



Research Article

Formulation And Evaluation of Herbal Tablets Using *Nyctanthes Arbor Tristis* Leaves Powder

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ABSTRACT

The formulation and evaluation of herbal tablets using *Nyctanthes arbor-tristis* (Nightflowering Jasmine) powder through wet granulation involves a multi-step process aimed at ensuring the tablets' efficacy, stability, and safety. The process begins with the thorough characterization of *Nyctanthes arbor-tristis* powder to understand its phytochemical composition and identify active compounds responsible for its medicinal properties. Suitable excipients are then selected based on their compatibility with the herbal powder and their ability to aid in granulation and tablet formation. Wet granulation involves mixing the *Nyctanthes arbor-tristis* powder with wetting agents and binders to form granules. The wet mass is then passed through a sieve to produce uniform granules of the desired size. These granules are then dried to remove excess moisture, ensuring stability during storage. The dried granules are then mixed with additional excipients such as disintegrants and lubricants to improve tablet characteristics and aid in the compression process. The mixture is compressed into tablets using tablet presses, forming tablets of consistent weight and hardness. The formulated tablets undergo evaluation for various parameters including weight variation, hardness, friability, disintegration time, and dissolution rate. These tests ensure that the tablets meet pharmacopoeial standards and requirements for quality and performance.

INTRODUCTION

Nyctanthes arbor-tristis (*N. arbor-tristis*) is a valuable medicinal plant which belongs to the family Oleaceae. The plant generally grows in tropical and subtropical region. *N. arbor-tristis*

commonly known as Night jasmine, Harsingar & Parijat. The flowers start falling after midnight and by the day break, the plant appears dull. The generic name 'Nyctanthes' has been coined from two Greek words 'Nykhta' (Night) and 'anthos' (flower)(1,2). It is usually a shrub or a small tree

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having brilliant, highly fragrant flowers, which bloom at night and fall off before sunrise, giving the ground underneath a pleasing blend of white and red. Thus, during the day the plant loses all its brightness and hence is called "Tree of sadness" (arbor-tristis). It is also known as Harsingar, Coral Jasmine, Parijat, queen of the night and night flowering jasmine. It is a *Nyctanthes arbortristis* of India, distributed in sub-Himalayan region and also found in Indian garden as ornamental plant (3). The plant is tolerant to moderate shade and can grow on rocky ground in dry hill shades, dry deciduous forests or at sea-level up to 1500 m altitude with a wide range of rainfall patterns, from seasonal to non-seasonal and is tolerant to moderate shade. It is often cultivated in gardens due to its most pleasant and peculiar fragrance(4). In India, it grows in the outer Himalayas and is found in tracts of Jammu and Kashmir, Nepal to East of Assam, Bengal, Tripura extended through the Central region up to Godavari in the South. Flowering usually occurs from July to October. *N. arbortristis* prefers a secluded and semi-shady place to grow. *N. arbortristis* is one of the well-known medicinal plants. It is a common wild hardy large shrub or small tree. Different parts of this plant are used in Indian systems of medicine for various pharmacological actions like as anti-leishmaniasis, anti-viral, anti-fungal, anti-pyretic, anti-histaminic, antimalarial, anti-oxidant, anti-inflammatory and many more activities. Herbs have been always the main principal form of medicine since traditions in India and now a day it becomes most popular throughout the world. Important large shrub of tropical and subtropical regions of the world that has been traditionally used to provoke menstruation, for treatment of scabies and other skin infections as hair tonic chalogogue and Herbal medicines are not only providing traditional and ethnic medicine but also promising for highly efficient novel bioactive molecules. Since ages, man has been dependent on

N. arbortristis for curing various body diseases. From ancient civilization various parts of different plants were used to pain, control suffering and counteract disease. Most of the drugs used in primitive medicine were obtained from plants and are the earliest and principal *N. arbortristis* source of medicines(5)

1.1. Plant Description

This tree grows well in a wide variety of loamy soils and in soils found in average garden situations, with pH 5.6–7.5. The plant requires conditions varying from full sunlight to partial shade and needs to be watered regularly, but does not require over watering. It is a terrestrial woody perennial having life span of 5 - 20 years.(3)

1.2. Classification of Plant

Class: Eudicots

Division: Angiosperm

Family: Oleaceae

Genus: *Nyctanthes*

Kingdom: Plantae

Order: Lamiales

Species: *Nyctanthes arbortristis*

1.3. The Plant is named different Vernacular languages as below

Bengali: Harsingar, Sephalika, Seoli.

English: Coral Jasmine, Night Jasmine.

Filipino: Coral Jasmine.

Gujarati: Jayaparvati, Parijatak.

Hindi: Harsingar, Seoli, Sheoli, Sihau.

Indonesian: Srigading (Sundanese, Javanese).

Kannada: Goli, Harsing, Parijata.

Konkani: Pardic, Parijatak, Parjonto

Lao (Tibetan): Salikaa.

Malay: Seri Gading.

Malayalam: Mannapu, Pavizhamalli, Parijatakom.

Marathi: Kharbadi, Kharassi, Khurasli, Parijatak.

Oriya: Godokodiko, Gunjoseyoli, Singaraharo.



Punjabi: Harsingar.

Sanskrit: Parijata, Parijatah, Parijataka, Sephalika.

Tamil: Manjhapu, Pavala-Malligai, Pavazha-Malligai.

Telugu: Kapilanagadustu, Pagadamalle, Parijat, Sepali.

Thai: Karanikaa.

Urdu: Gulejafari, Harsingar.

Vietnamese: Iai Tau

N. arbortristis is a deciduous tree grows up to 10 m tall, with quadrangular branches and grey or greenish-white rough bark (Fig.1). The leaves are rough, hairy, decussately opposite, and simple. The flowers are arranged at the tips of branches. It grows well in loamy soils. The plant requires conditions varying from full sunlight to partial shade and needs to be watered regularly Flowering usually occurs from July to October. The whole plant is of medicinally useful (6).

1.4. Characteristic Features of *Nyctanthes arbortristis*

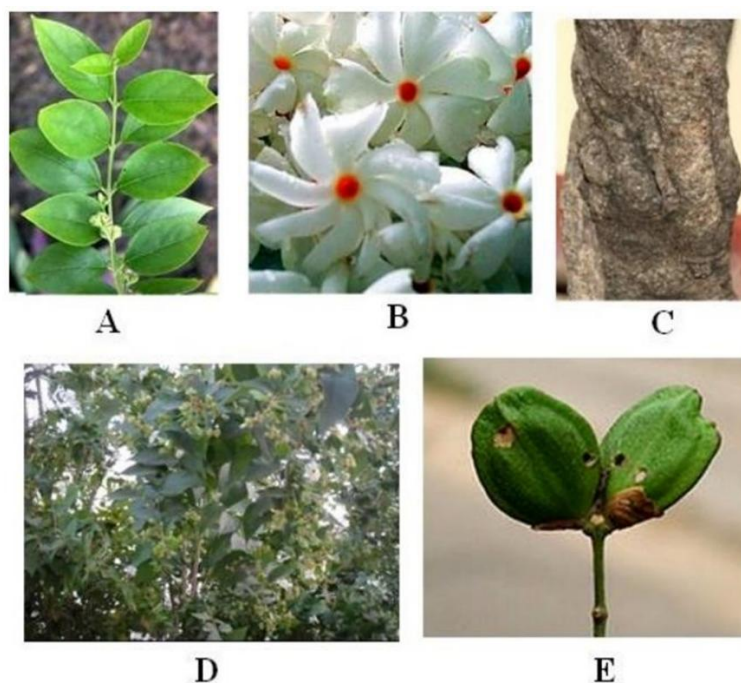


Figure 1: (A) Leaves (B) Flower (C) Bark (D) Plant (E) Seed and Fruit

1.4.1 Leaves:

Leaves are opposite, 5 -10 by 2.5 – 6.3 cm, ovate, acute or acuminate, entire or with a few large distant teeth, short bulbous hairs rounded or slight cuneate, main nerves few, conspicuous beneath, petiole 6cm long, hairy. Leaves are simple, petiolate and exstipulate(7) The lamina is ovate with acute or acuminate apex, the margin entire or serrated, somewhat undulated, particularly near the base, the upper surface dark green with dotted glands, and the lower surface pale green and softly

pubescent. *N. arbortristis* venation is unicostate, reticulate with an average of 12 lateral veins leaving the midrib. The petioles are about 5–7.7–10 mm long with adaxial concavity(8) (Fig.1)

1.4.2 Seeds:

The seed is compressed and is 1 per cell. Seeds are exalbuminous, testa thick, the outer layer of large transparent cells and heavily vascularised (7).(Fig.1)

1.4.3 Flowers:

The flowers are arranged at the tips of branches terminally or in the axils of leaves and are small, often seen in clusters of 2-7 together, delightfully fragrant, sessile in pedunculate bracteate fascicles of 3–5, peduncles 4-angled, slender, hairy, auxiliary and solitary and in terminal short trichotomous chymes, bracts broadly ovate or suborbicular, 6- 10 mm long, apiculate, hairy on both sides, Calyx 6-8 mm long, narrowly campanulate, hairy outside, glabrous inside, truncate or obscurely toothed or lobed, ciliated. Corolla glabrous rather more than 13 mm long, tube 6-8 mm long, orange colour, about equalling the limb, lobes white corolla with an orange-red center and sessile with companulate calyx, unequally obcordate, cuneate (7).(Fig.1)

1.4.4 Fruits:

Fruits of *N. Arborescens* are a capsule of 1-2 cm diameter, long and broad, obcordate orbicular, compressed, 2- celled, separating into 2 flat 1-seeded carpels, reticular veined, glabrous(7,8) Macroscopic character of fruit: the fruit is flat, brown and heart cordate-shaped to rounded capsule, around 2 cm in diameter with two celled opening transversely from the apex, each containing a single seed. Microscopically fruit showed typical character of fruit. In the epicarp epidermal cells were compactly arranged, polygonal cells with slightly anti-clinal walls covered by a thin cuticle followed by 1-3 layers of collenchyma, Spongy Parenchymatous tissue, sclerenchymatous fibres and oil gland(4). (Fig.1)

1.4.5 Stem & Bark:

It is large shrub growing up to 10 m tall, with quadrangular branches. Bark of *N. arborescens* plant is dark grey or brown in colour and rough and firm. Bark surface is dappled due to scaling off of circular barks and patchy due to grey brown colour regions. Scaling off the bark by circular flakes. Inner bark is creamy white, soft and collapsed and non-collapsed phloem zone distinctly visible(8). (Fig.1)

1.5 Chemical Constituents:

A variety of constituents belonging to different chemical classes such as terpenes, steroids, glycosides, flavonoids, alkaloids and aliphatic compounds have been isolated and characterized from different parts of *N. arborescens*. The secondary metabolites such as glycosides and alkaloids are the largest groups of chemicals produced by this plant. The glycosides are iridoid glycosides and phenylpropanoid glycosides. Iridoid glucosides, arborescenside A, B, D and E have been isolated from the seed. These possess immunomodulatory and anti-leishmanial activities(4).

1.5.1. Phyto-constituents From Leaves:

Leaves contain mannitol, astringent, resinous substances, ascorbic acid, coloring matters, sugar and traces of an oily substance, tannic acid, methyl salicylate, carotene, an amorphous resin and traces of volatile oil. Seed kernels yield 12-16% of the pale-yellow brown fixed oil, which consists of glucosides of linoleic, oleic, lignoceric, stearic, palmitic acid and β -sitosterol. Three new benzoic esters of Loganin and 6- β -hydroxy loganin, namely arborescenside-A, arborescenside-B, and arborescenside-C were found to be present in the leaves. Leaves also contain the alkaloid nictanthin along with mannitol, β -Amyrin β -Sitosterol, hentriacontane, benzoic acid, astragalol, nicotiflorin, oleanolic acid, nictanthic acid, friedelin and lupeol.

1.5.2. Phyto-constituents From Stems:

A glycoside Naringenin-4'-O- β -glucopyranosyl- α -xylopyranoside was screened from the stem chromatographed the chloroform extract of the stem over silica gel column and reported the presence of β -Amyrin, arborescenside-a, oleanolic acid, nictoside-a, nictanthic acid and 6- β -hydroxy loganin soluble polysaccharide containing D-Glucose and D-Mannose, indicating that the polysaccharide is a glucomannan. Iridoid glucosides arborescenside-A, arborescenside B, arborescenside-C and 6- β -hydroxy-loganin.



1.5.3. Phyto-constituents From Seeds:

Seeds give a water-soluble polysaccharide containing D-Glucose and D-Mannose, indicating that the polysaccharide is a **glucomannan**. Iridoid glucosides arbortristoside-A, arbortristoside B, arbortristoside-c and 6- β -hydroxy loganin. Further N. Arbortristis also contains two minor iridoid glucosides, arbortristoside-D and arbortristoside-E together with the previously reported arbortristoside-B. Other iridoid glucoside reported are as phenyl propanoid glycoside.

1.5.4. Phyto-constituents From Flowers:

Flowers contain modified diterpenoid nycanthin, flavonoids, anthocyanins and an essential oil which is similar to that of jasmine. The orange tubular calyx of the flower contains carotenoids. It also contain an anti-plasmodial cyclohexylethanol, renyolone, a new iridoid glucoside 6-O -trans-cinnamoyl-7- O-acetyl-6- β -hydroxy loganin and three known iridoid glucosides, arborside-C, 6- β -hydroxy loganin and nycanthoside. Rengyolone was first isolated from Forsythia suspansa (Oleaceae), an important plant of the crude drug “rengyo”. It was also reported that Halleridone from the African medicinal plant Halleria lucida (Scrophulariaceae) and as a cytotoxic constituent from Cornus controversa (cornaceae). It was found that after several months the compound arborside-C has changed to the isomeric structure with the benzoate group shifted to C-6-OH. This structure is named as aroarborsideC.

1.5.5 Phyto-constituents From Roots:

- i. The root portion of the plant showcases a distinctive blend of alkaloids, tannins, and glucosides, offering a rich reservoir of bioactive

compounds. Notably, from the chloroform extract of the root, researchers have isolated β -Sitosterol and oleanolic acid, contributing to its unique pharmacological profile and potential therapeutic applications.(4)

4.Objective:

1. To develop a herbal tablet formulation using Nyctanthes arbor-tristis powder.
2. To evaluate the physicochemical properties of Nyctanthes arbor-tristis powder for its suitability in tablet formulation.
3. To optimize the formulation parameters such as excipient selection and drug characterisation for tablet manufacturing.
4. Aim to provide a natural alternative to conventional medications with potential fewer side effects.

6.MATERIALS AND METHODS

6.1. Material

There are variety of material has been used for the formulation of herbal tablet including active ingredients. Nyctanthes arbor-tristis leaves, sourced locally and dried, were powdered for use in herbal tablets aimed at treating arthritis, joint pains, and providing antipyretic, analgesic, and antiinflammatory effects. The formulation includes Methylcellulose as a disintegrant, Magnesium stearate as a lubricant, Lactose as a diluent, and Talc for tablet appearance enhancement. Additionally, Acacia, HPMC-10, and Sodium alginate serve as binders for wet granulation preparation.

Table 1: Ingredients used in herbal tablet.

Ingredients	Application
Nyctanthes arbor-tristis leaves powder	Analgesic arthritis
Methylcellulose	Disintegrant
Magnesium stearate	Lubricant
Lactose	Diluent
Talc	appearance enhancement, lubricant
Acacia	Binder



Starch	Binder
Sodium alginate	Binder

6.2.Method:

Preparation of dry powder of nyctanthes arbor-tristis leaves powder: Collection of the leaves of Nyctanthes arbor-tristis from local area, rinsing each leaf in pure distilled water to purify its essence. Allow them to air-dry at room temperature, before transferring them to a hot air oven for thorough dehydration. The dried leaves are collected and grind in a mixer to make a fine powder.

Preparation of 1% acacia solution: Measure out 100 ml of distilled water into a beaker. weigh out 1 gram of finely ground acacia powder. Mix the acacia powder into the distilled water, stir it continuously until all powder was mix properly.

Preparation of 1% Starch solution: Measure out 100 ml of distilled water into a beaker. Introduce 1 gram of Starch in it. Stir continuously until form a jelly like appearance.

Preparation of 1% sodium alginate solution: Take 100 ml alcohol in a beaker. Add 1 gm of Sodium alginate Powder in 100 ml alcohol. Stir properly to mix well.

Wet granulation method: Weigh all ingredients accurately, mix well and triturate by using mortar and pestle. The prepared 1% binding agent was added slowly to form a damp mass. Damp mass was transfer through sieve no.22. Prepared granules are dried at room temperature. The well dried granules are ready for compression

Table 2: Compression of formulation ingredients of tablet

Sr. No.	Ingredients	Quantity		
		F1	F2	F3
1	Nyctanthes arbor-tristis	125 mg	125 mg	125 mg
2	Methyl cellulose	90 mg	90 mg	90 mg
3	Magnesium stearate	10 mg	10 mg	10 mg
4	Talc	5 mg	5 mg	5 mg
5	Lactose	25 mg	25 mg	25 mg
6	Acacia	1%	-	-
7	Starch	-	1%	-
8	Sodium alginate	-	-	1%

Pre formulation studies:(9)

In the avant-garde journey of crafting a new dosage form, the pre-formulation study stands as the foundational cornerstone, guiding the trajectory of potential drug development. This pivotal investigation delves deep into the known properties of the compound under consideration, laying the groundwork for the proposed development program. Beyond merely facilitating formulation development, preformulation studies

serve as beacons illuminating pathways for drug discovery, offering invaluable insights and paving the way for breakthrough innovations. Through meticulous exploration of precompressional parameters such as bulk density, Hausner's ratio, angle of repose, tapped density, friability testing, hardness testing, and compressibility indices, these studies unravel the intricate nuances of the compound's behavior, ensuring that no obstacle remains insurmountable in the quest for therapeutic excellence



Bulk Density(10)

The essence of bulk density lies in its ability to unveil the intrinsic homogeneity of the given sample, serving as a litmus test for uniformity and consistency. Executed within the confines of a meticulously dried 100 ml measuring cylinder, the process entails the gentle pouring of dried granules, each imbued with the promise of pharmaceutical potential. Through precise calculation utilizing the prescribed formula, the enigmatic ratio of bulk mass to bulk volume, denoted by the symbol ρ_b , is unveiled, shedding light on the collective cohesion and integrity of the granular matrix. This ritual of measurement, poised at the intersection of science and art, unveils the latent symphony of particles, laying the groundwork for pharmaceutical perfection.

Bulk density = Mass of the granules / Bulk volume of the granules

Tapped density: (11)

Tapped density, a pivotal metric in pharmaceutical science, unveils the intrinsic compactness and flow properties of a drug or formulation. The journey begins with the placement of a graduated cylinder, meticulously laden with a known mass of the precious substance, onto a mechanical tapper apparatus. With rhythmic precision, the apparatus orchestrates a symphony of taps, a fixed cadence of a thousand beats, until the powder bed settles to its minimum volume, revealing its true essence. This harmonious interplay between mechanical rigor and scientific inquiry unveils the dynamic interplay between particle cohesion and arrangement, laying bare the intricate dance of pharmaceutical potential.

Tapped density(ρ_t) = weight of powder blend / Minimum volume occupied by cylinder

Compressibility Indices

a. Carr's index

Based on the apparent bulk density and the tapped density, the percentage compressibility of the powder mixture was determined by the following formula.

$$\text{Carr's index} = \frac{\text{Tapped density} - \text{Bulk density}}{\text{Tapped Density}} \times 100$$

b. Hausner's ratio

It is an indirect index of ease of measuring of powder flow. Lower Hausner's ratio (1.25)¹⁰

$$\text{Hausner's ratio} = \frac{\text{Tapped density}}{\text{Bulk density}}$$

Angle of repose

Angle of repose was determined by using the funnel method. Following formula was used to calculate the angle of repose.

$$\Theta = \tan^{-1}[h/r]$$

Where h = height of granule cone formed.

r = radius of the granule cone formed.

Evaluation of Tablet (Post-Compression Parameter)

Evaluation of tablet includes the assessment of tablets physical, chemical and biological properties. To studies them the following test are formulated.

1.General Appearance:

The general appearance of a tablet serves as a pivotal nexus between patient compliance and seamless manufacturing. For patients, a legible and aesthetically pleasing tablet enhances adherence to medication regimens, fostering improved health outcomes. Meanwhile, for



manufacturers, consistent tablet appearance signals trouble-free production, ensuring uniformity from tablet to tablet and batch to batch. A comprehensive assessment of general appearance encompasses a spectrum of factors, including size, shape, odor, taste, texture, legibility, and identifying marks. Each element contributes to the tablet's identity, bridging the gap between pharmaceutical precision and patient-centered care.



Shape of the tablet:

Tablets from each formulation batch were examined under a microscope and revealed to have a round shape without any cracks.

2. Thickness: (12)

The crown thickness of each tablet was measured by a Vernier caliper.



Figure 3: Vernier caliper

3.Hardness:

The Monsanto hardness tester is used to assess the tablet's hardness.(13,14)



Figure 4: Monsanto hardness tester

4.Weight variation test: (15,16)

Using an electronic balance, 20 tablets were weighed separately. Based on that, the average weight was determined. By comparing the weight of each tablet with the average tablet weight, the percent deviation was computed.



Figure 5: weighing machine

5.Friability test: (17,18)

A number of tablets are weighed and placed in the apparatus where they are exposed to rolling and repeated shocks as they fall 6 inches in each turn within the apparatus. After four minutes of this treatment or 100 revolutions, the tablets are

weighed and the weight compared with the initial weight. The loss due to abrasion is a measure of the tablet friability. The value is expressed as a percentage. A maximum weight loss of not more than 1% of the weight of the tablets being tested during the friability test is considered generally acceptable and any broken or smashed tablets are not picked.(5)

The percentage friability was determined by the formula:

$$\% \text{ friability} = (W1 - W2) / W1 \times 100$$

W1 = Weight of tablets before test

W2 = Weight of tablets after test



Figure 6: Friabilator

Disintegration: (19,20)

Disintegration refers to the mechanical break up of a compressed tablet into small granules upon ingestion and therefore it is characterised by the breakdown of the inter-particulate bonds, which were forged during the compaction of the tablet. Disintegration is defined as the state in which any residue of the tablet, except fragments of insoluble coating remaining on the screen of the test apparatus consists of a soft mass having no palpably firm, unmoistened core. This

disintegration test is provided to determine whether tablets disintegrate within a prescribed time when placed in a liquid medium under the prescribed experimental conditions.

7.Result And Discussion:

7.1 Evaluation

7.1.1.Appearance

Brown to dark brown round shape tablet



Figure 7: Shape of tablet

7.1.2.Thickness:

The dimensions can also influence the rate of dissolution and absorption of the active ingredient in the body. Thicker tablets may take longer to dissolve, while larger diameters may increase surface area for faster dissolution. The size of the tablet affects ease of swallowing for consumers. Tablets that are too large may be difficult for some individuals to swallow, leading to potential compliance issues with medication regimens. Thickness -3.39mm

7.1.3 Hardness:

The Monsanto hardness tester is used to assess the tablet's hardness. Each tablet observed hardness is 3.5 kg. This guarantees that all compositions have good handling properties. Hardness tests help select materials and ensure products are strong and safe by measuring their resistance to deformation.

7.1.4. Weight variation:

The weight variation statistical quality control test ensures uniformity in dosage units, thus bolstering product safety, identity, and quality assurance

7.1.5. Friability:

Instrument used to calculate friability was Friabilator, having model no. FT 1020 and having

make LAB INDIA. This test is intended to determine the physical strength of the Tablet.

7.1.6. Disintegration:

In the disintegration test, the tablets should disintegrate into tiny fragments and pass through a 10-mesh screen. The disintegration time is very much required for drug absorption and activity. This parameter depends on the excipients used in the tablets and compression parameters.

Table no. 3: Physical parameter for herbal tablet

Sr. No	Parameter	F1	F2	F3
1	Thickness (mm)	3.39	3.21	3.42
2	Hardness (kg/cm ²)	3.5	3.4	3.5
3	Weight variation test	250%	270 %	275%
4	Friability test (%)	0.61%	0.93%	1.5%
5	Disintegration test (min)	32	30	33

Discussion:

In the present study, Herbal tablet of *N. Arborescens* were prepared. Tablets were prepared by wet granulation method. The prepared tablets were evaluated for its hardness, friability, uniformity of weight, uniformity of drug content, in vitro floating studies, and in vitro dissolution studies.

CONCLUSION:

The study focused on utilizing *Nyctanthes arborescens* leaves for arthritis relief. Through a wet granulation method, herbal tablets were formulated using various excipients. Preformulation studies indicated good flow properties of the granules. Physical parameters of the compressed tablets were evaluated, showing acceptable weight variation, hardness, thickness, friability, and disintegration time. The tablets exhibited promising characteristics for potential use in arthritis management. Overall, the study underscores the potential of *Nyctanthes*

arborescens as a natural remedy for arthritis and related conditions.

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