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DESIGN AND EVALUATION OF ANTIUROLITHIATIC EFFERVESCENT HERBAL TABLETS CONTAINING HYDROALCOHOLIC EXTRACT OF *BRYOPHYLLUM PINNATUM*

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The objective of this study was to prepare and evaluate effervescent tablets containing Bryophyllum pinnatum leaves extract and to assess the in vitro antiurolithiatic activity of these tablets. The leaves of Bryophyllum pinnatum were collected, authenticated, cleaned, dried and extracted using water:ethanol (80:20) as the solvent system. Prior to extraction the crude drug was tested for its macroscopic, microscopic and quantitative standards. The extract was also assessed for its antioxidant potential by determining the DPPH radical, hydroxyl radical, nitric oxide radical and hydrogen peroxide radical scavenging activities; total phenolic and total flavonoid contents. Thereafter, the extract was formulated into an effervescent tablet and characterized for its different evaluation parameters as described previously. The formulated tablets were then assessed for its in vitro antiurolithiatic activity through estimation of the rate of nucleation and aggregation of CaOx crystals. The results were compared with a standard marketed formulation, Cystone®. Statistical analyses were performed using GraphPad Prism software (v6.01, Sept 2012). The antioxidant studies indicated that the Bryophyllum pinnatum extract has high antioxidant potential. The effervescent tablets were prepared by wet granulation method and passed all the evaluation tests, viz. weight variation test, effervescence time, effervescence solution pH, hardness test, thickness of tablets, moisture content and friability. The tablets also demonstrated superior antiurolithiatic activity by reducing the rate of nucleation and aggregation of CaOx crystals.

Keywords: *Calcium oxalate; Bryophyllum pinnatum; Effervescent tablets; Nucleation; Aggregation*

INTRODUCTION

The formation of stone in the urinary system, i.e. in the kidney, ureter, and urinary bladder or in the urethra is called urolithiasis. 'Urolithiasis' = *ouron* (urine) and *lithos* (stone). Urolithiasis is a major cause of morbidity and one of the most common diseases of the urinary tract. Low liquid administration and a high dietary utilization of animal protein, sodium, refined sugars, fructose and high fructose corn syrup, oxalate, grapefruit juice, squeezed apple, and cola drinks are all dietary variables that enhance the risk of stone formation. Inadequate urine drainage, foreign bodies in the urinary tract, microbial infections, and a diet high in oxalates are all major causes of stone development[1]. Stone-forming crystalloids in urine that come out with solution create renal stones. About 75% of all stones are calcium-based, consisting of calcium oxalate, calcium phosphate, and a mixture of oxalate and phosphate. These mixed stones have more than one component, such as a uric acid nidus in aggregation with calcium. Another 10% of renal stones are uric acid-based, 1% cystine-based, and the remaining are primarily struvite. In susceptible patients, stone formation, begins when urine is supersaturated with calcium, cystine, uric acid, struvite or oxalate. Calcium stone formation involves different phases of increasing the accumulation of calcium oxalate and calcium phosphate. This major mechanism known for the formation of urolithiasis includes nucleation, crystal growth, crystal aggregation, crystal retention[2]. Management of any stone is

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dictated by stone location, composition, size and patient factors e.g. co-morbidities, solitary kidney and occupation. The surgical treatment available are Extracorporeal Shockwave Lithotripsy (ESWL), Percutaneous Nephrolithotomy (PCNL), Ureteroscopic Stone Removal Open (incisional) Surgery[2]. However, most of these therapies are surgical and consequently, they are expensive and not always widely available. Because of this, many people prefer or only have an access to traditional herbal medicines to treat urinary stones. Since, the prehistoric times medicinal plants have been identified, exploited, and are used as a natural remedy to cure a number of diseases. Natural products, such as plants, animals, microorganisms, and marine organisms were used by human beings as medicines to alleviate and treat diseases[3]. Several herbal remedies have been described to treat urinary stone diseases in different traditional system of medicine such as Ayurveda, Traditional Chinese medicine (TCM), Siddha and Unani[4].

In the present scenario about 75 – 80% of the world population use herbal medicine for primary health care due to the general belief that herbal drugs are without any side effects. Moreover, it is cheap and readily available Also, it is modest; promptly accessible and has less aggressive pharmacological effect[5]. Traditional plants used in the treatment of kidney diseases have a marked increase in urine volume that leads to the excretion of stones and mineral metabolites that influence the formation and growth of deposits[6]. The market for ayurvedic medicines is estimated to be expanding 20% annually. Therefore, it also has a brighter prospect in the global market[7].

Bryophyllum pinnatum belongs to the family Crassulaceae. It is an important and endemic medicinal plant found in Assam. It is commonly known as “Dupor Bon Tenga” in Assamese. Traditionally this plant has been used in the treatment of various ailments in which the fresh leaves are collected and cleaned, wash properly, and eaten raw. It was considered to be effective in cases of kidney and gallbladder stone. It was also considered to be effective in helminthiasis, urinary infection. Traditional healers of various countries have used the leaves of this plants for treating various ailments like renal calculi, hypertension, asthma, cold, abscesses, bleeding disorders[8].

MATERIALS AND METHODS

Plant Material and extraction

The leaves of *Bryophyllum pinnatum* were collected in the month of April, 2021 from Gaonrajsthan village, located in the Mushalpur area of the district of Baksa, Assam, India; by following the Good Agricultural and Collection Practice (GACP) guidelines. The plant herbarium was authenticated at the Assam Bio-Resoucre Centre, Madan Kamdev, Kamrup, Assam; under Assam Science Technology and Environment Council, Bigyan Bhavan, Government of Assam; vide Accession No. ABRC/1035/21. A specimen of the plant is maintained at the Pharmacognosy Research Lab of the Institute for further references. After collection, the leaves were washed thoroughly with water; dried partially under sunlight and partially under the shade for 20 days. More time was required to dry the material because the leaves were fleshy and contained a high amount of moisture. The dried leaves were cut into pieces, ground using a mechanical grinder and stored in airtight containers until further use.

The hydroalcoholic extract of the leaves of *Bryophyllum pinnatum* (HEB) was prepared by using cold maceration process with 1000 mL of water:ethanol (80:20) mixture. The cold maceration process was employed so as to avoid degradation of any thermolabile components that may be present. The extract was thereafter concentrated by using a rotary evaporator. Thereafter, the extract was subjected to preliminary phytochemical tests to ascertain the presence of different phytochemical constituents.

Chemicals

All chemicals used in this assay were of analytical grade and obtained from reputed suppliers like SRL Sisco Research Laboratories Pvt. Ltd., Mumbai, India; HiMedia Laboratory, Mumbai, India; Loba Chemie, Mumbai, India; and Rankem Chemicals, Faridabad, India.

Organoleptic evaluation

The sensory characteristics like the external morphology, odor, taste and surface characters were observed and recorded. Special features which were not possible to perceive with the naked eye were evaluated using a simple microscope of 10× magnification[9].

Microscopic analysis

The mature and fresh leaves of *Bryophyllum pinnatum* (about 6–12 weeks old) were collected and cleaned with water. The transverse sections of the bark leaves were cut and boiled in 10% potassium hydroxide solution and chloral hydrate to remove the presence of any fatty matters and coloring pigments[9]. The sections were stained with safranin dye and observed under a light microscope. Photographs of the sections were taken with a photomicrograph unit; Make: Labomed; Model: Lx 300.

Quantitative standards

The determination of the quantitative standards, namely total ash, acid insoluble ash, water soluble ash, extractive values, foaming index and loss on drying were evaluated as per the methods described in the Indian Pharmacopoeia and Ayurvedic Pharmacopoeia of India[9]. Each study was performed in triplicate and the mean values with the standard deviation were calculated.

***In vitro* antioxidant potential of *Bryophyllum pinnatum* extract**

The *in vitro* antioxidant activity of the HEB was evaluated as per the methods described earlier. The methods of analysis used for this assay include DPPH radical scavenging activity, hydroxyl radical scavenging activity, nitric oxide radical scavenging activity and hydrogen peroxide radical scavenging activity. The reducing power, total phenolic content and total flavonoid content were also determined using pre-established methods [9]. All tests under this heading were colorimetric reaction based and performed using a UV-visible spectrophotometer (Make: Shimadzu Corporation, Japan; Model: UV-1900).

Fabrication and characterization of effervescent tablets containing extract of *Bryophyllum pinnatum* leaves

Preparation of the effervescent tablets

All the required ingredients are first collected and identified properly. The ingredients were weighed properly and accurately in a suitable electronic balance. The formulae of the effervescent tablets are depicted in the Table 1. Sodium bicarbonate, tartaric acid, citric acid, sucrose and extract were mixed thoroughly in mortar and pestle. 10% PVP K-30 is prepared in isopropyl alcohol as binder and mixed with the mixture until wet dough is formed. The dough was passed through a sieve of 40 mesh and granules are obtained. The granules were dried in conventional hot air oven at 45°C for 30 min. A small amount of moisture should be present. The dried granules were sized through 40/60 mesh sieve to make them suitable for compression[10]. The dried granules are compressed into tablets in a tablet punching machine (Make: Shakti Pharmaceutical Pvt. Ltd (Type: SLP-1-9D; SR. No.: 165 W.O. NO-475)) located in the machine room of NETES Institute of Pharmaceutical Science, Mirza, Kamrup, Assam.

Table 1: Formula of effervescent tablet from *B. pinnatum* extract.

Ingredients	**Use**	**Quantity per 100 g (%)**	
		***B. pinnatum* tablet**	**Placebo tablet**
Sodium bicarbonate	Effervescent inducer, Alkaline ingredient	19.29	19.29
Tartaric acid	Effervescent inducer, Alkaline ingredient	6.43	6.43
Citric acid	Effervescent inducer, Alkaline ingredient	4.82	4.82
PVP-K30	Binder	3.2	3.2
Isopropyl alcohol	Solubilizer for PVP-K30	64.32	64.32
Sucrose	Filler, Sweetening agent	0.9648	0.9648
B. pinnatum extract	Active ingredient	0.9648	-

Evaluation of the effervescent tablets

The tablets were evaluated for its quality by using the established methods of weight variation test, effervescence time, effervescence solution pH, hardness test, thickness of tablets, moisture content and friability tests as described previously[10]. The tablets were also evaluated for its content uniformity using the methods described previously[11].

Evaluation of *in vitro* anti-urolithiatic activity of effervescent tablet containing hydroalcoholic extract of *Bryophyllum pinnatum* leaf

Nucleation assay

The effect of the effervescent tablet containing hydroalcoholic extract of *Bryophyllum pinnatum* leaf on calcium oxalate (CaOx) crystal formation was determined by using the method of nucleation assay as described previously[12]; with minor modifications. Calcium chloride ($CaCl_2$) (5 mM) along with sodium oxalate solution ($Na_2C_2O_4$) (7.5 mM) was prepared in Tris-HCl (0.5 M) and NaCl (0.15 M) buffer at pH 6.5. Both the tablets; viz. prepared *Bryophyllum pinnatum* effervescent tablet and Cystone® (obtained from Himalaya Herbal Healthcare, India) were dissolved in 200 mL (approx. 1 glass) of purified water. One milliliter of each of the solutions was mixed separately with 3 mL of $CaCl_2$ followed by the addition of 3 mL of $Na_2C_2O_4$ solution. The mixtures were incubated at 37 °C in an oven, for 30 min, and allowed to cool down to room temperature. The optical density (OD) of the mixtures was measured at 620 nm using a spectrophotometer (Make: Shimadzu Corporation, Japan; Model: UV-1900). The percentage inhibition of nucleation for the prepared *Bryophyllum pinnatum* effervescent tablet and Cystone® was calculated using the formula:

$$\%\ inhibition = [1 - (\frac{\mathrm{OD_{test}}}{\mathrm{OD_{control}}})\ \times 100]$$

Aggregation assay

The effect of the effervescent tablet containing hydroalcoholic extract of *Bryophyllum pinnatum* leaf and Cystone® on CaOx crystal aggregation was determined by using the protocol described previously; with minor modifications[12]. $CaCl_2$ and $Na_2C_2O_4$ solutions (50 mM each) were mixed together and heated to 60 °C in a water bath for 1 hr. The mixture was then incubated overnight at 37 °C. Post drying, a CaOx crystal solution (0.8 mg/mL) was prepared in a 0.05 M Tris-HCl and 0.5 M NaCl buffer (pH 6.5). Both the tablets; viz. prepared *Bryophyllum pinnatum* effervescent tablet and Cystone® (obtained from Himalaya Herbal Healthcare, India) were dissolved in 200 mL (approx. 1 glass) of purified water. One milliliter of each of the solutions was mixed separately with 3 mL of CaOx solution, vortexed and incubated at 37 °C for 30 min. OD of the final mixtures was read at 620 nm and the percentage inhibition of aggregation was calculated as described for the nucleation assay.

RESULTS AND DISCUSSION

Organoleptic evaluation of *Bryophyllum pinnatum* leaf

The leaves collected from the mature *Bryophyllum pinnatum* plants yielded oblong, glabrous, fleshy leaves with serrated margin which were 6-10 cm long and 3-5 cm wide. The collected leaves were dark green in colour when fresh which changed to yellowish brown upon drying. The leaves had a characteristic acceptable odour with a sour taste. The leaves were found to contain exceptionally high amount of moisture due which the time taken for complete drying of the leaves was observed to be around 15-20 days. The photographs of the collected crude drug are depicted in Figure 1. It is noteworthy to mention that the sour taste of the leaves increased its intensity during the noon time of the day due which the plant is locally known as “Dupor-tenga (“Dupor” means “noon” and “tenga” means “sour” in Assamese language). This effect may be attributed to possible chemical changes within the plant physiology due to the intense UV rays of the sun. Therefore, the leaves were collected between 11:30-13:30 hours IST.

Preliminary phytochemical analysis of the extract of *Bryophyllum pinnatum* leaf

The hydroalcoholic extract of *Bryophyllum pinnatum* leaf showed the presence of a number of important chemical constituents such as alkaloids, carbohydrates, flavonoids, steroids, tannins and phenolic compounds. The complete results are tabulated in Table 2.

Fig.1: The collected plant material – leaves of *Bryophyllum pinnatum*.

Table 2: Preliminary phytochemcical analysis of the hydroalcoholic extract of *Bryophyllum pinnatum* leaves.

Plant Constituents	**Test**	**Observation**
Alkaloids	Dragendorff's test	+
	Mayer's Test	+
	Hager's Test	+
	Wagner's Test	+
Amino acids	Ninhydrin Test	-
Carbohydrates	Molisch Test	+
	Fehling's Test (for reducing sugars)	+
	Benedict's Test (for non-reducing sugars)	-
Fats and Oils	Saponification Test	+
Flavonoids	Shinoda Test	+
	Alkaline reagent test	+
Anthraquinone glycosides	Borntrager's test	-
	Modified Borntrager's test	-
Cardiac glycosides	Legal's test	-
	Liebermann's test	-
	Keller–Killiani Test	-
Saponin glycosides	Foam test	+
Coumarin glycosides	Alkaline treatment of alcoholic extract	-
Gums	Sample hydrolysis followed by Benedict's test	-
Lignins	Sample+alcoholic phluroglucinol+HCl	+
Proteins	Biuret test	-
	Million's test (detection of tyrosine)	-
Steroids	Liebermann–Burchard's Test	+
	Salkowski Test	+
Triterpenoids	Noller's test	+
Saponins	Foam test	+
Tannins and Phenolic Compounds	Sample+5% $FeCl_3$ Solution	+
	Sample+Dilute HNO_3	+

+, present; –, absent; n = 10; The values were from three independent replicates.

Microscopic analysis of *Bryophyllum pinnatum* leaf

The transverse sections of the fresh leaf of *Bryophyllum pinnatum* is depicted in Figure 2. Since the leaves were large and fleshy, the margin and midrib were observed separately. The large fleshy leaves resembled succulents in their anatomy and found to contain a high quantity of water. The observed characteristics were similar to those reported in previous literature[13]. As reported by Anjoo *et. al.*, 2010; the TS a thin epidermal layer, comprising of small cells. The midrib was found to be homogenous, parenchymatous and comprised of compact cells. Hemispherical shaped vascular strand, with thick xylem and phloem were found to be present. The mesophyll layer of undifferentiated spongy and palisade parenchyma[13].

Quantitative standards

The quantitative analyses of any crude drug are essential in order to ascertain the purity and authenticity of the crude drug. These numerical standards are useful for the evaluation of the drug either in crude or dried form. The results of the quantitative analyses are depicted in Table 3.

The results of the antioxidant study of the hydroalcoholic extract of *Bryophyllum pinnatum* leaf depicted that the leaf was rich in antioxidant compounds such as, flavonoids and phenolics. The total flavonoid content and total phenolic content of the hydroalcoholic extract of *Bryophyllum pinnatum* leaf was found to be 152 mg g^{-1} in terms of Quercetin equivalent (QE) and 105 mg g^{-1} in terms of Gallic acid equivalents (GAE), respectively. In terms of the free radical scavenging activity, the extract displayed tremendous potential in terms of DPPH radical scavenging activity, hydroxyl radical scavenging activity, nitric oxide radical scavenging activity and hydrogen peroxide radical scavenging activity (see Table 4). It is observed that although the IC_{50} values for the extract were found to be lower than the standard antioxidant compounds, the values were still comparatively exhibiting high antioxidant values. This high antioxidant activity can be attributed to the high amount of polyphenolic and flavonoid contents of the plant. Figure 3 depicts the standard calibration curves of quercetin and gallic acid used for the calculation of the total flavonoid content and total phenolic contents.

***In vitro* antioxidant potential of *Bryophyllum pinnatum* extract**

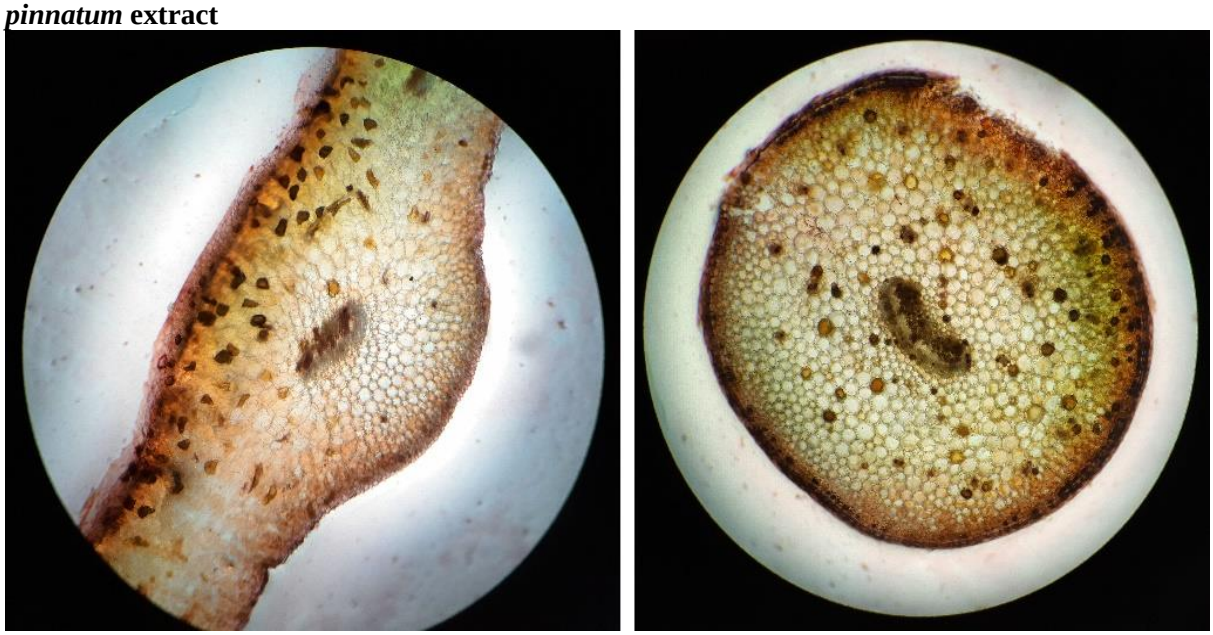

Fig. 2: Microscopic images of the transverse section of *Bryophyllum pinnatum* leaf (Plate A) and leaf stalk (Plate B).

Table 3: Quantitative standards of the crude drug of *Bryophyllum pinnatum*. Values are expressed as Mean ± Standard deviation (n=3).

Sl. No.	Parameters	Results
1	Total ash	20.08 ± 4.76
2	Acid insoluble ash	2.97 ± 1.50
3	Water soluble ash	10.49 ± 2.01
4	Water soluble extractive	6.67 ± 1.08
5	Alcohol soluble extractive	3.89 ± 0.99
6	Loss on drying	95.74 ± 1.86

Table 4: *In vitro* antioxidant activity of the hydroalcoholic extract of *Bryophyllum pinnatum* leaves. Results are expressed as Mean ± Standard deviation (n=3).

Sl. No.	Parameters	IC_{50} value	
		Standard	HEB
1	DPPH radical scavenging activity	90.67 ± 5.51	114.00 ± 7.81
2	Hydroxyl radical scavenging activity	390.00 ± 65.58	516.00 ± 62.79
3	Nitric oxide radical scavenging activity	198.67 ± 20.14	236.00 ± 33.29
4	Hydrogen peroxide radical scavenging activity	145.00 ± 22.92	156.00 ± 19.31

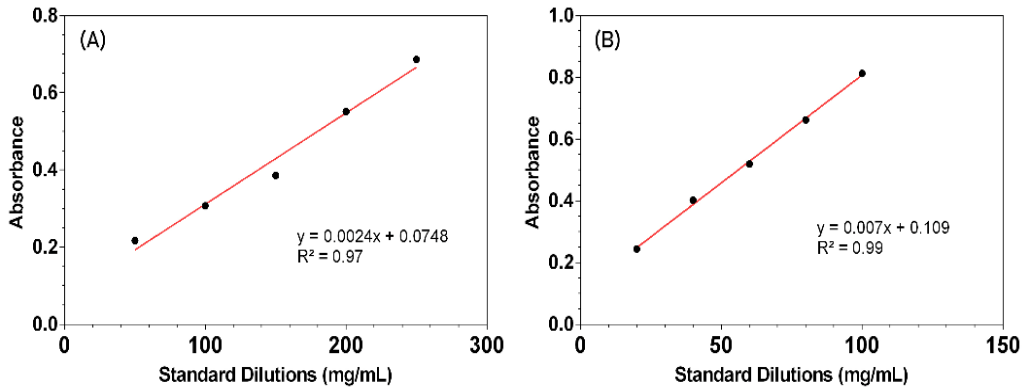

Fig. 3: Standard calibration curve of (A) Quercetin; (B) Gallic acid.

Fabrication and characterization of effervescent tablets containing extract of *Bryophyllum pinnatum* leaves

As per the protocols mentioned in the British Pharmacopoeia (B.P.), the effervescent tablets were evaluated for their weight variation test, disintegration test, hardness test and friability test. The results are tabulated in Table 5. As observed these parameters were tested for both the *B. pinnatum* effervescent tablet and placebo tablet. It was observed that both the tablets passed all the quality control tests as per the B.P. Values for all the parameters for both the tablets were comparable with other. However, it is also evident that the parameters like tablet hardness and disintegration time was lower in the placebo tablet when compared with the *B. pinnatum* tablet. This may be due to the fact that since the *B. pinnatum* extract had a gummy texture; it resulted in the formation of a harder tablet with a slightly longer disintegration time. It is also noteworthy to mention that the effervescence time for the tablet is 1.47 min which is essential characteristic of an effervescent tablet. It was also observed that the HEB showed a λ_{max} at 336 nm which was determined using a spectrophotometer (Make: Shimadzu Corporation, Japan; Model: UV-1900) by obtaining a spectrum with wavelength scan of 200–800 nm (Figure 4, Plate A). The content uniformity was obtained from the calibration curve of the HEB which was obtained at 336 nm (Figure 4, Plate B) and percentages of individual drug content were calculated against the average drug content according to the specifications. The analysis showed that the content of HEB was found to be 0.046 ± 0.001.

Table 5: *In vitro* antioxidant activity of the hydroalcoholic extract of *Bryophyllum pinnatum* leaves. Values are expressed as Mean ± Standard deviation (n=3).

Sl. No.	Parameters	Results	
		***B. pinnatum* tablet**	**Placebo tablet**
1	Hardness (kg/cm^2)	2.63 ± 0.15	2.50 ± 0.26
2	Weight Variation (%)	5.7 ± 0.62	5.8 ± 0.26
3	Friability (%)	0.43 ± 1.52	0.53 ± 0.15
4	Effervescence time (minutes)	1.47 ± 0.08	1.36 ± 0.29
5	Effervescence solution pH	5.80 ± 0.10	5.50 ± 0.15
6	Tablet thickness (mm)	5.73 ± 0.05	5.70 ± 0.01
7	Moisture content (%)	0.10 ± 0.15	0.08 ± 0.01
8	Drug content uniformity (g/tablet)	0.046 ± 0.001	-

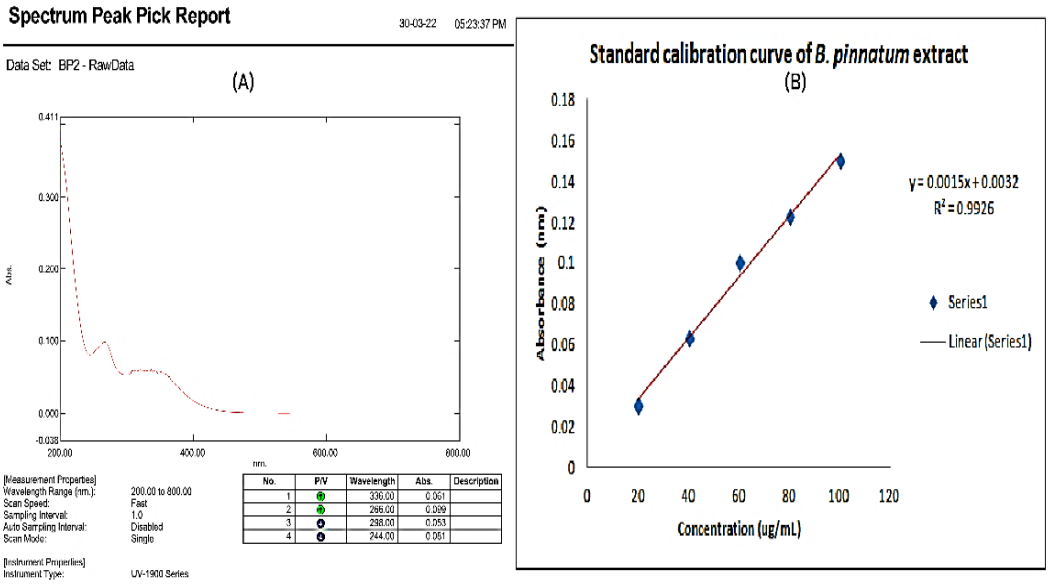

Fig. 4: (A) Peak spectrum report of HEB showing the λ_{max} at 336 nm; (B) Standard calibration curve of HEB.

Evaluation of *in vitro* anti-urolithiatic activity

Nucleation assay

In the nucleation assay, addition of $Na_2C_2O_4$ solution to the reaction mixture consisting of $CaCl_2$ resulted in the formation of numerous CaOx crystals. The test formulation and standard drug Cystone reduced the size and number of calcium oxalate. The percentage reduction in size of CaOx crystals produced by test formulation was 48.59%, comparable to that of the Cystone which was 60.12%. (Table 6). CaOx nucleation is a phase-change thermodynamic driven process in which dissolved substances spontaneously crystallize in a supersaturated solution. A comparable phase change and formation of CaOx crystals was observed during the nucleation assay[14]. Significant inhibition in the nucleation of CaOx crystals was observed in the presence of test formulations. This suggests the anti-crystallization activity of the test formulation in the CaOx crystallization assay. The anti-crystallization activity of the test formulation could be its ability to complex with free calcium and oxalate ions thus preventing the formation of CaOx complexes. Calcium oxalate monohydrate (COM) and calcium oxalate dehydrate (COD); are CaOx polymorphs commonly found in urolithiasis, with COM being more stable, highly aggregatory and with more adhesive ability. Thereby, COM generates large crystal aggregates which deposits heavily into the renal epithelial tissue, causing injuries. In this study, the test formulation inhibit the aggregation of COM and also inhibit urinary stone formation[12].

Table 6: *In vitro* antiurolithiatic potential of *B. pinnatum* effervescent tablets versus Cystone® tablets. Values are expressed as Mean ± Standard deviation (n = 3).

Groups	% Inhibition	
	Nucleation Assay	Aggregation Assay
Control	-	-
Cystone®	60.12 ± 4.70	67.09 ± 4.35
Test formulation	48.59 ± 7.01	56.22 ± 8.09

Aggregation assay

In the aggregation assay, the percentage reduction in aggregation produced by the test formulation was found to be 56.22% compared to Cystone® which was found to be 67.09%. (Table 6). The test formulation exhibited growth inhibitory activity, which was confirmed by reduction in crystal size in the presence of the test formulation. Aggregation of crystals marks the process wherein numerous crystals in the solution come together and adhere to form large crystals agglomerates. Aggregation is a key determinant of crystal retention, as large crystals agglomerates are the ones that produce renal tubular obstruction, thereby promoting stone formation. The test formulation showed significant inhibitory effect on CaOx crystal aggregation further inhibiting urinary stone formation[12].

Conclusion

This study concentrates on the development of a novel formulation containing the leaf extracts of a proven antiurolithiatic plant, viz. *Bryophyllum pinnatum*. Till date, no self dissolving effervescent antiurolithiatic tablets have been reported in the market which contains the extract of *Bryophyllum pinnatum*. The effervescent tablets contained ingredients like; sodium bicarbonate, tartaric acid, citric acid, PVP-K30, isopropyl alcohol, sucrose etc; which are standard pharmaceutical ingredients and possess a record of being safe for administration. Prior to the formulation, analyses like pharmacognostic parameters of the crude drug and the phytochemical estimation, antioxidant activity of the hydroalcoholic extracts demonstrated the purity and authenticity of the botanicals. Thereafter, the formulation was prepared and evaluated for all the parameters pertaining to the evaluation as per the British Pharmacopoeia. The antiurolithiatic activity was established by using various *in vitro* methods. It was observed that the tablets passed all the evaluation parameters and demonstrated a superior antiurolithiatic activity when compared to a standard antiurolithiatic medication available in the market. It is noteworthy to mention that *Bryophyllum pinnatum* is a proven, safe and effective nutraceutical which finds its use in the treatment of various kinds of lithiathic conditions, predominantly that of the kidneys. Therefore, the formulation fabricated in this study can be used either as a prophylactic and preventive medicine or as a daily intake nutraceutical agent.

As we are aware that natural products have gained immense popularity in the field of preventive medicines and as non-invasive, non-toxic medicinal alternatives. However, most individuals have a low compliance rate when it comes to consumption of raw plant material or non-standardized plant extracts. This study and the formula used in the self-dissolving tablets will pave the way for development of newer herbal formulations which will allow the consumers to complete their medicinal and nutraceutical requirements. The formulation is designed to be palatable, convenient to prepare and delivers the exact dose as required. However, further preclinical and clinical studies are required which sheds light on the safety profile; *in vivo* antiurolithiatic activity and the absorption patterns of the plant extracts into the body. The formulation possesses the potential to be marketed for mass consumption it passes all the aforementioned studies.

Conflict of interest

The authors declare no conflict of interest, financial or otherwise.

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نشرة العلوم الصيدلية
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تصميم وتقييم الأقراص العشبية الفوارة المضادة لليوروليثيات التي تحتوي على مستخلص مائي كحولي من البريوفيلوم بيناتوم

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كان الهدف من هذه الدراسة هو إعداد وتقييم الأقراص الفوارة التي تحتوي على مستخلص أوراق البريوفيلوم بيناتوم وتقييم النشاط المضاد لليوروليثيات في المختبر لهذه الأقراص. تم جمع أوراق البريوفيلوم بيناتوم وتوثيقها وتنظيفها وتجفيفها واستخلاصها باستخدام الماء: الإيثانول (٨٠:٢٠). قبل الاستخلاص الدواء الخام تم اختباره لمعاييره العيانية والمجهرية والكمية. تم تقييم المستخلص أيضًا لإمكاناته المضادة للأكسدة عن طريق تحديد أنشطة دي بي اتش و الهيدروكسيل و أكسيد النيتريك و بيروكسيد الهيدروجين ؛ إجمالي محتويات الفينول والفلافونويد الكلية. بعد ذلك ، تمت صياغة المستخلص في قرص فوار وتقيمه بمعايير التقييم المختلفة كما هو موضح سابقًا. بعد ذلك تم تقييم الأقراص المصنّعة من حيث نشاطها المضاد لليوروليتياتيك في المختبر من خلال تقدير معدل التنوي وتجميع بلورات اوكسالات الكالسيوم. تمت مقارنة النتائج بالتركيبة القياسية الموجودة في السوق ® Cystone. تم إجراء التحليلات الإحصائية باستخدام برنامج جرافباد برزم (الإصدار ٦,٠١ ، سبتمبر ٢٠١٢). أشارت الدراسات المضادة للأكسدة إلى أن مستخلص البريوفيلوم بيناتوم يحتوي على إمكانات عالية كمضادات الأكسدة. تم تحضير الأقراص الفوارة بطريقة التحبيب الرطب واجتازت جميع اختبارات التقييم ، مثل اختبار تغير الوزن ، وقت الانقلاب ، درجة الحموضة في محلول الفوران ، اختبار الصلابة ، سمك الأقراص ، محتوى الرطوبة والتفتت. أظهرت الأقراص أيضًا نشاطًا مضادًا لليوروليثيات الفائق عن طريق تقليل معدل التنوي وتجميع بلورات اوكسالات الكالسيوم.