IJBPAS, May, 2024, 13(5): 2186-2205

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

DEVELOPMENT AND EVALUATION OF POLYHERBAL TABLET INCORPORATED WITH *BRYOPHYLLUM PINNATUM* AND *AMARANTHUS VIRIDIS* LEAF EXTRACT FOR THE TREATMENT OF URINARY STONES

MISTRY HN[1*], KHRISTI NS[2], GOHEL VM[3], PAREKH RS[4], PATEL SK[5] AND GANDHI TR[6]

[1, 2, 3, 4]Research Scholars, Anand Pharmacy College, Anand, Gujarat, India

[5]Associate Professor, Department of Pharmacognosy, Anand Pharmacy College, Anand, Gujarat, India

[6]Professor and Principal, Department of Pharmacology, Anand Pharmacy College, Anand, Gujarat, India

***Corresponding Author: Ms. Hardi N. Mistry: E Mail: hardimistry3236@gmail.com**

Received 15th May 2023; Revised 16th July 2023; Accepted 24th Aug. 2023; Available online 1st May 2024

https://doi.org/10.31032/IJBPAS/2024/13.5.8001

ABSTRACT

Objective: The purpose of the study was to formulate and evaluate polyherbal tablets intended for the treatment of urinary stones. To prevent the recurrence of urinary stones and the painful urination associated with urinary stone diseases.

Methods: Tablets were prepared using methanolic leaf extracts of the selected plants, viz. *Bryophyllum pinnatum* and *Amaranthus viridis* , with the help of wet granulation techniques using sodium starch glycolate, polyvinylpyrrolidone, and lactose in different percentages. Evaluation assessments such as the substantial test, weight variation, hardness, friability, content uniformity, disintegration, in vitro dissolution, and stability study were carried out.

results: For all formulations, the micromeritics of the extract powder were evaluated, indicating satisfactory flow characteristics. It was determined that the substantial examination complies with all official requirements for friability and weight uniformity throughout all formulations. All formulations had disintegration times that ranged from 22 to 32 minutes. Formula 2 (F2) was chosen for in vitro dissolution, which demonstrated 93.57±0.305% drug release. The IR compatibility indicates that there is no chemical interaction between the extracts and excipients.

The results of the stability studies showed that the polyherbal tablets were stable over three months.

Conclusion: According to the study, the F2 formulation had the best disintegration time and in vitro dissolution. Hence, it was selected as an optimised formulation and subjected to stability study. Stability study results revealed that, formulation F2 was a stable formulation having better disintegration time and %friability and could be used for effective treatment of urinary stones.

Keywords: *Amaranthus viridis*, *Bryophyllum pinnatum*, Diuretic activity, Antiurolithiatic activity, Polyherbal tablet, Renal calculi, Calcium oxalate stones

INTRODUCTION:

A crystal concretion called a kidney stone normally forms inside the kidneys. It is a growing urological condition that has an impact on human health and affects 12% of the global population. Of this 12%, 50% of the population has renal impairment that is quite severe and even results in kidney **[1]**. About 12% of the population suffers from urinary stone disease, which has a recurrence rate of 70 to 81% in men and 47 to 60% in women. Among men, urolithiasis is one of the oldest and most painful disorders of the urinary tract. The majority of urinary stones in urolithiasis patients are made primarily of calcium oxalate (CaOx). About 80% of stones are made of calcium oxalate and calcium phosphate; 10% are made of struvite; 9% are made of uric acid; and the remaining 1% are made of cystine. Urolithiasis is quite common worldwide, however, there is no effective treatment for it. To treat urolithiasis, extracorporeal shock wave lithotripsy (ESWL) and percutaneous nephrolithotomy (PCNL) are used in combination with surgical and medicinal methods. All of these procedures are rather expensive, uncomfortable, and have unfavorable side effects such as haemorrhage, hypertension, tubular necrosis, and eventual fibrosis of the kidney causing cell damage and recurrence of renal stone production **[2]**. Therefore, it would be worthwhile to explore alternative methods of treating urolithiasis, and therefore medicinal plants have been adopted as a treatment. In the present study, the two medicinal plant parts such as *Bryophyllum pinnatum* leaves and *Amaranthus viridis* leaves and their combination were selected for designing the herbal tablet for the treatment of urinary stones.

Plant Profile:

As described earlier in the study two medicinal plants are used *Bryophyllum pinnatum* and *Amaranthus viridis* .

(1a) (1b)

Figure 1: 1a-*Bryophyllum pinnatum* ,1b- *Amaranthus viridis*

Plant Name: *Bryophyllum pinnatum*

Synonym: Kalanchoe Pinnata

Family: Crassulaceae

Common Name: Zakham –e –hayat, Life plant, air or Maternity plant, love plant, Canterberry bells, Cathedral bells, Parnabija etc.

Vernacular Name:

Sanskrit: Pashanabheda

English: Air plant

Hindi: Zakhmhaiyat, Patharchoor

Kannada: Gandukalinga

Tamil: Malaikalli, Ranakalli

Telgu: Ranapaluka

Marathi: Gayamari

Bengali: Koppatha, Patharkuch

Taxonomical Classification [3]:

Kingdom: Plantae

Subkingdom: *Tracheobionta*

Subdivision: *Magnoloiphyta*

Subclass: *Rosidae*

Order: *Saxifragales*

Family: *Crassulaceae*

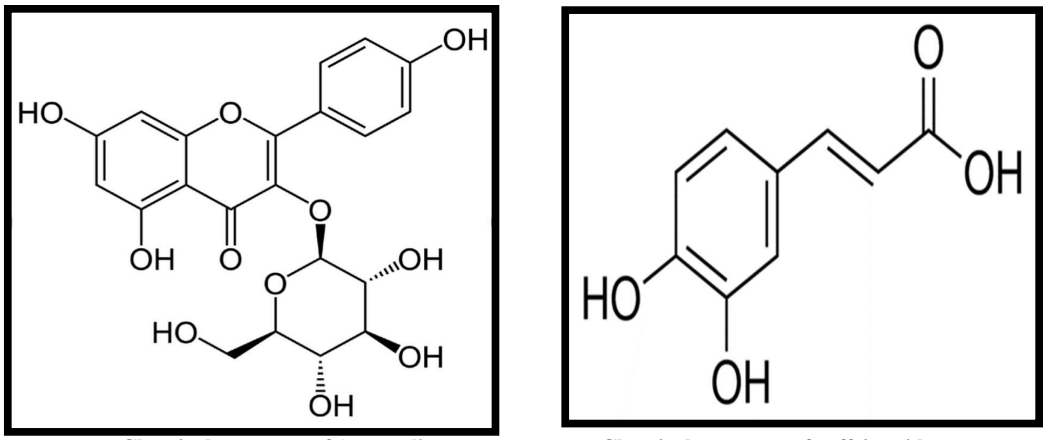
Morphology:

It can reach heights of 60 to 120 cm. There are notches at the margins of both simple and compound leaves. Their flowers are bell-shaped. The plantlets fall off and take root in one place, producing numerous new plants. The initial leaves are simple and petiolate. The terminal leaflet may occasionally be all that remains of the later leaves, which are imparipinnate, short-stalked, 3-foliolate, and occasionally 5-foliolate. All of the leaves are fleshy, elongated-ovate, light green with purple streaks, and have bulbils in the leaf margin notches **[4]**.

Chemical Constituents:

Alkaloids, triterpenes, glycosides, flavonoids, cardienolides, steroids, bufadienolides, and lipids are abundant in *B. Pinnatum* **[5]**. Bufadienolides, a class of very potent compounds, are found in the leaves. Bufadienolides like bryotoxin A, B, and C, have antibacterial, antitumor, cancer-preventive, and insecticidal properties and are structurally and functionally very similar

to two other cardiac glycosides, digoxin, and digitoxin **[6]**. In addition to luteolin and rutin, leaves also contain astragalin, 3,8-dimethoxy-4,5,7-trihydroxyflavone, friedelin, and epigallocatechin-3-o-syringate **[7]**. Syringic acid, caffeic acid, 4-hydroxy-3-methoxycinnamic acid, 4-hydroxybenzoic acid, kaempferol, quercetin, and quercetin-3-L-rhamonsido-L-arabino furanoside are also present in the plant **[8]**. As a result of its rare occurrence and quantity in B. Pinnatum, flavonoid may be a chemical indicator of the plant with a high potential for medicinal use. It contains an antioxidant named Astragalin, which has a nephroprotective efficacy. Its action was mediated by antioxidant and oxidative free radical scavenging **[9]**.



Chemical structure of Astragalin **Chemical structure of caffeic acid**

Figure 2: Chemical structure of constituents of *Bryophyllum pinnatum*

Plant Name: *Amaranthus viridis L*

Synonym: Amaranthus gracilis, Amaranthus polystachyus, Euxolus viridis

Family: Amaranthaceae**.**

Common Name: slender amaranth/ wild amaranth

Vernacular Name: Slender amaranth/wild amaranth (English), Jangali chaulai (Urdu), Marrissag (Bengali), and Bledo blanco (Spanish), Amarante verte (French) are some of its other names **[10]**. Kuppaikeerai in Tamil, Kuppacheera in Malayalam, Jungalichaulayl in Hindi, and Chilaka-thotakoora in Telugu are all names for the same plant **[11]**.

Taxonomical Classification [12]:

Kingdom: Plantae

Subkingdom: *Magnoliophyta*

Subdivision: *Magnoliopsida*

Subclass: *Caryophyllidae*

Order: *Caryophyllales*

Family**:** *Amaranthacea*

Genus**:** *Amaranthus*

Subject**:** *Amaranthus viridis L*

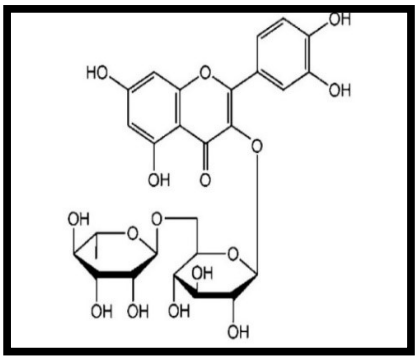
Morphology:

Amaranthus viridis is erect, 10 to 75 cm long, thin, angular, and branching. The

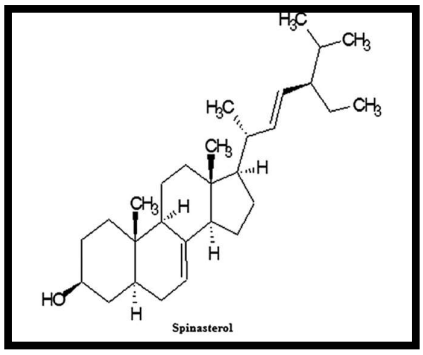
leaves have long, approximately 10 cm-long petioles and are glabrous. The flowers are unisexual and green **[13]**. It has alternating leaves with petioles up to 10 cm long, blades 2-8 cm 1.5-6 cm, deltoid-ovate to rhomboid-oblong, apex emarginate with a tiny mucro, base briefly cuneate, and is glabrous to pubescent. It also comprises axillary or largely terminal spikes that are frequently paniculated, agglomerated cymes that are placed in slender, up to 12 cm long clusters in the lower section of the stem **[14]**.

Chemical Constituents:

Methanolic leaf extract of *Amaranthus viridis* demonstrated the presence of rutin and quercetin. Moreover, there were other substances like Spinasterol (24-ethyl-22-dehydrolathosterol), 24-methyl-22-dehydrolathosterol, 24 methyllathosterol, 24-ethyl-22-dehydrocholesterol, and 24-ethyllathosterol **[15]**. In addition to these, it is a superb and exceptional source of antioxidant leaf pigments like β-Cyanin, β-xanthin, and betalain as well as a source of other pigments like carotenoids, anthocyanin, chlorophylls, and antioxidant phytochemicals like -carotene, vitamin C, phenolics, and flavonoids. The pigments β-Cyanin, β-xanthin, betalain, carotenoids, and amaranthine have significant anti-free radical activity **[16]**



Chemical structure of Rutin



Chemical structure of Spinasterol

Figure 3: Chemical structure of constituents of *Amaranthus viridis*

MATERIAL AND METHOD:

Collection and Authentication:

Bryophyllum pinnatum leaves were collected from Navsari, Gujarat, while the entire plant of *Amaranthus viridis* was purchased from the local market of Vapi, Valsad. The collection of these plant materials was carried out in the month of September. The identification and authentication of all selected plants were carried out by Dr. Geetha Madhira, Ph.D., Department of Pharmacognosy, Anand Pharmacy College, Anand. (Voucher specimen: APC/2023/06 and APC/2023/08).

Preparation of Extract:

In the shade, the leaves were allowed to dry for a total of 14 days. The pulverized dry leaves were stored in a sterile bottle at room temperature. Powdered leaves of both plants were defatted by Soxhlet using petroleum ether at 60–80 °C. After further extraction with methanol **[17]**, Methanol extraction was carried out with the aid of a Soxhlet extractor. 250 ml of solvent was used to extract 50 g of powdered dried leaf material **[18]**.

Preliminary Phytochemical Evaluation:

Amaranthus viridis and *Bryophyllum pinnatum* solvent extracts were used in various solvent concentrations to test for the presence of phytoconstituents. Standard procedures were used for the identification of glycosides, alkaloids, phenolic compounds and tannins, saponins, flavonoids, resins, proteins, and amino acids as well as fixed oil and fats, carbohydrates, and sterols **[19]**.

Thin Layer Chromatography (TLC) of the Extract:

Amaranthus viridis and *Bryophyllum pinnatum's* methanolic extracts were subjected to thin-layer chromatography.

Sample Preparation: *Amaranthus viridis* and *Bryophyllum pinnatum* extracts were taken in small amounts and dissolved in the appropriate solvents **[20]**.

For *Amaranthus viridis*: A 500 ml beaker of chloroform, ethyl acetate, and acetic acid (9: 0.5: 0.5) was saturated. With the aid of a capillary tube, the sample is deposited in the stationary phase (Silica gel G) and transferred to the mobile phase in a beaker for development. After the chromatogram has developed by 3/4, the plate will be taken out, dried, and detected by a UV fluorescence chamber at 254 and 365 nm **[21]**. Calculations were made for the retention factors for eluted active compounds.

For *Bryophyllum pinnatum:* A 500 ml beaker of Chloroform: methanol (8:2) was saturated. With the aid of a capillary tube, the sample is deposited in the stationary phase (Silica gel G) and transferred to the mobile phase in a beaker for development. After the chromatogram has developed by 3/4, the plate will be taken out, dried, and detected by a UV fluorescence chamber at 254 and 365 nm **[22]**. Calculations were made for the retention factors for eluted active compounds.

UV/Visible Spectroscopy:

For the UV/Visible scanning, extract stock solutions (1 mg/ml) were made in methanol. The same solvent was used as the blank, and methanol was added to the stock solution to increase the volume to 10 ml. Scans were performed in the UV/Vis range (200–800 nm), and the maximum wavelength (max) for each extract was recorded.

FTIR Spectroscopy:

For standardization, the extracts were analyzed using FTIR technology. 100 mg of

potassium bromide was combined with the material (1 mg of KBr). The mixture was then moved to a die, where it underwent hydraulic press compression to create pellets. FTIR spectra were collected.

Formulation of Poly Herbal Antiurolithiatic Tablets:

In this formulation, lactose, sodium starch glycolate, magnesium stearate, talc, and polyvinylpyrrolidone are used to compose tablets. Lactose is used as a bulking agent; Sodium Starch Glycolate is used as a disintegrating agent; Magnesium Stearate is used for lubrication;

Talc is used as a glidant; and Polyvinylpyrrolidone is used as a binder. In the present study, dried ethanolic extracts of *Bryophyllum pinnatum* and *Amaranthus viridis* were formulated into tablet dosage form by the wet granulation method. The formulation has the following composition, as depicted in the following **Table 1**. Three batches were prepared using different compositions of binder and disintegrating agent. The formulations were coded as Formula 1(F1), Formula 2(F2), and Formula 3(F3). Using hand-rotating single punch tablet presses with an 11 X 8 mm punch set and the proper compression pressure, power mixes were compressed to 600 mg tablets. Before being punched into tablets, the granules were combined with talc and magnesium stearate. The die cavity was then adjusted for the necessary weight.

Table 1: Formulation of Polyherbal Tablets

Ingredients	Amount (mg) for one table		
	Formula 1	Formula 2	Formula 3
Extract of *Amaranthus viridis*	30	30	30
Extract of *Bryophyllum pinnatum*	250	250	250
Lactose	260	230	200
Sodium Starch Glycolate	24	36	48
Polyvinylpyrrolidone	18	36	54
Magnesium Stearate	6	6	6
Talc	12	12	12
Total	600	600	600

Pre-Compression Studies:

Bulk density, tapped density, angle of repose, Carr's index, and Hausner Ratio were investigated for various precompression parameters before compression to ascertain the granules' flow properties **[23]**.

Post-Compression Studies:

General appearance, hardness test, % friability test, uniformity of weight, disintegration test, and in vitro dissolution test were some of the post-compression parameters that were investigated **[24]**.

Wetting Time:

Twice folded tissue paper was placed in a petri dish having an internal diameter of 5 cm containing 6 ml of water. A polyherbal tablets was carefully placed on the surface of the tissue paper in the petri dish. The time required for water to reach the upper surface of the tablet and to completely wet was noted as the wetting time.

Accelerated Stability Studies:

Temperature, light, air, and humidity during storage, as well as the elements of the package, can have an impact on a medication dosage form's stability properties. For a period of three months, all of the formulations underwent accelerated temperature conditions, including room temperature (25°C) at 60% relative humidity (RH), 5°C at ambient, and 40°C at 75% RH. The various parameters, including average weight, hardness, friability, color, odour, and texture of the tablets, as well as disintegration time, were examined under accelerated temperature settings **[25]**.

RESULT AND DISCUSSION:

Preliminary Phytochemical Evaluation:

In addition to carrying a variety of phytochemicals such as flavonoids, quercitrin, glycosides, carotenoids, saponin, kaempferol, and alkaloids, *Bryophyllum pinnata* has a notable ability to dissolve calcium oxalate, which is the most prevalent component in producing stones in the urinary tract. These flavonoids reduce calcium oxalate build-up and CaOx crystal formation in renal tubules **[26]**.

Alkaloids, flavonoids, saponins, and steroids are only a few of the plant's many active ingredients. Rutin and quercetin concentrations in the methanolic leaf extract of *Amaranthus viridis* were reported **[27]**. It also contains spinasterol (24-ethyl-22-dehydrolathosterol), which is a prominent component of the sterol fraction, along with lesser components such as 24-methyllathosterol, 24-ethyllathosterol, 24-methyl-22-dehydrolathosterol, 24-ethyl cholesterol, and 24-ethyl-22-dehydrocholesterol **[28]**.

Thin layer chromatography (TLC) of the Extract:

The extracts of *Amaranthus viridis* and *Bryophyllum pinnatum* were spotted in the stationary phase; the developed chromatogram is viewed at 365 nm and 254 nm, as noted in **Figure 4.3** for *Amaranthus viridis* extract Two spots were observed at Rf values of 0.51 and 0.83 **[29]**. And for *Bryophyllum pinnatum* extract Two spots were observed at Rf values of 0.68 and 0.87 **[30]**.

UV/Visible Spectroscopy:

According to the results **(Figure 4.5)**, the region of 200–800 nm contained the lambda maximum for both samples. *Bryophyllum pinnatum 's* methanol extract exhibits its highest peak at wavelengths of 267 nm, 351 nm, and 362 nm, respectively **[31]**. Astragalin standard has a UV maximum (MeOH) of 267, 351 nm, and the isolated compound has a UV maximum of 362nm,**[32]** as illustrated in Figure 4.5. UV (MeOH) max for the standard spinasterol molecule was 203 and 274 nm **[33]**. and the isolated compound from *Amaranthus viridis* has a UV maximum of 267 nm.

FTIR spectroscopy:

FTIR spectra of *Bryophyllum pinnatum* leaf extract **(Figure 4.6a)** show a weak and broad peak at the 3149.86 cm-1 (OH stretching) which indicates the presence of alcohol. Peaks between 3000-2800 cm-1 indicate the presence of amine salt (strong broad, N-H stretch). At the 1646.3 cm-1, there is a C=O stretch which showed the presence of esters and saturated aliphatic functional groups. Extract overlay **(Figure 4.6a)** has exhibited the presence of alkanes, hydroxyl, and aromatic groups **[34]**.

FTIR spectra of *Amaranthus viridis* show the presence of multiple functional groups at various places. The absorption bands in Figure 5d correspond to the stretching of the free O-H group at 3245.34 cm-1 and the C-H group at 2928 cm-1. the absorption bands correspond to C-I stretching at 566.13 cm-1 **[35]**. **Figure 4.6b** displays the FTIR spectrum of the combination of *Amaranthus viridis* leaf extract and *Bryophyllum pinnatum* leaf extract, along with the tablet excipients. The tablet may include several bioactive substances, such as flavonoids, polyphenols, etc., as evidenced by the presence of various functional groups. **Figure 4.1 to 4.8** shows the results of the test.

Pre-Compression Studies:

The findings of the three formulas F1, F2, and F3 were reported in **Table 3**, which showed that the granule combination had high flow properties and strong packing ability.

Post-Compression Studies:

General appearance like the color, smell, and texture of the tablet was noted while examining its overall look, and the results were mentioned in **Table 4.1**.

Hardness Test: A digital hardness tester was used to measure the hardness of each formulation, which was found to range from 1–7.2 kg/cm2. The hardness of each formulation was also found to have remained intact after being dropped from a height of three feet.

Percentage Friability Test: Since there was no capping issue with the tablet, commercial use was an option. During the shipping process, there was no loss.

Uniformity of Weight: Since the average percentage weight variation was under the USP limit of ±5%, all of the tablets passed the weight variation test.

Disintegration Test: The DT of the tablet was between 22 and 32min.

***In Vitro Dissolution Test*:** From the pre-compression study the best batch i.e. F2 is selected and the drug released in a medium of F2 formulation of tablet was found to be more than 90% of the initial concentration in 45 min **[36]**.

wetting time:

To estimate the lag between soaking and disintegration, wetting time was calculated. The wetting time for batches varied from 30

to 69 seconds. For the F2 formula, the wetting time was observed to be 51 seconds.

Accelerated Stability Studies:

When exposed to stability experiments at 25 °C/60% RH and 40 °C/75% RH for a period of three months, the chosen polyherbal tablet formulation F2 was discovered to be stable. In terms of appearance, friability percentage, and hardness of the tablets, there was no noticeable change. After three months, there was a slight variation in the disintegration time; it was 23.05±0.030 min as opposed to the disintegration time of F2 of 24.66±0.603 min.

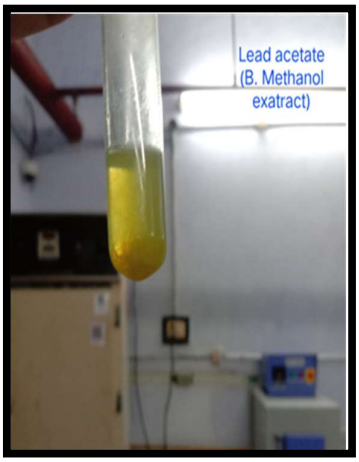
Table 2: Preliminary Phytochemical Studies for leaf extract of *Amaranthus viridis* and *Bryophyllum pinnatum*

Phytoconstituents	*Bryophyllum pinnatum*		*Amaranthus viridis*	
	Petroleum ether extract	Methanolic extract	Petroleum ether extract	Methanolic extract
Alkaloids	-	+	-	+
Flavonoids	+	+	-	+
Phenols	+	+	-	-
Saponins	-	+	-	+
Sterol	-	+	-	-
Carbohydrate	-	+	-	+
Proteins	-	-	-	-
Tannins	+	+	+	-

Where "+" indicate presence of phytoconstituent "-" indicate absence of phytoconstituent

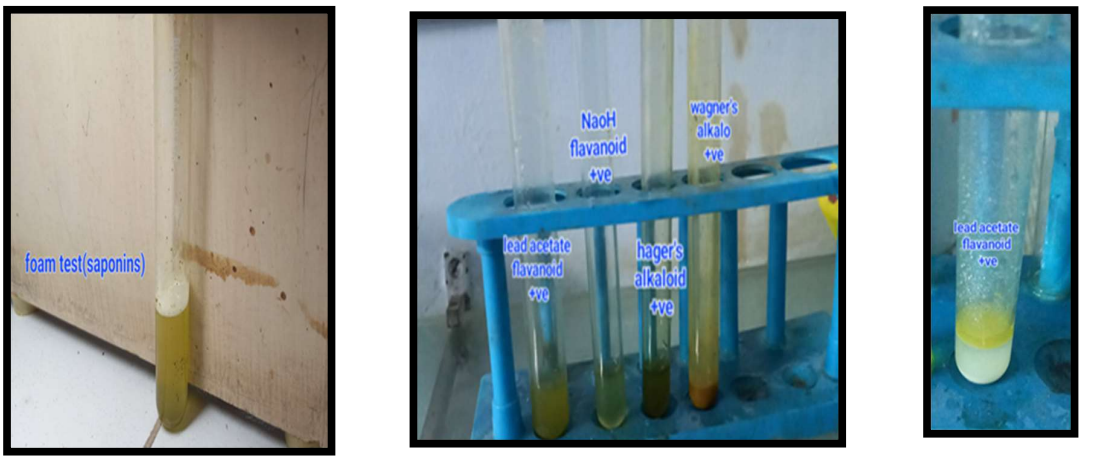
Test for phenolic compound

Test for flavonoids



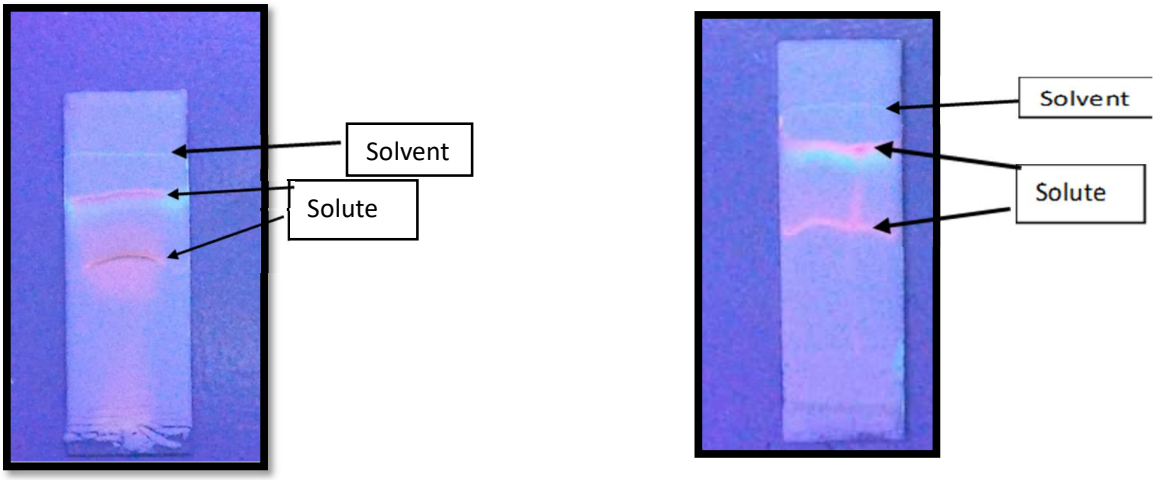
Test for Tannin

Figure 4.1: Preliminary Phytochemical test of methanolic extract of *Bryophyllum pinnatum* leaf extract



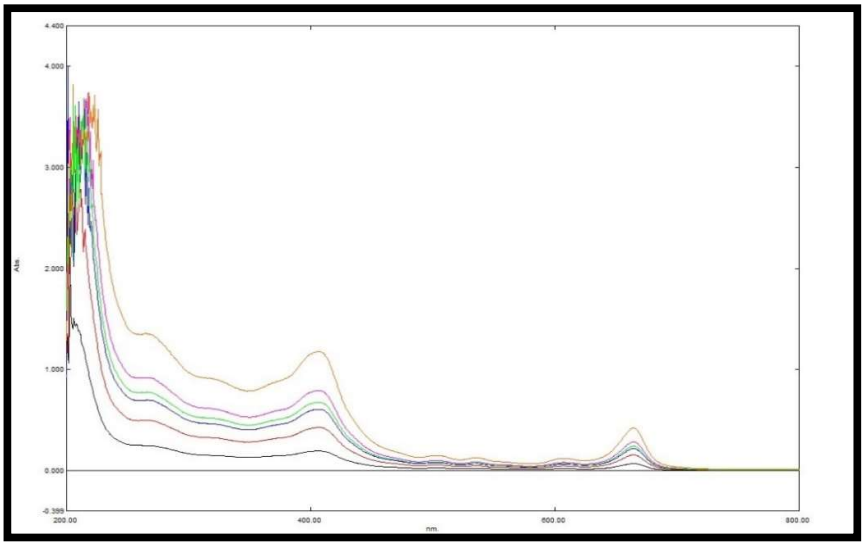
Test for Saponin **Test for Alkaloids** **Test for flavonoids**

Figure 4.2: Preliminary Phytochemical test of methanolic extract of *Amaranthus viridis* leaf extract

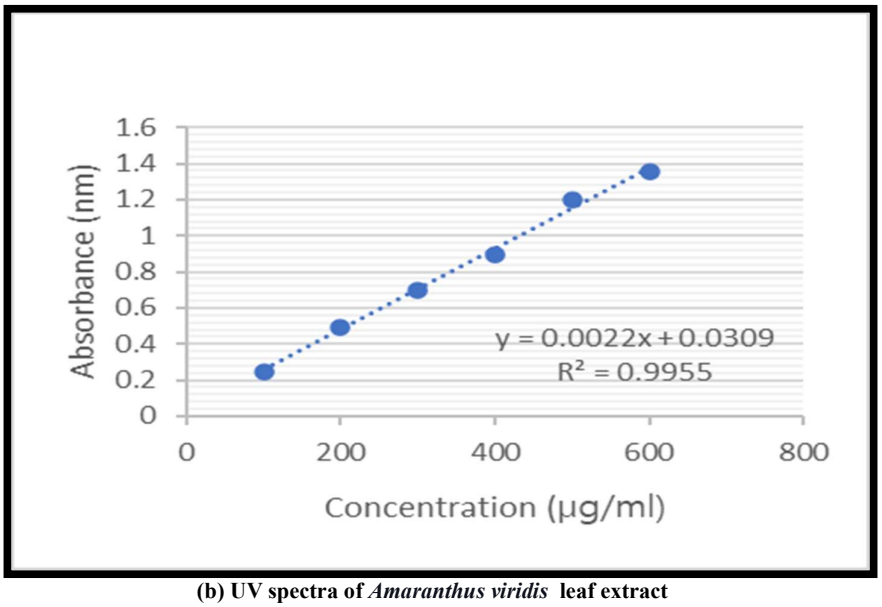


TLC of *Amaranthus viridis* extract **TLC of *Bryophyllum pinnatum* extract**

Figure 4.3: TLC of the extract

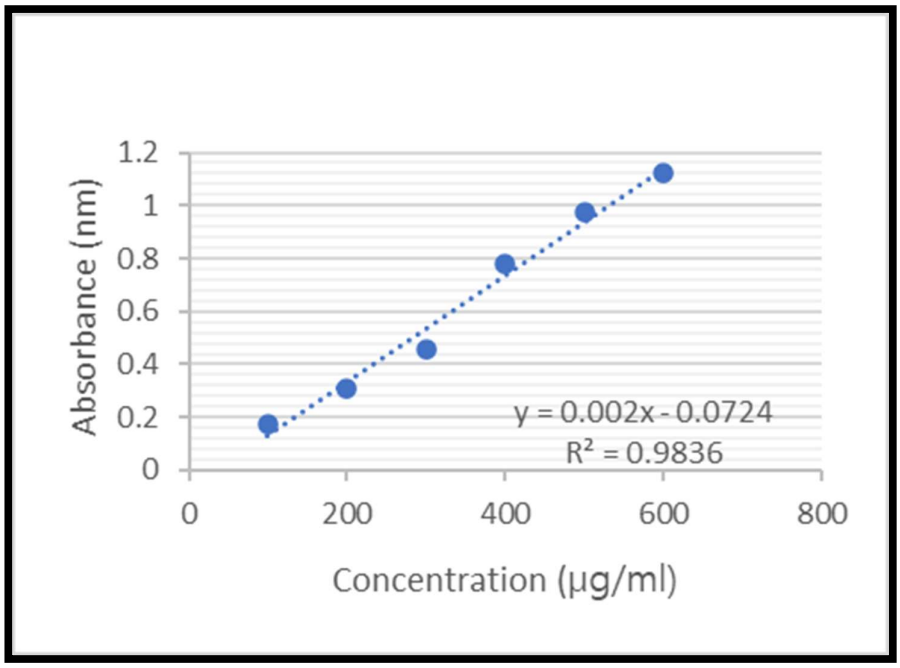


(a) Calibration curve of *Amaranthus viridis* leaf extract

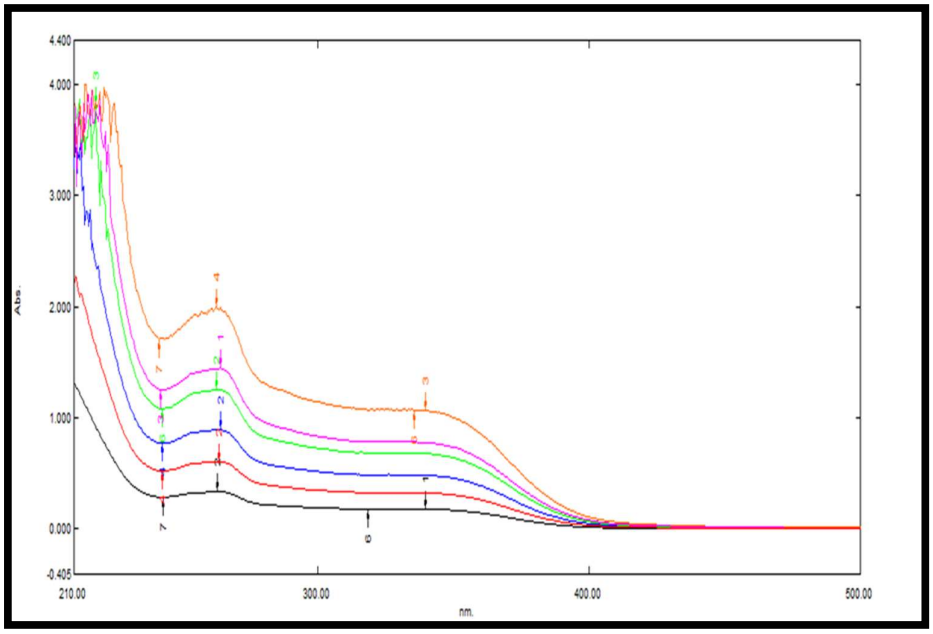


(b) UV spectra of *Amaranthus viridis* leaf extract

Figure 4.4: (a) Calibration curve and (b) UV spectra of methanolic extract of *Amaranthus viridis* leaf extract

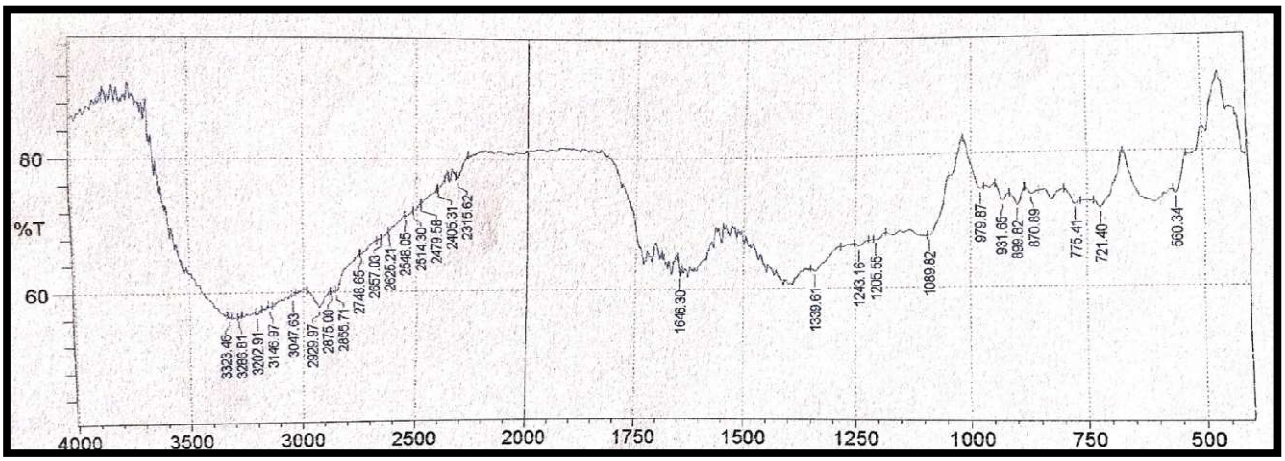


(a) Calibration curve of *Bryophyllum pinnatum* leaf extract

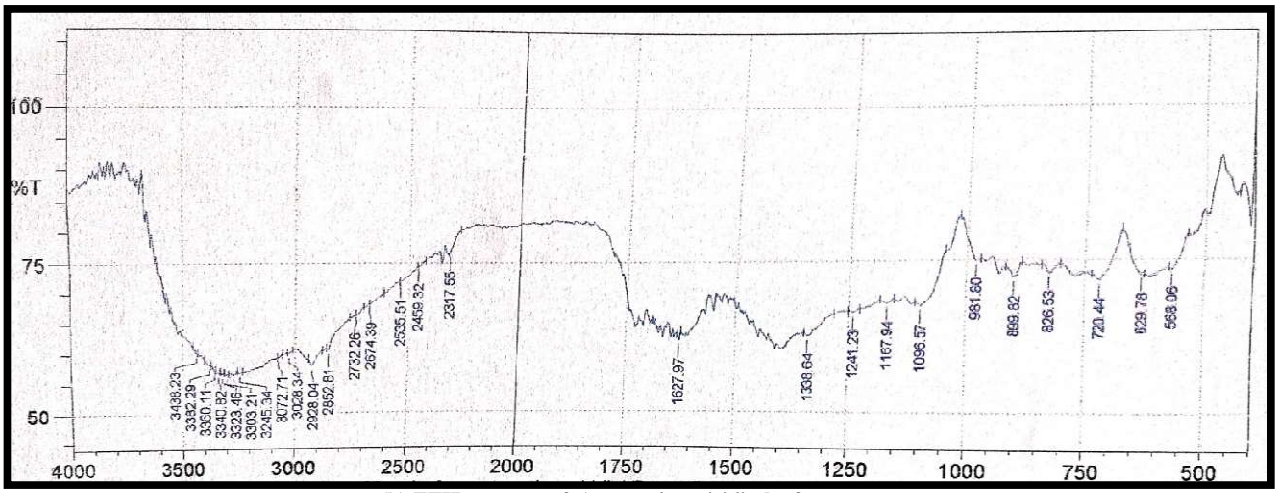


(b) UV spectra of methanolic extract of *Bryophyllum pinnatum* leaf extract.

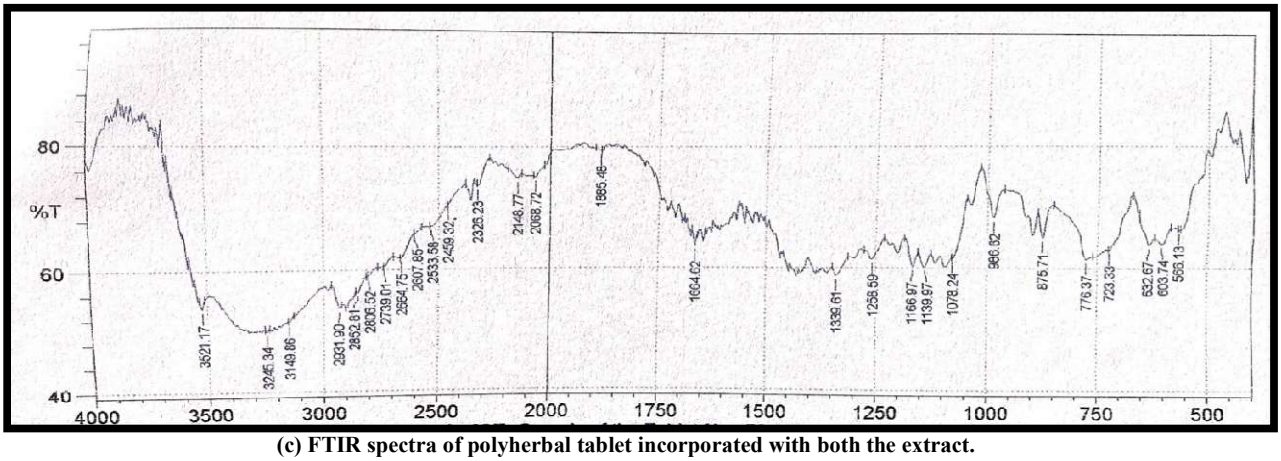
Figure 4.5: (a) Calibration curve and (b) UV spectra of methanolic extract of *Bryophyllum pinnatum* leaf extract



a) FTIR spectra of *Bryophyllum pinnatum* leaf extract



(b) FTIR spectra of *Amaranthus viridis* leaf extract



(c) FTIR spectra of polyherbal tablet incorporated with both the extract.

Figure 4.6: (a) FTIR spectra of *Bryophyllum pinnatum* leaf extract. (b) FTIR spectra of *Amaranthus viridis* leaf extract. (c) FTIR spectra of polyherbal tablet incorporated with both the extract

Table 3: Pre-compression studies

Formula	F1	F2	F3
Bulk density	0.411±0.0078	0.41±0.0057	0.504±0.0127
Tapped density	0.501±0.001	0.46±0.0057	0.57±0.0105
Angle of Repose (°)	29.84±0.693	30.67±0.86	29.677±0.436
Carr's index (%)	17.96±1.4146	10.78±0.132	11.42 ±3.093
Hausner Ratio	1.12±0.040	1.11±0.0063	1.21±0.0230

Data represented as mean ± SD, n=3

Table 4: 4.1 Physical appearance of the tablet, 4.2 Post-compression test of tablets, 4.3 Drug release profile for tablet

4.1 Physical appearance of the tablet

Parameter	Observations
Colour	Light green
Shape	Round
Odour	Characteristic odour
Taste	Bitter taste

4.2 Post-compression test of tablets

Formula	F1	F2	F3
Hardness kg/cm2	4.07±0.30	3.15±0.47	4.10±0.42
Thickness (mm)	4.1±0.17	3.9±0.23	4.2±0.28
Friability %	0	0	0
Wt. variation %	Pass	Pass	Pass
Disintegration time (min)	25.54±0.975	24.66±0.603	31.68±0.72

Data represented as mean ± SD, n=3

4.3 Drug release profile for tablet

Time (min)	F2
5	2.24±0.0302
10	6.73±0.153
15	15.73 ± 0.262
20	28.04± 0.503
25	42.30± 0.141
30	61.36±0.189
45	93.57± 0.305

Data represented as mean ± SD, n=3

CONCLUSION:

The most prevalent health issue in society nowadays is the development of kidney stones. Untreated, it may result in death. The market had a wide variety of synthetic medications, but they all had negative side effects. There are other options for breaking the stone into smaller pieces, such as surgery, shock wave lithotripsy, and percutaneous nephrolithotomy; however, these treatments are not very effective. With these therapies, there is a higher chance of stone recurrence. Consequently, polyherbal tablets were formulated for the treatment and prevention of kidney stone disease. Physical tests showed that the formulation's hardness, friability, and disintegration time were all within acceptable ranges. Additionally, the results of the post-compression studies were acceptable. Formulation F2 was shown to be the optimum formulation for pre- and post-compression compliance. As a result, it was selected as the ideal formulation and

evaluated for stability. Therefore, it might be concluded that additional study is required to fully grasp the underlying mechanism of action of the developed tablet of extract of *Amaranthus viridis* leaves and *Bryophyllum pinnatum* leaves. The results of the studies showed that the extract from the leaves of *Bryophyllum pinnatum* has antiurolithiatic activity, while the extract from the leaves of *Amaranthus viridis* helps to relieve kidney stone pain. Kidney stones could be successfully treated with the formulation F2, which was stable and had a quicker rate of breakdown.

ACKNOWLEDGMENT:

We would like to express our sincere gratitude to our mentor, for his valuable guidance and support throughout the research process. We are also grateful to Anand Pharmacy College, Anand for providing us with the resources and support we needed to complete this project.

REFERENCES

[1] M. Guha, H. Banerjee, P. Mitra, and M. Das, "The demographic diversity of food intake and prevalence of kidney stone diseases in the Indian continent," Foods, vol. 8, no. 37. MDPI Multidisciplinary Digital Publishing Institute, 2019. doi: 10.3390/foods8010037.

[2] S Asha and P Thirunavukkarasu, "Antiurolithiatic Activity of *Amaranthus viridis* on Ethylene Glycol Induced Male Rats," Inventi Journals (P) Ltd, vol. 2013, no., 2013, [Online]. Available: https://www.researchgate.net/publication/264977853

[3] T. O. Elufioye, A. O. Oyedeji, and S. Habtemariam, "A Review of the Traditional Uses, Phytochemistry and Pharmacology of *Bryophyllum pinnatum* (Lam.) (Crassulaceae)," Journal of Biologically Active Products from Nature, vol. 12, no. 3. Taylor and Francis Ltd., pp. 190–222, 2022. doi: 10.1080/22311866.2021.1988706.

[4] P. García-Pérez, E. Lozano-Milo, M. Landin, and P. P. Gallego, "From ethnomedicine to plant biotechnology and machine learning: The valorization of the medicinal plant *bryophyllum* sp.," Pharmaceuticals, vol. 13, no. 12. MDPI AG, pp. 1–23, Dec. 01, 2020. doi: 10.3390/ph13120444.

[5] M. M. Rahman, M. J. Uddin, A. S. M. Ali Reza, A. M. Tareq, T. Bin Emran, and J. Simal-gandara, "Ethnomedicinal value of antidiabetic plants in Bangladesh: A comprehensive review," Plants, vol. 10, no. 4. MDPI AG, Apr. 01, 2021. doi: 10.3390/plants10040729.

[6] S. Kumar Vaidya, A. K. Prasad, S. Kumar, S. V Iyer, R. J. Sudani, and

S. K. Vaidya, "Pharmacognostical, phytochemical and pharmacological review on *Bryophyllum pinnata*," 2012. [Online]. Available: https://www.researchgate.net/publication/281875016

[7] N. Indriyanti, A. N. Garmana, and F. Setiawan, "Repairing effects of aqueous extract of *Kalanchoe pinnata* (lmk) pers. On lupus nephritis mice," Pharmacognosy Journal, vol. 10, no. 3, pp. 548–552, May 2018, doi: 10.5530/pj.2018.3.89.

[8] A. Latif, K. Ashiq, M. Qayyum, S. Ashiq, E. Ali, and I. Anwer, "Phytochemical and Pharmacological Profile of The Medicinal Herb: *Bryophyllum pinnatum*," Raiwind Road Lahore, Pakistan, 2019.

[9] S. S. Thorat, R. R. Shah, S. A. Mohite, and N. R. Patel, "A REVIEW ON *Bryophyllum pinnatum*," International Research Journal of Pharmacy, vol. 8, no. 12, pp. 1–3, Jan. 2018, doi: 10.7897/2230-8407.0812243.

[10] M. M. Ferrer, M. del R. Ruenes-Morales, P. I. Montañez-Escalante, and H. Estrada-Medina, "Mexican Plum (*Spondias purpurea* L.)," in Handbook of Phytonutrients in Indigenous Fruits and Vegetables, CABI, 2022, pp. 405–420. doi: 10.1079/9781789248067.0028.

[11] R. P. Frank and P. G. Yoganandam, "Pharmacognostical characteristics of *Amaranthus viridis* L," ~ 1949 ~ Journal of Pharmacognosy and Phytochemistry, vol. 8, no. 6, pp. 1949–1953, 2019, [Online]. Available: http://www.phytojournal.com

[12] Md. Reyad-ul-Ferdous, "Present Biological Status of Potential Medicinal Plant of *Amaranthus viridis*: A Comprehensive Review," American Journal of Clinical and Experimental Medicine, vol. 3, no. 5, p. 12, 2015, doi: 10.11648/j.ajcem.s.2015030501.13

[13] D. Iamonico, "A nomenclatural survey of the genus Amaranthus (Amaranthaceae) 7: Names published by Willdenow," Willdenowia, vol. 50, no. 1. Botanischer Garten und Botanisches Museum Berlin-Dahlem, pp. 147–155, Mar. 31, 2020. doi: 10.3372/wi.50.50114.

[14] A. Ganjare and N. Raut, "Nutritional and medicinal potential of Amaranthus spinosus," ~ 3149 ~ Journal of Pharmacognosy and Phytochemistry, vol. 8, no. 3, 2019.

[15] K. Peter and P. Gandhi, "Rediscovering the therapeutic potential of Amaranthus species: A

review," Egyptian Journal of Basic and Applied Sciences, vol. 4, no. 3, pp. 196–205, Sep. 2017, doi: 10.1016/j.ejbas.2017.05.001.

[16] U. Sarker and S. Oba, "Polyphenol and flavonoid profiles and radical scavenging activity in leafy vegetable Amaranthus gangeticus," BMC Plant Biol, vol. 20, no. 1, Dec. 2020, doi: 10.1186/s12870-020-02700-0.

[17] M. Tzanova, V. Atanasov, Z. Yaneva, D. Ivanova, and T. Dinev, "Selectivity of current extraction techniques for flavonoids from plant materials," Processes, vol. 8, no. 10. MDPI AG, pp. 1–30, Oct. 01, 2020. doi: 10.3390/pr8101222.

[18] J. M. Fernandes, L. M. Cunha, E. P. Azevedo, E. M. G. Lourenço, M. F. Fernandes-Pedrosa, and S. M. Zucolotto, "Kalanchoe laciniata and *Bryophyllum pinnatum* : an updated review about ethnopharmacology, phytochemistry, pharmacology and toxicology," Revista Brasileira de Farmacognosia, vol. 29, no. 4. Elsevier Editora Ltda, pp. 529–558, Jul. 01, 2019. doi: 10.1016/j.bjp.2019.01.012.

[19] S. Singh, S. B. Mishra, and A. Mukerjee, "HPTLC Fingerprinting Analysis of Phytoconstituents from Indigenous Medicinal Plants," in Evidence Based Validation of Traditional Medicines, Singapore: Springer Singapore, 2021, pp. 337–358. doi: 10.1007/978-981-15-8127-4_17.

[20] R. Srivastava, A. Muhammad Rurum, P. Mishra, I. Aminu Shehu, C. Rajak, and C. Rajani Srivastava, "Preliminary phytochemical investigation and TLC fingerprint profile of Amaranthus herbs with nutraceutical potential," ~ 224 ~ The Pharma Innovation Journal, vol. 7, no. 5, pp. 224–229, 2018, [Online]. Available: www.thepharmajournal.com

[21] S. S, S. M, M. S, D. Maharaj U, and K. G, "Estimation of Phenolic acid and Flavonoids in leaves of *Amaranthus viridis* and Amaranthus spinosus," Res J Pharm Technol, pp. 3889–3895, Jul. 2021, doi: 10.52711/0974-360X.2021.00675.

[22] Patel Kanika, Neelesh Kumar, and N.K. Sharma, "Pharmacognostic & Phytochemical Evaluation of *Bryophyllum pinnatum* Leaves," J Adv Sci Res, pp. 42–49, 2011.

[23] N. Kumar and D. Munish Mani, "Formulation, Evaluation of Polyherbal Dosage Form, And

Study of Its Antioxidant Activity," 2022.

[24] R. Deepika, K. Anuj, and C. Himanshu, "Formulation and evaluation of herbal tablet containing Terminalia chebula extract," Letters in Applied NanoBioscience, vol. 8, no. 4, pp. 692–697, 2019, doi: 10.2019/Accepted.

[25] S. Kumar Kushwaha and M. L. Kori, "Development and Evaluation of Polyherbal Tablet from Some Hepatoprotective Herbs," Scholars Academic Journal of Pharmacy (SAJP), vol. 3, no. 3, pp. 321–326, 2014, [Online]. Available: www.saspublisher.com

[26] Nagpal G and Sharma M, "Kalanchoe Pinnata and Its Remedial Properties to Treat Kidney Stone– A Lesser Known Plant," Int J Biol Pharm Allied Sci, vol. 9, no. 11, Nov. 2020, doi: 10.31032/ijbpas/2020/9.11.5259.

[27] S. Pulipati, P. Babu, and M. Narasu, "Phytochemical and pharmacological potential of *Amaranthus viridis* L," International Journal of Phytomedicine ISSN: 0975-0185, vol. 6, no. 3, pp. 322–326, 2014.

[28] Md. Reyad-ul-Ferdous, "Present Biological Status of Potential Medicinal Plant of *Amaranthus viridis*: A Comprehensive Review," American Journal of Clinical and Experimental Medicine, vol. 3, no. 5, p. 12, 2015, doi: 10.11648/j.ajcem.s.2015030501.13

[29] T. Sarkar *et al*., "Underutilized green leafy vegetables: frontier in fortified food development and nutrition," Crit Rev Food Sci Nutr, pp. 1–55, Jul. 2022, doi: 10.1080/10408398.2022.2095555.

[30] A. Ahuchaogu, R. I. Uchegbu, A. Anslem Ahuchaogu, K. O. Amanze, and C. O. Ibe, "Chioma Onyekachi Ibe. Chemical Constituents Analysis of the Leaves of *Bryophyllum pinnatum* by GC-MS," Kenneth Obichere Amanze, 2017. [Online]. Available:http://www.aascit.org/journal/chemistry

[31] K. Ashiq, E. Ali, and S. Qamar, "Phytochemical Analysis And In Vitro Investigation of Anti-Inflammatory and Xanthine Oxidase Inhibition Potential of Root Extracts Of *Bryophyllum pinnatum* Evaluation of herbal medicines View project pharmacological activity of oxadiazole 2 thiol View project," 2020.

[32] A. Mehdi, W. M. K. Al-Ani, and A. Raoof, "Isolation of astragalin from iraqi chenopodium album," Asian Journal of Pharmaceutical and Clinical Research, vol. 11, no. 12, pp. 530–535, Dec. 2018, doi: 10.22159/ajpcr.2018.v11i12.27958

[33] Y. C. Wang *et al*., "In vitro activity of 2-methoxy-1,4-naphthoquinone and stigmasta-7,22-diene- 3β-ol from Impatiens *balsamina* L. against multiple antibiotic-resistant Helicobacter pylori," Evidence-based Complementary and Alternative Medicine, vol. 2011, 2011, doi: 10.1093/ecam/nep147.

[34] R. Jagdish and K. Nehra, "*Bryophyllum pinnatum* mediated synthesis of zinc oxide nanoparticles: characterization and application as biocontrol agents for multi-drug-resistant uropathogens," Heliyon, vol. 8, no. 10, Oct. 2022, doi:10.1016/j.heliyon.2022.e11080

[35] A. N. M. da Silva, L. R. Amado, B. C. B. de Barrosa, O. A. Sakai, A. M. Picolloto, and K. de S. Silva, "Effect of *Amaranthus viridis ebidens pilosa* leaves extract on properties of soy protein-locust bean gum active films," Research, Society and Development, vol. 12, no. 4, p. e10512440991, Apr. 2023, doi: 10.33448/rsd-v12i4.40991.

[36] Yamini Bhusan Tripathi, "Development and Evaluation of Herbal Tablet Loaded with *Pueraria tuberosa* Water Extract with Use of Different Excipients," Asian J Pharm, vol. 12, no. 2, 2018.