

# Formulation and Evaluation of Herbal Anti-inflammatory Lollipop using *Sterculia Lychnophora* Seed Extract

Shalini Dhawale\*, Rajkumar Moon, Pavan Birgad, Ujwala Salve,  
Pratiksha Bhajikhaye, Dipali Korde, Vishal Pagare, Suraj Thakare  
School of Pharmacy, Swami Ramanand Teerth Marathwada University, Nanded

**Abstract:-** We are moving away from nature as our lifecycle becomes more technologically savvy. Herbs are natural items, thus they have no negative side effects and are also relatively safe, environmentally friendly, and locally accessible. In many of the pathological conditions like mouth ulcers, throat infection, cough etc, it needs to localize the medicament in the oral cavity region. Considering these facts present study aims to formulate and evaluate herbal lollipop using *Sterculia Lychnophora* seed extract for anti-inflammatory activity. The advantages of the current study effort include higher oral dosage form bioavailability and retention time, as well as a decrease in stomach discomfort due to first pass metabolism. The conventional dosage forms like tablets and capsules, syrups etc are inconvenient for paediatric patients because of difficult to swallow tablets and capsules or unpleasant taste of drug. As a result demand for developing new technologies has been increasing day by day. In the present investigation herbal lollipop containing *Sterculia Lychnophora* seed extract were prepared by heating and congealing technique. For drug analysis, many instrumental techniques such as UV, FTIR, and others were used. The generated lollipop formulations were tested for thickness, weight variation, friability, hardness, stability studies, and anti-inflammatory efficacy.

**Keywords:-** *Sterculia Lychnophora* Seeds, Herbal Lollipop, Anti-Inflammatory Activity.

## I. INTRODUCTION

*Sterculia Lychnophora* Hanse is species of tree in the genus *Sterculia*, native to mainland South east Asia. It is the deciduous tree that belongs to the *Sterculiaceae* family. The trees grow mainly in tropical zones including India, Malaysia, Thailand, Indonesia. Its seed is used in traditional Chinese medicine as a “coolant” for a gastrointestinal disorder and for soothing the throat. This traditional drug is reputed for its prevention and remedy against pharyngitis. It has also been used for the treatment of tussis and constipation since ancient times [3][4]. *Sterculia Lychnophora* species have been extensively used in traditional medicine in the various countries across the world. The tree can reach a height of 25-30 m. Young fruit is green yellow and matures to a dark brown tint. Seeds are usually collected from the tree or from the ground after

shaking or cutting the branches. To ease collection a cover can be spread out on the ground. The optimal time of collection is reached when fruits have changed in colour from green to brownish. The flesh surrounding the dried seeds swells to eight time its original volume when it is overnight soaked in water its exposed interior is yellowish brown with a spongy mucus rich consistency, when chewed at length, is cool or cold in nature [1][2].

## II. PHARMACOLOGICAL ACTIVITIES

The Chinese Pharmacopoeia (2000) recognises *Sterculia Lychnophora* Hanse. The seeds of *sterculia* are used to prevent and treat pharyngitis. It's also been used to cure constipation. *Sterculia Lychnophora* is typically boiled or soaked in hot water and used as a beverage to cure sore throats, combat toxicity, and lubricate the intestines. *Bassorin* has the ability to constrict vascular smooth muscle, reduce mucosal irritation, and decrease spastic discomfort. Hoarseness of voice, dry cough or productive cough with yellow sticky phlegm, painful, dry throat caused by heat in the lung, and constipation with headache and bloodshot eyes are all treatable symptoms. *Malva* nut can be consumed by adding one or two nuts to a large cup of boiling water and drinking the liquid. Typically, in traditional Chinese medicine, *malva* nut would be part of larger formula of herbs designed to address person conditions. Although it possesses medicinal properties care must be taken with its consumption. Avoid boiling more than 3 seeds per drink. Although it has medical benefits, it must be consumed with caution. Don't cook more than three seeds each drink. Symptoms of overconsumption include white watery sputum, nausea, coughing, and a swollen tongue. People who have frequent digestion issues, abdominal pain, or diarrhoea should avoid it completely [12].

### A. Inflammation

Inflammation is a defence reaction caused by tissue damage or injury, characterised by redness, heat, swelling and pain. The basic goal of inflammation is to localise and eliminate the irritant while also repairing the surrounding tissue. Inflammation facilitates the removal of bacteria, poisons, or foreign material at the site of injury, inhibits their spread to other organs, and prepares the region for tissue healing, therefore it is beneficial. restores tissue homeostasis [5].

### B. Lollipops

The oral route of drug administration is the most common and easiest method of drug delivery. The oral route of drug delivery has gained widespread acceptability, accounting for 50-60% of total dosage form. The use of solid dosage forms allows for easier administration, more accurate dosing, self-medication, pain avoidance, and, most significantly, patient compliance. However, paediatric, geriatric, and bedridden patients have difficulty swallowing standard pills or capsules due to issues swallowing with less water with the drug and being unable to take. When many drugs are prepared as liquid dose forms, they have an unpleasant taste, which leads to poor patient compliance. Over the last two decades, there has been an increase in demand for more patient-friendly dose forms, which has resulted in an increased push for innovative administration technologies. Because the development cost of a new chemical entity is extremely costly, pharmaceutical companies are now focused on the development of new drug delivery systems for current drugs with increased efficacy and bioavailability, as well as reduced dose frequency, in order to minimise adverse effects [1][2][4].

### C. Types of lollipops

#### ➤ Hard lollipops [11]

Hard lollipops could be called solid sugar syrups. These dosage forms are created by boiling sugars and other ingredients before putting the liquid into a mould. Hard lollipops resemble hard candy. In fact, many hard lollipop recipes are variations on hard candy recipes.

#### ➤ Soft lollipops [11]

Soft lollipops have grown in popularity due to their ease of preparation and their suitability for a wide range of medications. The base is often made up of a combination of various PEGs, acacia-related compounds, glycerol gelatine, and an acacia: sucrose base. These lollipops can be coloured and flavoured, and depending on the intended impact of the included medicine, they can be eaten or slowly dissolved in the mouth.

#### ➤ Advantages of Herbal lollipops [2]

- Maintaining medications in contact with the oral cavity for an extended amount of time by using formulations that are simple to alter and can be patient specific.
- Patients who have difficulties swallowing can be given lollipops.
- Lollipops have a nice taste and increase the amount of time that a medicine spends in the oral cavity to generate a therapeutic effect.
- Lollipops are simple to make with minimal equipment and effort, allowing for non-invasive and waterless administration.

#### ➤ Disadvantages of herbal lollipops [2]

- Heat labile medicines are not suited for use in lollipop formulations due to the high temperature necessary for manufacture.
- however, medications with a low bitter taste are acceptable.

- The medication is drained from the oral cavity into the stomach along with saliva.

## III. MATERIAL AND METHODS

### A. Material used:

*Sterculia Lychnophora* seeds were acquired from Herbal Pharmacy in Nanded, Maharashtra, India. The specimen was subsequently treated and mounted on a herbarium sheet according to the technique of the Indian Botanical Survey for identification and authenticity by Prof. Dr. R. M. Mulani, Head of Department of Botany, School of Life Science, S.R.T.M. University Nanded. S.D. Fine Chemicals Ltd in Mumbai provided all of the remaining ingredients.

#### ➤ Collection, Identification and preparation of *Sterculia Lychnophora* seeds

Following identification, the collected seeds were dried in a shady location at room temperature for 30 days to prevent active chemical degradation. Prior to usage, the husk and kernels of the seed material were separated after drying. The seeds were broken into small pieces and mechanically ground into a coarse powdery condition for extraction and phytochemical analysis.

#### ➤ Extraction of *Sterculia Lychnophora* seeds

The husk and kernels of *S. Lychnophora* seed material were separated prior to use. The grounded powder of *Sterculia Lychnophora* seeds used for the preparation of extract using Soxhlet apparatus by successive extraction method with different solvent (Petroleum Ether, Ethyl acetate, methanol, water).

### B. FTIR Spectroscopy

FTIR spectrum analysis was performed on the produced extract. Approximately 1mg of extract was dissolved in KBr powder and placed in the sample container, and the FTIR spectra was acquired using powder diffuse reflectance on an FTIR spectrophotometer.

#### ➤ Anti-inflammatory activity of extract

The selected extract sample was tested for anti-inflammatory efficacy in vivo using the carrageenan-induced rat paw edoema technique. Adult albino rats were chosen in groups of five. The experiment employed Wistar rats of either sexes weighing 150-200 grammes. They were housed in polypropylene cages with husk bedding, which were changed every 48 hours under a 12:12 h light dark cycle at roughly 250 degrees Celsius. They were fed commercial pellet rat chow and given unlimited water. Each rat's right hind paw was injected subplantarily with 0.1 ml of 1% carrageenan in saline to induce edoema. Suspension of selected extract samples in 1% w/v gum acacia was produced and delivered orally at doses of 100 and 300 mg/kg 1 hour before carrageenan injection. The control group received just vehicle, while the standard group received diclofenac sodium. The volume of the injected and control paws was measured using a plenthsymometer at 0, 1, 3, and 5 hours after induction. The value was expressed as a

percentage reduction in volume compared to the control group at various time periods [10].

➤ *Preparation of herbal lollipop by heating and congealing technique*

- The syrup base was made by dissolving the needed amount of sugar and boiling it at 110 degrees Celsius for around 90 minutes.
- Dextrose was dissolved in a tiny amount of water and heated to 110°C until it entirely dissolved, forming a transparent viscous syrup.
- The dextrose syrup was then added to the sugar syrup and cooked to 160 degrees Celsius until the colour changed to golden yellow.

- Flavour was added at 120°C to 135°C, then the temperature was reduced to 90°C, then extract, polymer, and other ingredients were added and thoroughly combined.
- The produced slurry was put into the calibrated mould and air dried for 1-2 hours.
- To prevent moisture absorption, the produced lollipops were wrapped in aluminium foil and placed in a desiccator.

➤ *Formulation of herbal lollipop*

Table 1: Formulation of herbal lollipop

Sr. No.	Composition (in miligram)	F1	F2	F3	F4	F5	F6
1	<i>Sterculia Lychnophora</i> Seed Extract	100	100	100	100	100	100
2	Sucrose	4600	----	3600	3500	3400	3300
3	Dextrose	----	4600	1000	1100	1200	1300
4	HPMC	100	100	200	300	400	500
5	Citric Acid	100	100	100	100	100	100
6	Calcium Carbonate	5	5	5	5	5	5
7	Colouring Agent	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S
8	Flavouring Agent	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S
	Total Weight	5000	5000	5000	5000	5000	5000

IV. RESULT AND DISCUSSION

A. *Identification and authentication of the plant*

The plant's seeds were purchased from a local herbal pharmacy in Nanded, Maharashtra state, India, and then processed and mounted on herbarium sheets according to the procedure of the Indian Botanical Survey, and were identified and authenticated as *Sterculia Lychnophora* seeds by Prof. Dr. R. M. Mulani, Head, Department of Botany, School of Life Sciences, S. R. T. M. University, Nanded.

➤ *Physical characteristics of extract*

Table 2: Physical characteristics of extract

Properties	Observation of <i>Sterculia Lychnophora</i> extract
Colour	Brown
Odour	Characteristic
Taste	Slightly bitter
Solubility	Soluble in alcohol

➤ *Phytochemical Characterization of Sterculia Lychnophora seed extract*

Preliminary phytochemical screening tests were performed to determine the phytoconstituents in extract. Results are given in table 3.

Table 3: Phytochemical Characterisation of *Sterculia Lychnophora* seed extract

Sr. No.	Class of compound	Test performed	Result
1	Alkaloids	Mayer's test	Possitive
2	Flavonoids	Alkaline Reagent test	Negative
3	Protein	Biuret test	Negative
4	Tannin	Ferric Chloride test	Negative
5	Triterpenoid	Salkowski test	Possitive
6	Steroid	Lieberman-burchard test	Negative
7	Fats and Fixed oil	Glycerine test	Negative
8	Polyphenols	-	Possitive
9	Phenol	TLC	Possitive



Fig 1: *Sterculia Lychnophora* Seed

Phytochemical Analysis: Present = (+), Absent = (-)

➤ *Anti-inflammatory activity of sterculia lychnophora extract*

The anti-inflammatory efficacy of sterculia lychnophora extract in vitro was investigated using the carrageenan-induced rat paw edema technique. According to the findings, the extract has anti-inflammatory properties.

Table 4: Anti-inflammatory activity of extract

Treatment	Dose	Inflammation (Volume in ml)					
		30 min	60 min	120 min	180 min	240 min	300 min
Positive control	Carrageenan	0.26	0.39	0.70	0.81	0.73	0.66
Low dose	100 mg/kg	0.27	0.34	0.59	0.70	0.67	0.63
High dose	300 mg/kg	0.23	0.29	0.48	0.56	0.57	0.59
Standard (Diclofenac)	5 mg/kg	0.18	0.20	0.29	0.27	0.31	0.30

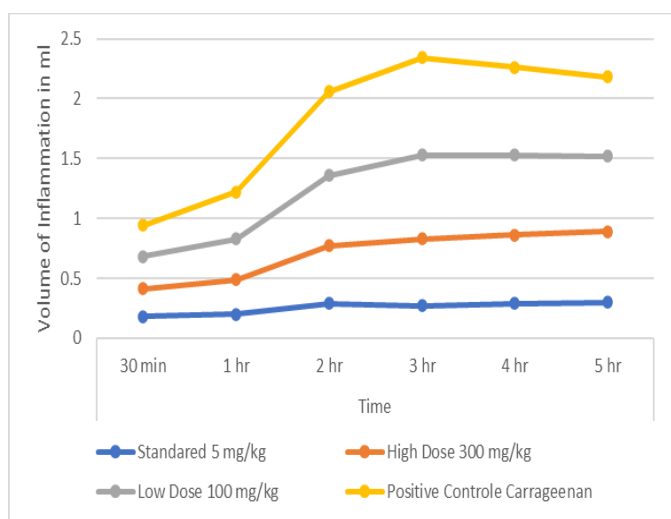


Fig 2: Effect of *S. Lychnophora* extract on carrageenan induced rat paw edema

➤ *FTIR Spectroscopy*

FTIR spectra obtained showed characteristic peaks of, OH at 3328 cm<sup>-1</sup> (Alcohol, Phenols, Group of glycosides), N-H at 1448 cm<sup>-1</sup> (Presence of flavones Glycosides indicative of Flavonoids), C-H at 2926, 2835 cm<sup>-1</sup> (Alkanes, presence of long chain fatty acids, phytosterols) and C-O at 1050-1150 cm<sup>-1</sup> (Corresponds to flavonoids).

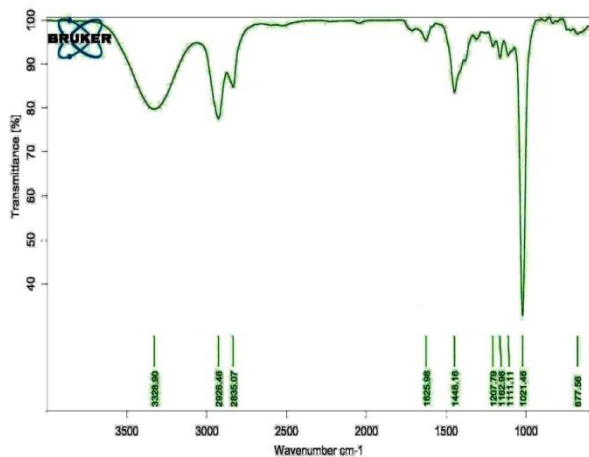


Fig 3: FT-IR Spectra of *S. Lychnophora* Seed extract

Compatibility of extract with excipient (Sucrose + HPMC + Citric acid + Calcium carbonate) was studied by FTIR. The FTIR spectra of all excipients in combination with extract shows the characteristic peaks same as that of pure extract alone which confirmed the compatibility of extract and excipients with no chemical modification.

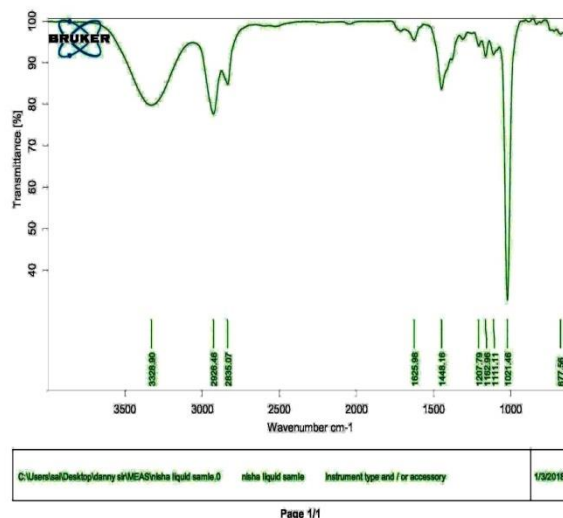


Fig 4: FTIR Spectra of extract and excipient in combination

B. *Evaluation of anti-inflammatory herbal lollipop*

➤ *Organoleptic Characterization*

The prepared lollipops were inspected visually for colour, clarity, presence of any particular materials and texture. This test is important for patient compliance and acceptance.

Table 5: Organoleptic characteristics of lollipops

Formulation	Colour	C
F1	Reddish, little sticky, easily removed from mould	Hom
F2	Reddish, sticky, easily removed from mould, smooth	Hom
F3	Reddish, sticky, smooth	Hom
F4	Reddish, sticky	Hom
F5	Reddish, sticky	Hom
F6	Reddish, little sticky	Hom



➤ *Diameter and thickness*

The diameter of the lollipop is vital for consistency in the size of the lollipops. Vernier callipers were used to measure thickness and diameter table 6.

Table 6: Thickness and diameter of lollipops

Formulation	Thickness in mm	Diameter in cm
F1	14.80	2.46
F2	14.95	2.44
F3	15	2.50
F4	15	2.50
F5	15	2.50
F6	15	2.50

➤ *Weight Variation test for lollipops*

Individual weight of 20 lollipops was taken and average weight of the 20 lollipops was calculated and weight variation of each batch was determined (table 7).

$$\text{Weight Variation} = \frac{\text{Average weight minus Initial weight}}{\text{Average weight}}$$

Table 7: Weight variation of lollipops

Formulation	Weight variation of lollipops in g
F1	5.05
F2	4.86
F3	4.99
F4	5.01
F5	5.03
F6	5.04

➤ *Hardness and friability*

The hardness of lozenges determines their resistance to shipment or breakage during storage, transportation, and handling prior to use. The hardness of lollipops was determined using a Monsanto hardness tester, which measures the force necessary to shatter the lollipop in kilogrammes per square centimetre.

The friability was tested using the Roche Friabilator. Twenty lollipops were precisely weighed and placed in the tumbling equipment, which resolves at 25 rpm. After 4 minutes, the lollipops were weighed to establish the % drop in lollipops weight. Furthermore, the greatest weight reduction cannot exceed 1% of the overall weight. Table 8 displays the results collected. All of the results are between the 0.1 - 0.9% range. All batches were deemed to be acceptable based on the results.

Table 8: Hardness and friability of lollipops

Formulation	Hardness in kg/cm <sup>2</sup>	Friability in %
F1	10.86	0.85
F2	11.00	0.82
F3	11.04	0.85
F4	11.06	0.85
F5	11.01	0.84
F6	11.08	0.86

➤ *Stability studies*

The stability study was carried out for one month and results revealed that all the lollipops showed better stability at 8°C, Room Temperature, 45°C.

Table 9: Stability study of lollipop

Days	Temperatures	Colour	Crystallization	Presence of any particular materials
8	8°C	Reddish, little sticky	No	No
	Room Temp.	Reddish, Sticky	No	No
	45°C	Reddish, Sticky	No	No
15	8°C	Reddish, Sticky	No	No
	Room temp.	Reddish, Sticky	No	No
	45°C	Reddish, Sticky	No	No
30	8°C	Reddish	No	No
	Room Temp.	Reddish	No	No
	45°C	Reddish	No	No

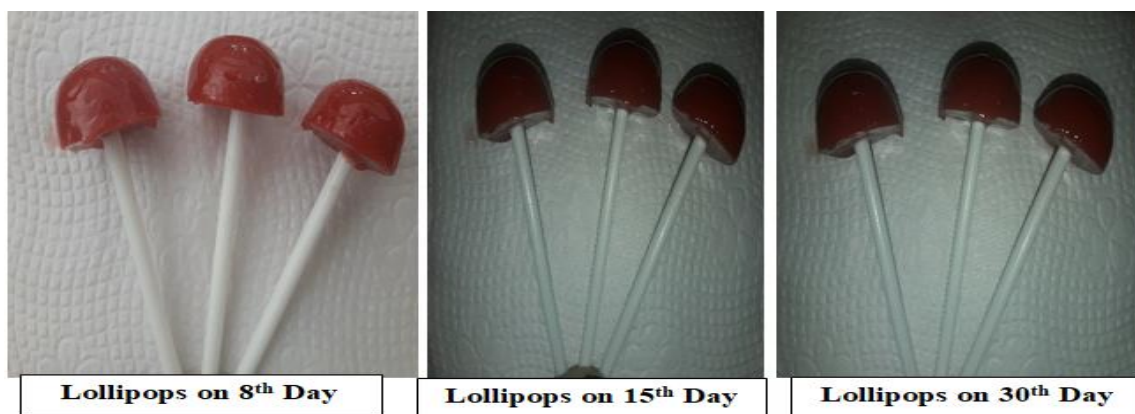


Fig 5: Stability study of Lollipops

## V. CONCLUSION

According to the findings of this study, sucrose-based medicated herbal lollipop may be an ideal dosage form for paediatric patients for the successful therapy of pharyngitis, tonsillitis, and swollen gums. The stability investigations revealed that the manufactured lollipops were stable when stored in an airtight container for the storage time and under the various conditions examined. These findings may be useful in developing such formulations for paediatric patients.

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