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Development & Evaluation of herbal Fast Dissolving Tablet of *Tectona grandis* Linn & *Bauhenia veriagata* Linn .mixture.

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Abstract: Fast dissolving Tablets are disintegrating and/or dissolve rapidly in the saliva without the need for water. FDTs can be prepared by different methods as direct compression, freeze-drying, spray drying, sublimation and wet granulation method. Herbal drugs comprise of a major share of all the officially recognised systems of health in India. The herbal extract of *Tectona grandis* Linn is & *Bauhenia veriagata* Linn are used in this formulation. The aim of this study was to formulate FDTs with sufficient mechanical integrity and to achieve faster disintegration in the oral cavity without water. To achieve this goal, MCC is used as diluent and sodium saccharin as sweetening agent for the formulation of tablets. Attempts were made to enhance dissolution rate along with faster disintegration using superdisintegrants like Crospovidone, Sodium starch glycolate (SSG)and mixture of crospovidone and sodium starch glycolatein the formulation of tablets. The tablets were subjected to weight variation, drug content uniformity, hardness, friability, wetting time, *In vitro* dispersion time and *In vitro* drug release studies.

Key words: Fast dissolving tablets (FDTs), Sodium starch glycolate (SSG), Microcrystalline cellulose (MCC), Crospovidone (CP).

Introduction:

Fast dissolving Tablets are disintegrating and/or dissolve rapidly in the saliva without the need for water. Some tablets are designed to dissolve in saliva extremely fast, within a few seconds, and are true fast-dissolving tablets. Others contain agents to increase the rate of tablet disintegration in the oral cavity, and are more appropriately termed fast-disintegrating tablets. Fast or mouth dissolving tablets have been formulated for pediatric, geriatric, patients and for active patients who are busy and traveling and may not have access to water. Such formulations provide an opportunity for product line expansion in the many elderly persons will have difficulties in taking conventional oral dosage forms (viz., solutions, suspensions, tablets, and capsules) because of hand tremors. Swallowing problems also are common in young individuals because of their underdeveloped muscular and nervous systems. Other groups that may experience problems using conventional oral dosage forms include the mentally ill, the developmentally disabled, and patients who are uncooperative, or are nauseated.[1]FDTs can be prepared by different methods as direct compression, freeze-drying, spray drying, sublimation and wet granulation method.[2]

In the present era, market of all commodities has become global. Market of health-related products has been active and these products are manufactured at different parts of the world and sold all over. Standardization is necessary to make sure the availability of a uniform product in all parts of the world. Herbal medicines are effective in all types of disease. Standardization assures a consistently stronger product with

guaranteed constituents. WHO collaborates and assists health ministries in establishing mechanisms for the introduction of traditional plant medicines into primary healthcare programs, in assessing safety and efficacy, in ensuring adequate supplies, and in the quality control of raw and processed materials. Herbal formulations in general can be standardized schematically as to formulate the medicament using raw materials collected from different localities and a comparative chemical efficacy of different batches of formulation is to be observed. A preparation with better clinical efficacy has to be selected. In India, diabetes is a serious disease due to irrational food habits. Most of the hypoglycemic agents used in allopathic practice to treat diabetes mellitus are reported to have side effects in long term use. Hence, there is the need to search for effective and safe drugs for these ailments. Based on the above basis the present study was undertaken with an aim to standardize some herbal antidiabetic drugs based on their physicochemical characteristics.[3]

There are some good examples. Indian medicinal plants also provide a rich source for antioxidants that are known to prevent/delay different diseased states. The antioxidant protectionis observed at different levels. The medicinal plants also contain other beneficial compounds like ingredients for functional foods. Hence, the global knowledge about Ayurveda and Indian herbals will optimistically be enhanced by information on the evidence-base of these plants. This will yield rich dividends in the coming years.[4]

The aim of this study was to formulate FDTs with sufficient mechanical integrity and to achieve faster disintegration in the oral cavity without water. To achieve this goal, MCC is used as diluent and sodium saccharin as sweetening agent for the formulation of tablets. Attempts were made to enhance dissolution rate along with faster disintegration using superdisintegrants like Crospovidone,Sodium starch glycolate (SSG)and mixture of crospovidone and sodium starch glycolatein the formulation of tablets.

Two herbal extracts of viz *Bauhenia Veriagata* Linn and *Tectona grandis* Linn are used in this formulation. It is a herbal formulation prepared for diabetis. Diabetes mellitus is a group of metabolic diseases characterized by hyperglycaemia, hypertriglyceridaemia and hypercholesterolaemia. The synthetic hypoglycemic agents have serious side effects like haematological effects, disease of liver, kidney and coma etc. Plant derived drugs are mostly considered to be less toxic and with fewer side effects. Therefore, search for more effective and safer herbal antidiabetic agent has become an area of active research.[5]

1.Plant Name: *Bauhinia variegata* Linn Plant

Bauhinia variegata Linn is a medium-sized, deciduous tree, found throughout India, ascending to an altitude up to 1800 meter in the Himalayas. The Hong Kong Orchid Tree, botanically known as genus Bauhinia. The name Bauhinia was named after the Bauhin brothers who were sixteenth century herbalists.[6]

The plant is known by various names in different languages as under.

English	:	Mountain Ebony
Marathi	:	Rakta kanchan
Kannada	:	Kempu mandara
Hindi	:	Kachnar
Tamil	:	Shemmandarai
Telgu	:	Daevakanchanamu

Morphology

Bark is grey with longitudinal cracks, pale pink inside. Leaves are broader than deep, rigidly sub-coriaceous, deeply cordate with two leaflets, connate for about two-thirds up, leaflets are ovate, rounded at apex, 10-15cm long, adult beneath when young.

Its young stem Flowers are variously coloured, in few-flowered, lateral, sessile or short peduncle corymbs, the uppermost petal darker and variegated usually appearing before the leaves in short axillary or terminal racemes, stamens 5, staminodes absent, fruits flat; hard glabrous dehiscent pods, 10-15 seeded.

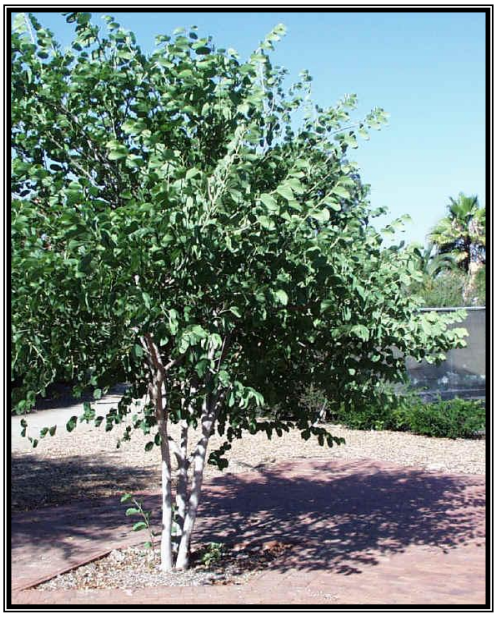


Fig. 1*: Bauhinia variegata* Linn. Plant **Fig.2: Roots of *Bauhinia variegata*Linn Plant**

Chemical Constituents

ß-Sitosterol, lupeol, kaempferol-3-glucoside, tannins ,carbohydrates, amides, reducing sugars, vitamin C, crude protein, fibers (Sharma et al.,1966), calcium, phosphorus, quercetin, rutin, quercitrin, apigenin, apigenin-7-O-glucoside, heptatriacontan-12,13-diol and dotetracont-15-en-9-ol etc.[7,8]

Medicinal Uses

It is used as antitumor, antimicrobial, antidiabetic, astringent to bowels, tonic to the liver and useful in treatment of leucoderma, leprosy, menorrhagia, asthma, wounds and ulcers.This is also used in treatment of diarrhea, dysentery, piles and haematuria.[7,8]

2.Plant Name: *Tectona grandis* Linn Plant

Tectona grandis Linn *Tectona grandis* Linn. (Verbenaceae) is a large deciduous tree. Branchlets are quadrangular, channeled. The tree is growing in higher situations, native to central India, Konkan, Western Deccan peninsula, South India and Burma. Teak is a hardwood species of worldwide reputation.[9]

The plant is known by various names in different languages as under

English	Teak
Marathi	Sag
Kannada	Tega, Jadi
Hindi	Sagvan
Sanskrit	Sakah
Telgu	Peddateku

Morphology

*Tectona grandis*Linn (Verbenaceae) is a large deciduous tree. Branchlets are quadrangular, channeled and stellately tomentose. The tree is growing in higher situations, native to central India, Konkan, Western Deccan peninsula, South India and Burma. Teak is a hardwood species of worldwide reputation. Leaves are 30-40 by 15-30cm, elliptic or obvate, acute or acuminate. Upper surface of leaf is rough but usually glabrous and the lower clothed with dense stellate grey. Flowers are shortly pedicellate withlanceolate bracts at the forks. Fruits are 1-3 cm indiameter, subflobose; pericarp is soft with densefelted stellate hairs.[9]

Chemical Constituents

Root contains lapachol, tectol, tectoquinone, b-sitosterol and a diterpene, Tectograndinol. Bark contains Tannin (7.14%), quinine 5-hydroxy-1,4-napthalenedione (juglone),sterols Obtusifolina, Desidro-A-lapachona etc.[10]

Medicinal Uses

It is used for wound healing activity when administered orally , it is also beneficial in dyspepsia with burning of stomach.It is also used as antiulcer, antifungal.[11]

Fig. 3:*Tectona grandis* Linn Plants

Fig. 4: Bark of *Tectona grandis* Linn

Mechanism of Action[11,12]

Tectona Grandis and *Bauhinia variegata* shows hypoglycemic mechanism at cellular level by stimulation of glucose uptake by peripheral tissue, inhibition of insulinase activity in both liver and kidney. Inhibition of endogenous glucose production of renal glucose reabsorption.

Both of these plants contain flavonoids, sterols and quinones as active constituents. This has antidiabetic activity. The hypoglycemic activity is due to regeneration of beta cells of pancreas. Due to diabetes the free radicals are formed, which damages the beta cells. These herbal extracts of the plants *Tectona Grandis* and *Bauhinia variegate* prevent free radical formation and shows antioxidant property. This leads to decrease in blood glucose level.

Experimental Design:

Materials:

The plant Tectona grandis Linn & *Bauhinia variegata* was collected from western ghats. The roots were collected, dried and powdered. Crospovidone, Sodium starch glycolate and microcrystalline cellulose were obtained as gift sample from Loba Chemie Pvt Ltd Mumbai 40002.All other chemicals and reagent was of analytical grade.

Method:

Preparation of *Tectona grandis* Linn & *Bauhinia variegata* Linn extract:

The Barks of the plant Tectona grandis Linn & *Bauhinia variegata* Linn are collected. Dried under roof & then powdered. This Powder is then placed in the soxhlet Apparatus for extraction process. 250gm of powder is placed in packing column & extraction is carried out by mixture of water & alcohol (1:1).The extraction process is continued upto 8 cycles for 24hrs. Then the extract is dried at room temperature. This powdered extract is used for preparation of the tablet .[13]

Preparation of fast dissolving tablet:

Herbal Fast dissolving tablets were prepared by direct compression method using various formulation additives in varying concentrations. All the ingredients were powdered separately in a clean and dry porcelain mortar and then they were passed through # 60 mesh sieve. The extract and β- cyclodextrin were complexed (kneading method) and then all the additives were mixed thoroughly in an inflated polyethylene pouch in a geometric ratio of their weight. Then the powder mixture was compressed in to the tablets of 500 mg weight [14]

Table 1: Formulation table of fast dissolving tablets of Mixture of *Bauhinia variegata* Linn and *Tectona grandis* Linn (for 1 tab)

Ingredients (mg/ tab)	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9
Extract	200	200	200	200	200	200	200	200	200
β-cyclo dextrin	200	200	200	200	200	200	200	200	200
crospovidone	15			15			15		
SSG		20			20			20	
Mixture of CP + SSG			25			25			25
MCC	65	60	55	65	60	55	65	60	55
Sodium saccharin	10	10	10	10	10	10	10	10	10
Mg.sterate	5	5	5	5	5	5	5	5	5
Talc	5	5	5	5	5	5	5	5	5
TOTAL	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**

CP – Crospovidone , SSG – Sodium starch glycolate

Evaluation of tablets

The tablets from all the batches were evaluated for different parameters as follows:

Appearance

Tablets were evaluated for organoleptic properties.

Weight Variation[15]

Ten tablets were selected and average weight was determined. Then individual tablets were weighed and the individual weight was compared with an average weight.

Friability[15]

Pre-weighed sample of tablets was placed in the Roche Friabilator tester, which was then operated for 100 revolutions. Tablets were deducted and reweighed; tablets should not lose more than 1% of their initial weight.

Despersion time[15]

Two tablets were placed in 100 ml of *water* and stirred gently until completely dispersed. A smooth dispersion was obtained which passes through a sieve screen with a nominal mesh aperture of 710 µm.

Wetting Time[15]

A piece of tissue paper (12cmx10.75cm) folded twice was placed in a Petri dish containing 10 ml of water. Containing Eosin, a water soluble dye, was added to Petri dish. A tablet was carefully placed on the surface of the tissue paper and allowed to wet completely. The time required for water to reach upper surface of the tablet was noted as a wetting time.

Disintegration Time[15]

The disintegration time of tablet was measured in water (37 ^{0}C) according to USP Disintegration test apparatus.

Hardness [16]

Tablets were selected at random from each formulation and hardness was checked using Monsanto Hardness Tester.

Drug content[17]

Drug content of all the batches was determined. Six tablets were weighed and crushed with pestle in a small glass mortar. The fine powder was weighed to get 500 mg, and transferred to 250 ml conical flask containing 100 ml of Distilled water stirred for 45 min in ultra sonicator. Solution was filtered and the filtrates obtained were analyzed UV spectrophotometrically and drug content was determined.

***In-vitro* Dissolution**[18]

The in vitro dissolution study was performed in the USP apparatus type II Aliquot equal to 5 ml of dissolution medium was withdrawn at specific interval and replaced with fresh medium for maintaining sink condition. Sample was filtered and absorbance of filtered solutions determined by UV spectroscopy. Dissolution rate was studied for all formulations.

Stability studies[18]

Stability is defined as the ability of particular drug or dosage form in a specific container to remain with its physical, chemical, therapeutic and toxicological specifications. In any rational design and evaluation of dosages forms for drugs, the stability of the active component must be major criteria in determining their acceptance or rejection. During the stability studies the product is exposed to normal condition of temperature and humidity. However the studies will take a longer time and hence it would be convenient to carry out accelerated stability studies, were the product is stored under extreme condition of temperature and humidity. In the present study, stability studies were carried out on optimized formulation under the following condition for one month period as prescribed by ICH guidelines for accelerated study at 40 ± 2 ^{0} C and RH 75 % ± 5 % .The tablets were withdrawn after a period of 30 days and analyzed for physical characterization, dissolution and drug content.

Table 2: Evaluation of Mixture of *Bauhinia variegata* Linn & *Tectona grandis* Linn tablet

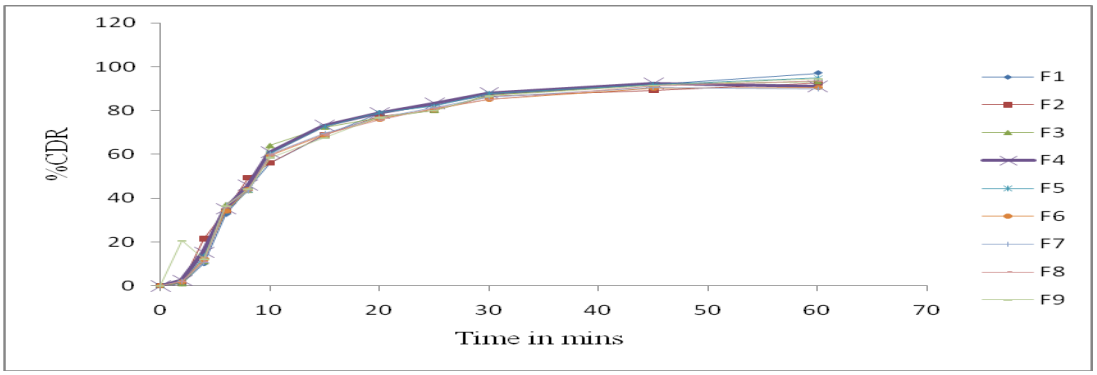
Batch	Hardness (kg/cm^2)	% Weight variation	% Friability	Disintegration time	Wetting Time	Drug Content
F1	3.3±.08	1.55±0.0021	0.60±0.085	19 sec	50sec	**102.87**
F2	3.4±0.06	2.63±0.0020	0.62±0.088	48 sec	2min 3sec	100.60
F3	3.5±0.052	2.50±0.0028	0.63±0.066	1 min 5 sec	3min 8sec	98.69
F4	3.9±0.07	2.55±0.0022	0.63±0.058	1 min 32 sec	1 min 3sec	98.45

F5	3.4±0.09	2.33±0.0023	0.60±0.024	1 min 46 sec	2min 7 sec	99.64
F6	3.5±0.055	2.55±0.0026	0.63±0.057	1 min 50 sec	2 min	100.55
F7	3.8±0.084	2.33±0.0030	0.66±0.047	59 sec	1 min9 sec	100.14
F8	3.6±0.08	2.55±0.0022	0.62±0.084	1 min 2 sec	3min 9sec	101.03
F9	3.8±0.07	2.26±0.0020	0.62±0.094	1 min 18 sec	2 min	99.12

Table 3: Drug Release Profile for mixture of *Bauhinia variegata* Linn and *Tectona grandis* linn

Time in min	F1 %CDR	F2 %CDR	F3 %CDR	F4 %CDR	F5 %CDR	F6 %CDR	F7 %CDR	F8 %CDR	F9 %CDR
2	0.92	1.15	0.92	2.54	1.36	1.62	2.03	1.98	20.44
4	10.00	21.35	11.04	15.36	13.29	12.22	10.33	11.01	12.22
6	32.49	34.05	37.04	35.21	33.65	34.12	36.54	35.98	36.51
8	44.57	49.21	43.57	46.05	43.66	44.00	43.28	44.26	44.28
10	56.06	56.02	64.07	61.08	60.29	59.36	60.02	59.68	58.54
15	68.71	68.71	72.46	73.25	72.59	68.75	69.38	68.97	67.42
20	78.92	77.06	76.58	78.90	79.01	76.24	76.54	75.61	76.81
25	82.63	79.86	80.12	83.21	82.00	80.61	81.23	80.93	80.15
30	87.28	86.34	87.28	88.03	87.69	85.24	85.99	85.06	86.64
45	91.90	89.14	91.90	92.45	91.87	90.33	90.36	91.06	91.45
60	97.07	92.40	95.19	95.09	94.88	94.61	95.01	95.45	94.51

Fig. 5: Drug release of mixture of *Bauhinia variegata* Linn and *Tectona grandis*linn



Result and Discussion

Physicochemical evaluation of tablets

The results of physicochemical evaluation of tablets are given in Table 2. As the material was free flowing, tablets were obtained of uniform weight due to uniform die filling. Hardness of tablets was between 3.2-3.7kg/cm2 for all the formulations. Friability was found in between 0.62-0.69%. The friability value below 1% was an indication of good mechanical resistance of the tablet. The drug content was found to be 98.18-102.50% which was within the acceptable limits. The disintegration time is shorter with quick wetting properties at the core of the tablets. The wetting time/dispersion time decreases with increase in the concentration of superdisintegrants.

In vitro release study

Formulations F1, F4 and F7 which contains 3% superdisintegrants releases 97.43%, 91.00% and 93.75% drug respectively at the end of 60 min . An increase in the drug release was observed when 3% superdisintegrants used in formulations. The rapid drug dissolution might be due to easy breakdown of particles and rapid absorption of drug into the dissolution medium.

Stability studies

The stability studies were carried out for selected tablets at 40℃ ±2 ℃ / 75 % RH ± 5 % for a month. The orodispersible tablets were evaluated by their drug content, wetting time, water absorption ratio, dispersion time, disintegration time and *in vitro* drug release. The studies indicated that, there were no significant changes found in the tablet properties.

Conclusion

The prepared herbal fast dissolving tablets shows good disintegration property and dissolution rate. The comparative study of several superdisintegrants yielded a conclusion that Crospovidone at 3% concentration are suitable for the preparation of Herbal fast dissolving tablets which will satisfy all the criteria and official limits.

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