formulation's laxative, digestive, and detoxifying properties. The synergistic action of its ingredients enhances bowel motility, softens fecal matter, improves digestion, and balances Tridoshas. The study establishes baseline quality control parameters for ST Tablet, which can be used for ensuring batch-to-batch consistency and scientific validation of the formulation.

KEYWORDS: ST Tablet; Vibandha; Polyherbal formulation; Laxative; Phytochemical analysis; Ayurveda.

1. INTRODUCTION

Ayurveda, the traditional system of medicine in India, is based on a holistic approach to health and disease management, emphasizing the balance of three fundamental biological energies known as Vata, Pitta, and Kapha. Polyherbal formulations form the backbone of Ayurvedic therapeutics, where multiple herbs are combined to achieve synergistic pharmacological effects. Despite their widespread use, the lack of standardized quality control parameters has limited their global scientific acceptance. Therefore, establishing physicochemical and phytochemical standards is essential for ensuring the safety, efficacy, and reproducibility of such formulations.

Constipation is one of the most common gastrointestinal disorders affecting individuals across all age groups. Clinically, it is defined as having fewer than three bowel

movements per week or experiencing difficulty during defecation. The etiology of constipation includes inadequate dietary fiber intake, dehydration, sedentary lifestyle, psychological stress, and adverse effects of medications such as opioids and anticholinergics. Chronic constipation may lead to complications such as hemorrhoids, fissures, and impaired quality of life.

In Ayurvedic literature, constipation is referred to as Vibandha, which is primarily caused by the aggravation of Vata dosha, particularly Apana Vayu, responsible for elimination processes. When Apana Vayu becomes obstructed or dysfunctional (Moodha), it leads to dryness and hardness of stools, resulting in difficulty in evacuation. Management of Vibandha involves the use of laxatives (Virechana dravyas), dietary modifications, and lifestyle corrections.

ST Tablet is a polyherbal formulation designed to address constipation through a multi-target mechanism. The formulation contains Senna, a well-known stimulant laxative rich in anthraquinone glycosides; Triphala, a classical Ayurvedic combination known for its digestive and detoxifying properties; Trivrit, a potent purgative drug; and Yashtimadhu, which exhibits demulcent and anti-inflammatory effects on the gastrointestinal mucosa.

The present study was undertaken to scientifically evaluate and standardize ST Tablet using organoleptic, physicochemical, and phytochemical parameters, along with chromatographic profiling, to establish quality benchmarks for this formulation.

2. MATERIALS AND METHODS

2.1 Collection and authentication of raw materials

All raw materials used in the preparation of ST Tablet were procured from the raw material repository of Sitaram Ayurveda Pvt. Ltd., Thrissur, Kerala. The materials were authenticated by experts in the Pharmacognosy Division based on macroscopic and microscopic characteristics. Voucher specimens were preserved for future reference in the Quality Control Division.

2.2 Composition of ST Tablet

The formulation consists of the following ingredients:

Table 1: List of herbal raw materials: ST Tablet.

Sl. No	Ingredient	Botanical name	Part used	Role
1.	Senna	*Cassia angustifolia*	Leaf	Stimulant laxative
2.	Triphala	*T. chebula*, *T. bellirica*, *E. officinalis*	Fruit	Digestive, mild laxative
3.	Trivrit	*Operculina turpethum*	Root	Strong purgative
4.	Yashtimadhu	*Glycyrrhiza glabra*	Root	Demulcent, anti-inflammatory

2.3 Preparation of ST Tablet

The raw materials were thoroughly cleaned with water to remove impurities, dried under controlled conditions, and pulverized separately into fine powders. The powders were passed through appropriate sieves to ensure uniform particle size. The ingredients were then blended in specified proportions to obtain a homogeneous mixture.

Granulation was carried out using suitable binding agents to improve compressibility. The granules were dried and subjected to tablet compression using a rotary tablet compression machine under controlled environmental conditions. The tablets were evaluated for uniformity of weight, hardness, and friability.

2.4 Organoleptic evaluation

Organoleptic characteristics such as colour, odour, taste, and appearance were evaluated using sensory perception as per SOP. These parameters provide preliminary information about the identity and quality of the formulation.

2.5 Physicochemical analysis

Physicochemical parameters were evaluated as per standard procedures outlined in the Ayurvedic Pharmacopoeia of India. These included:

- Loss on drying (moisture content)
- Total ash (inorganic content)
- Acid-insoluble ash (siliceous matter)
- Water-soluble extractives
- Alcohol-soluble extractives
- Hardness
- Friability

These parameters are critical for determining purity, stability, and quality consistency.

2.6 Preliminary phytochemical screening

Qualitative phytochemical tests were performed to detect the presence of major classes of phytoconstituents, including:

- Carbohydrates
- Glycosides
- Flavonoids
- Phenolic compounds
- Tannins
- Saponins
- Alkaloids

These phytochemicals contribute to the pharmacological activity of the formulation.

2.7 Thin Layer Chromatography (TLC) analysis

TLC fingerprinting was carried out to establish a characteristic chromatographic profile of the formulation. Extracts of the sample were prepared using suitable solvents and spotted on silica gel plates. The plates were developed using an appropriate mobile phase and visualized under UV light at different wavelengths and after derivatization.

TLC serves as a rapid and reliable method for ensuring batch-to-batch consistency and detecting adulteration.

TLC fingerprinting was carried out to establish a characteristic chromatographic profile of the formulation. Approximately 20 g each of dried Haritaki (Terminalia chebula) fruit rind, dried Senna leaves, and powdered ST tablets were separately subjected to Soxhlet extraction using 50 mL of methanol. The extraction was carried out until complete exhaustion of the material. The extracts were then allowed to cool to room temperature and subsequently filtered through filter paper. The filtrates were concentrated to 10 mL and collected as methanolic extracts for TLC analysis.

Chromatographic development was performed on pre-coated silica gel 60 F254 plates, which served as the stationary phase. A small volume of each methanolic extract was applied as a spot on the TLC plate using a fine capillary tube at approximately 1 cm above the lower edge of the plate. The plates were then placed in a TLC chamber previously saturated with the mobile phase consisting of Toluene: Ethyl acetate: Formic acid in the ratio 9:1:0.5. Chromatographic development was carried until the solvent front migrated to an appropriate distance from the origin. The plates were subsequently air-dried and examined under UV light at 366 nm. The retardation factor (Rf) values of the resolved spots were calculated and recorded.

3. RESULTS AND DISCUSSION

3.1. Physicochemical Analysis of ST Tablet

The physicochemical parameters confirm the quality and stability of the finished tablet dosage form. The results are in complete compliance with the in-house and API specifications (Table 2).

Table 2 Physicochemical parameters of ST Tablet.

Physicochemical Evaluation of ST Tablets

The physicochemical parameters confirmed that the developed formulation complies with in-house and pharmacopeial specifications. Three independent batches were evaluated to ensure batch-to-batch consistency. All results are expressed as mean ± standard deviation (SD) with the number of observations (n) indicated.

Table 2: Physicochemical parameters of ST Tablets (combined results of three batches)

Sl. No.	Parameter	Specification	Unit	Result
1	Description	18 mm capsule-shaped uncoated tablet	–	Complies
2	Colour	Brown	–	Complies
3	Odour	Characteristic	–	Complies
4	Taste	Astringent	–	Complies
5	Loss on Drying @105°C	Not more than 7	%	4.87 ± 0.20
6	Average Weight	1000 mg ± 5%	mg	1012 ± 15
7	Friability	Not more than 1	%	0.10 ± 0.03
8	Disintegration Time	Not more than 60	minutes	30 ± 3
9	Hardness	2.0 – 5.0	kg/cm²	3.1 ± 0.3

3.2. Microbiological Analysis

The tablet complies with AYUSH Standard microbial limits (Table 3).

Table 3: Microbiological parameters of ST Tablet.

Sl. No.	Parameters Tested	Specification	Unit	Result
1.	Total Yeast and Mold Count	10^3	CFU/ml	Absent
2.	Total Plate Count	10^5	CFU/ml	Absent
3	*E.coli, P. aeruginosa, Salmonella spp., S. aureus*	Absent	Present or Absent/ml	Absent

3.3. Phytochemical analysis

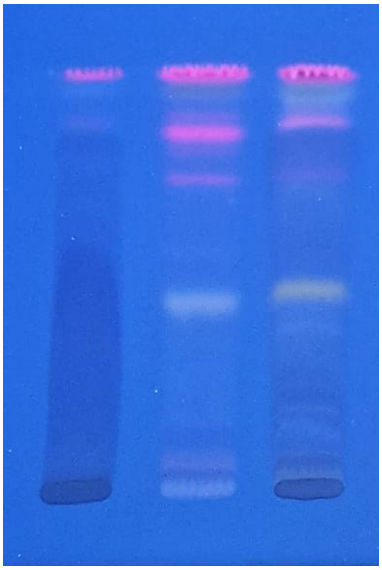
The activity of a herb depends on the class of phytoconstituents or specific phytoconstituents being present in it. In majority, of the herbals which are in use the knowledge about these is fairly known. Therefore, it is necessary to devise a method of standardization based upon the presence of these chemicals. Hence the primary phytochemical analysis plays very important role in the efficacy of particular drug action. The phytochemical constituents present in ST Tablet is listed in Table 4.

Table 4: Phytochemical analysis of ST Tablet.

Sl. No.	Phytochemical constituents	Name of the test	Present (+) / Absent (-)
1.	Carbohydrate	Molisch's test	+
2.	Sugar	Benedict test	+
3.	Reducing sugar	Fehling's test	+
4.	Ketose	Seliwanoff's test	+
5.	Amino acid	Ninhydrin test	-
6.	Protein	Ninhydrin test	-
7.	Starch	K I test	-
8.	Quinone	H2SO4	-
9.	Glycoside	Salkowski test	+
10.	Flavonoid	Alkaline reagent	+
11.	Phenol	Phenol reagent test	+
12.	Saponin	Foam test	+
13.	Alkaloid	Wagner reagent	-
14.	Tannin	Ferric chloride test	+
15.	Coumarin	NaOH test	+

3.4 Thin Layer Chromatography (TLC) Fingerprint Analysis

The TLC profiles clearly establish the presence of marker constituents from both Haritaki fruit rind and Senna leaf in the ST Tablet. The ST Tablet extract shows superimposable spots with the reference ingredients, confirming batch-to-batch consistency and authenticity of the formulation.



Under UV-366

Figure 1: TLC profile of Haritaki, Senna & ST Tablet in subsequent lanes.

Table 5: Rf values under UV 366 nm.

Sl. No.	Sample	Rf values
1.	Haritaki	0.02, 0.46, 0.68, 0.73, 0.76, 0.80
2.	Senna	0.034, 0.20, 0.40, 0.45, 0.60, 0.64, 0.73, 0.76, 0.77, 0.80
3.	ST Tablet	0.034, 0.20, 0.21, 0.32, 0.40, 0.60, 0.73, 0.76, 0.77, 0.80

TLC is a very simple tool to standardize a drug formulations and more relevant that other analytical methods. It is relatively simple, handy, easier, quick, convenient, efficient and inexpensive method for quick assessment of the quality of most of the herbal preparations. Multiple common Rf values (especially 0.034, 0.20, 0.40, 0.60, 0.73, 0.76, 0.77, 0.80) between Senna leaf, Haritaki and ST Tablet prove the successful incorporation of both ingredients and the absence of major degradation or adulteration.

4. CONCLUSION

ST Tablet was characterized on the basis of organoleptic, physical, phytochemical and chromatographic fingerprint analysis. Brown colour, characteristic odour, astringent taste, Loss on Drying 4.87 ± 0.20%, average weight 1012 ± 15 mg, friability 0.10 ± 0.03%, disintegration time 30

±3 minutes, hardness 3.1 ± 0.3 kg/cm², and compliance with all AYUSH microbial limits were found to be characteristic of the tablet. TLC fingerprint using Toluene: Ethyl acetate: Formic acid (9:1:0.5) as mobile phase clearly matches the marker spots of Kadukka and Senna, confirming the identity and consistency of the formulation.

All these parameters may be employed as standard reference for quality control analysis of ST Tablet. This scientific validation helps in developing new treatment protocols and can be taken as a reference standard of ST Tablet.

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Disclosure of conflict of interest

The authors have no conflicts of interest to declare.

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