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Formulation and Evaluation of Conventional Tablets Using *Abelmoschus esculentus* (L.) Moench

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[1*]Sonali P. Mahaparale, [2]Harshada Dilip Patil

HOD of Pharmaceutical Chemistry Department, Dr. D.Y. Patil College of Pharmacy, [2]PG student, DR. D.Y. Patil College of Pharmacy, Akurdi Pune-411044, Maharashtra, India

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ABSTRACT

The present paper describes the formulation of conventional tablets using *Abelmoschus esculentus* (L.) Moench. Particularly, *A. esculentus* seed powder is used as an active ingredient in the formulation. Four trial batches followed by an optimum batch of pharmaceutical preparation were prepared using active *A. esculentus* seed powder and other diluents. The micrometrics properties were determined for all the physical mixtures. The result of Angle of repose, Hausner's ratio, Cars index denoted that all the physical properties of powder had good flow properties and compressibility. Moreover, the formed tablets were subjected to the examination of quality parameters were evaluated like- Hardness, Friability, Weight variation, % weight, dissolution test, and stability testing. Out of all Four batches, the F1 batch showed optimum Rheological properties and the best biopharmaceutical properties. Thus considering this formulation of the tablet can be used for the compilation of other medicinally active and useful crude plant drug powders in a form of tablet dosages to achieve quantitive and qualitative accuracy and dose compliance.

INTRODUCTION:

Tablets are the foremost widely used solid dosage forms thanks to their advantages and recognition increasing day by day. Tablet usually contains filler, diluents, binders, lubricants, glidants, disintegrates, anti-adherent, colouring agents, and flavouring agents as excipients. [2] Tablets are conventionally prepared by weight granulation, dry granulation, and direct compression method. But from among all direct compression has the advantages that it requires a lesser number of production steps. And these methods can be applied to moisture-sensitive and thermosensitive drugs. [1] World Health Organization (WHO) guesses that 80 % of the people of some Asian and African nations currently use the herbal drug for some aspect of main health care. [7] Pharmaceuticals are prohibitively Among more affluent peoples in together industrialized and evolving countries, balancing and alternative practices are popular although proof of their care and efficiency is modest. Evidence grounded research in Ayurveda receives larger reception in India and abroad. [6] In comparison, herbal medicines can be grown from seed or gathered from nature for little or no cost. [8] Diabetes mellitus is commonly known as diabetes. It is a metabolic disorder in which there is increased blood glucose (sugar) level over a prolonged period. Diabetic mellitus is essentially considered by long-lasting hyperglycemia subsequent from deficiencies in insulin excretion, insulin action, or together. [9,10] The international diabetes federation (IDF) estimated that there are about a 50.8million people in India suffering from diabetes and it is expected to grow up to 87.0 million by 2030. About 90% of the individual are suffering from type 2 diabetes mellitus when compared to type first diabetes mellitus. [11] various medicinal usage of "*A. esculentus*" has been reported in the traditional systems of medicine like Ayurveda, Unani & Siddha. Also according to Turkish folk medicine Okra seeds are used in managing increased blood glucose concentration. [3] "Okra" seed is rich in Phenolic compounds, mainly composed of flavones derivatives and catechins. while roasted seeds (for 10–60 min) denoted increased nutrients & antioxidant activity, whereas pre-treatment (soaking & blanching) increased the nutrient composition, but decreases antioxidant activity." [4] Restoration of pancreatic ß-cells mass is achieved and ß-cell damage was reversed upon treating with "*A. esculentus*" powder. And results revealed that the Drug had a beneficial effect on the pancreas of diabetic rats by the restoration of ß-cell mass and modulation of PPAR-dependent pathways. Thus, okra could improve metabolic complications in an animal model of diabetes. Also, the study revealed that water-soluble fraction of "*A. esculentus*" compact the fascination of glucose since the intestine. thus Various mechanisms have been

proposed for antidiabetic action of "*A. esculentus*". [5] Thus, the use of "*A. esculentus*" was finished the formulation of the tablet which may be used for type-2 diabetic patient. Also, the formulated herbal medicament may show synergistic effect and can act as an agonist when taken with other allopathic antidiabetic medicine.

The objective behind the work is to minimize the intake of more and more allopathic medicines, to prevent the various side effects caused by them on Kidneys, Liver, Stomach, etc. Moreover, low-cost medicament whose active ingredient is easily available can be obtained by this work if, furthermore research and analytical work is done.

MATERIALS AND METHODS:

MATERIALS:

Materials utilized for this work, that is Matured Okra Pods were collected from local farms. The whole Okra pods were dried naturally under the sun. And then whole seeds were then removed from the dried Okra pods. The excipients were used in higher grades. And the distilled water and other solvents were used of analytical standard throughout the work.

METHODS:

❖ **Pre-formulation studies of Okra seed powder and excipients-**

Pre-formulation studies aim to check the physicochemical characterization of new plant-based crude drug powder. And to evaluate the compatibility of Okra seed drug powder used with different excipients used in this formulation.

Pre-formulation studies include: -

1. Characterization of drugs-

a) Macroscopic characteristics: The plant was macroscopically examined for shape, size, surface characteristics, texture, colour, consistency, odour, taste, etc.

b) Organoleptic properties: 1 gm of Okra seed powder was placed separately into a glass container and observed for the following parameters like - Colour, Odour, State and Taste.

c) Solubility: Solubility of sample drug powder was checked in ethanol, water and 0.1N HCL. For this 10mg of Okra drug powder was put in a 50ml beaker followed by solvent and

the beaker was placed on sonicated for 30 minutes and 60 minutes respectively. And then the solution was observed for clarity.

2. UV Spectroscopy (Calibration curve of drug)-

The stock solution of Okra powder (100µg/ml) was prepared in water. The wavelength of maximum absorption (λ max) was determined. Various strengths of drug solutions were prepared out of stock solution. That are suitable dilutions ranging from 10 µg/ml, 20 µg/ml, 30 µg/ml, 40 µg/ml, and 50 µg/ml respectively was prepared. And the solution was analysed by UV-Spectrophotometer (UV-1700 Shimadzu) at 257nm of wavelength and the results were recorded.

3. Drug excipient compatibility studies (FTIR Spectroscopy)-

The FTIR spectroscopy was done to check chemical compatibility of drug powder and excipients used. The FTIR spectrum of Okra drug powder and excipients was recorded.

4. Physicochemical characterization of isolated Okra seed powder- [12]

It **is** Preliminary confirmatory test for dried Okra drug powder.

a) Bromine water test for Tannins.

b) Ninhydrin test done for Amino acids. [13]

c) Shinoda test for Flavonoids.

d) Salkowski reaction for Steroids.

e) Ferric chloride test for Phenols.

❖ **Pre-compressional parameters of tablet formulation-** Pre-compressional parameters are done in order to check the flow property of powder blend of medicament.

1. Determination of Angle of repose.

Angle of repose (Θ): The fractional forces in loose powder can be measured by the angle of repose. This is the maximum angle possible between the surface of a pile of a powder and the horizontal plane.

$$\tan \Theta = \frac{h}{r}$$

$$\Theta = \tan^{-1}(h/r)$$

Where Ɵ is angle of repose,

h is the height of heap of powder,

r is the radius.

The powder was allowed to flow through the funnel fixed to a stand at a definite height. The angle of repose was then calculated by measuring the height and radius of the heap of the powder formed.

Table No. 1: Relationship between Angle of repose and flow properties

Angle of Repose (Ɵ) (degrees)	Flow
< 25	Excellent
25 – 30	Good
30 – 40	Passable
>40	Very poor

2. Determination of poured Bulk density [14]

It is the ratio of total mass of a powder to the bulk volume of a powder. For measuring bulk density, a certain amount of powder was weighed. Then the powder was poured into a graduated cylinder and from the cylinder, volume was measured. During pouring the powder into the cylinder, the cylinder was kept at a 450 angle to avoid the initial taping of the powder. If the powder is poured into the cylinder keeping it at 90^0 angle, then the powder will be tapped, and the actual bulk density will not be obtained. Then by using the following formula we determined the bulk density of the drug powder and excipients (dispensed drug powder.

$$D_b = M / V_b$$

Where, M is the mass of powder,

V_b is the bulk volume of the powder.

3. Tapped density.

Tapped density is the ratio of the total mass of the powder to the tapped volume of a powder. To determine the tapped density of the powdered excipients a certain amount of powder was weighed by taking it in a measuring cylinder. Then the measuring cylinder was placed on a mechanical tapper apparatus, which was operated for 100 times tapping. After tapping the

powder bed volume reached a minimum was noted. The difference between these two volumes is less than 2%. If it is more than 2%, then tapping is continued for sometimes and then tapped volume is noted. Tapping is kept continued until the difference between the successive volume is less than 2% (in a bulk density apparatus). It is measured in g/ml and the formula:

$$D_t = M / V_t$$

Where, M is the mass of a powder,

V_t is the tapped volume of a powder.

4. Compressibility index.

The simple method of measurement of the free flow nature of powder is compressibility. It is an indication of the ease with which material can be induced to flow. It is given by compressibility index (I).

Percent compressibility of the powdered excipients is directly measured from the following formula,

$$\text{Carr's index} = D_t - D_b / D_t \times 100$$

Where D_t is the tapped density of the powder,

D_b is the bulk density of the powder.

5. Determination of Hausner ratio (HR)-

Hausner's ratio is the indirect index of ease of powder flow, it is calculated by the following formula.

$$\text{Hausner's ratio} = D_t / D_b$$

Where, D_t is the tapped density,

D_b is the bulk density.

❖ Formulation of conventional tablet by direct compression method.

The drug powder blend of formulation was evaluated for bulk density, tapped density, compressibility and angle of repose using methods described earlier. Which are important before designing the formulation.

Isolation and preparation of seed powder from whole dried okra pods. The matured Okra pods selected from the nearby market were dried in naturally under sun, so that damage to active constituents should be prevented. Then the dried Okra seeds were removed from the whole dried Okra pods.

The isolated dried okra seed was pulverized in a grinder at (180W) and in a steady manner to prevent generation of heat. And the obtained powder was sieved through No.80 mesh seize to obtain a fine powder and packed in an airtight container.

❖ Design of formula- Formulation of a trial batch of Okra seed powder-

It was prepared by incorporating the Okra seed powder with various types of suitable excipients in different concentrations.

Table No. 2: Formulation trial batch of Okra seed powder

Sr. No.	Components	F1	F2	F3	F4
1	Okra seed powder	199mg	199mg	199mg	199mg
2	Talc	15mg	10mg	15mg	12mg
3	Sodium benzoate	13mg	14.5mg	14mg	12.5mg
4	HPMC	17.5mg	18mg	15.8mg	16.5mg
5	Cross povidone	5.5mg	8.5mg	4.2mg	10mg
6	Total	250mg	250mg	250mg	250mg

Post-compressional parameters of the conventional tablet (Evaluation of tablet)

The formulated tablets were evaluated for hardness, friability, thickness, weight variation, content uniformity.

1. Hardness:

Hardness can be defined as the tablet crushing load required to break the tablet by compression. The hardness of the tablet was determined by using the Monsanto hardness tester. For these 5 randomly selected tablets were taken. The hardness was measured in terms of kg/cm2. The average hardness of 5 of the tablets was taken.

2. Friability:

Friability test allows to access the effect of friction, shock which may often make the tablet susceptible to break, clip and capping. Basically, it allows to test the durability of tablets during transit. The friability of the tablet was determined using Roche type friabilator. The operator was operated for 4 min at a speed of 25 rpm. Pre-weighed and de-dusted 20 tablets were placed in the friability apparatus and were operated at 100 revolutions (4 min). after completion of cycle, the tablet was re-weighed. The compressed tablet should not lose more than 1% of their weight.

It is calculated by formula-

$$\%\ \text{friability} = \frac{\text{Initial wt.} - \text{final wt.}}{\text{final wt.}} \times 100$$

3. Thickness:

Tablet thickness was measured using Vernier calliper. 10 tablets of the batch were selected for measuring the thickness. Thickness is an essential parameter in order to attain uniformity of tablet.

4. Content Uniformity: Randomly selected 20 tablets of each formulation were individually weighed and recorded. The average value was calculated and compared to each individual tablet weight. Content uniformity is calculated to ensure uniform distribution of weight of tablet and thus, distribution of all constituent in a uniform manner.

5. Weight variation: [15]

Weight variation is carried out to ensure that, each of tablets contains the proper amount of drug. The test was carried out by weighing the 20 tablets individually using analytical balance followed by calculation of average weight and comparing the individual tablet weights to the average.

The percentage of weight variation is calculated by using the formula-

$$\%\ of\ weight\ variation = \frac{Initial\ wt. - average\ wt.}{average} \times 100.$$

Table No. 3: Weight Variation Limits for Tablets (I.P)

Sr. No.	Average weight of tablets (mg)	Maximum percentage difference allowed
1.	300 or less	± 10.0
2.	130 - 324	± 7.50
3	More than 324	± 5.0

❖ *In-vitro* Drug Release studies.

RESULT AND DISCUSSION:

1. Results of pre-formulation studies:

1) Organoleptic characteristics of drug powder

Table No. 4: Characteristics of drug powder

Sr. No.	Parameters	Okra seed powder
1.	Form / State	Smooth Powder
2.	Colour	Yellowish white
3.	Odour	Sweetish blind
4.	Taste	Bland
5.	Solubility	Soluble in water

2) Result of determination of maximum absorption (λ max) of drug powder solution.

Maximum absorption of Okra seed powder solution was found to be at 257 nm using distilled water.

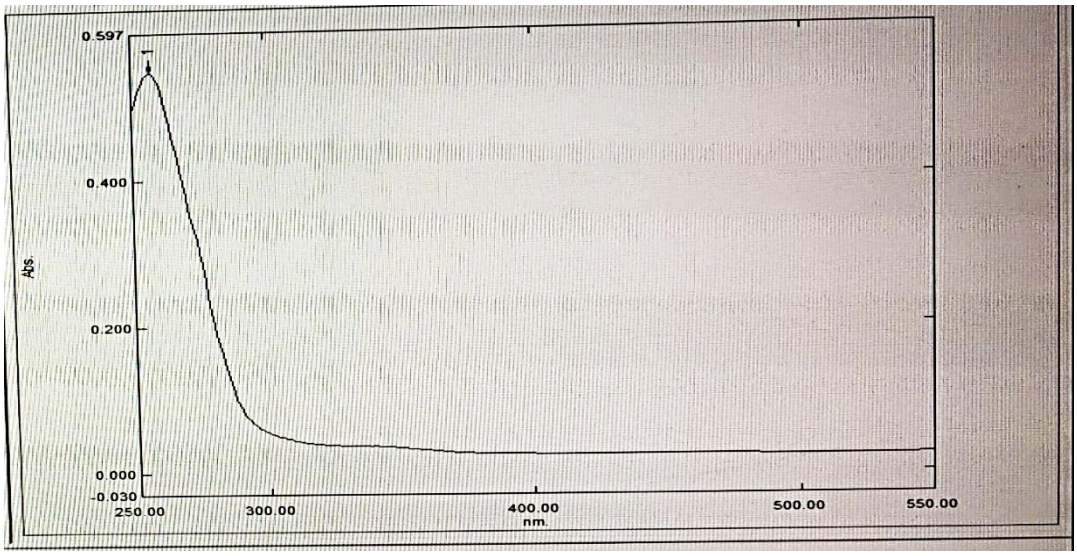

Figure No. 1: UV spectrum (λ max) of Okra seed powder

Construction of Calibration Curve: The standard Calibration Curve of Okra seed powder filtrate was obtained by plotting absorbance vs. concentration as shown in table No.5 and the standard calibration curve is shown in figure No.1. The curve was found to be linear in the concentration range of 10 – 50 µg/ml (Beer's range) at 257 nm.

Table No. 5: Calibration curve of Okra seed powder filtrate

Concentration (µg/ml)	Absorbance
10	0.057
20	0.116
30	0.157
40	0.22
50	0.27

3) Result of determination of calibration curve of drug powder-

R square (R^2) value for Okra seed powder filtrate was found to be 0.9941.

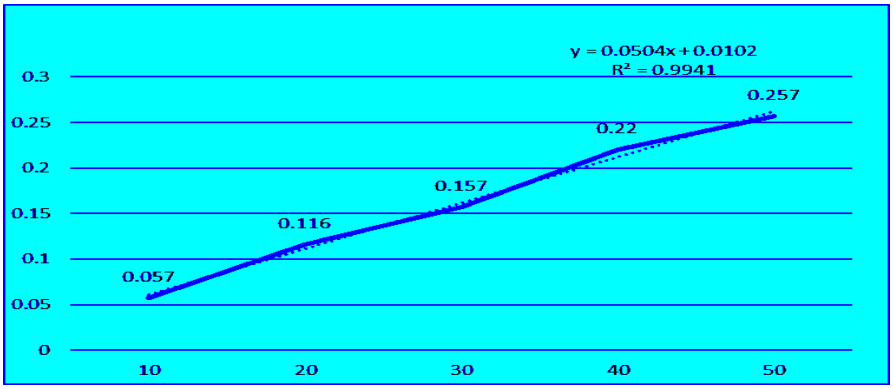

Figure No. 2: Calibration curve of Okra seed powder filtrate. Concentration on X-axis vs. absorbance on Y-axis

Table No. 6: Data for calibration curve

Sr. No.	Parameters	In distilled water
1.	Maximum absorbance	257nm
2.	Slope	0.0102
3.	Intercept	0.0504
4.	Correlation coefficient	0.994
5.	Equation	Y=0.0504x+0.102

4) FTIR Spectroscopy (Result of drug excipients Compatibility studies):

The FTIR spectrum of Okra seed powder drug powder was recorded using Shimadzu- FTIR Affinity IS by KBr pellet technique.

a) FTIR spectrum of "*Abelmoschus Esculentus*":

The drug compatibility studies are very important to know the degradation rate of drug with various excipients and polymeric substances used in formulation. In the present study, it was observed that there were no major shifts in the individual main peaks. This indicated that there was no change observed in the quality of Okra seed powder used and thus indicates good compatibility.

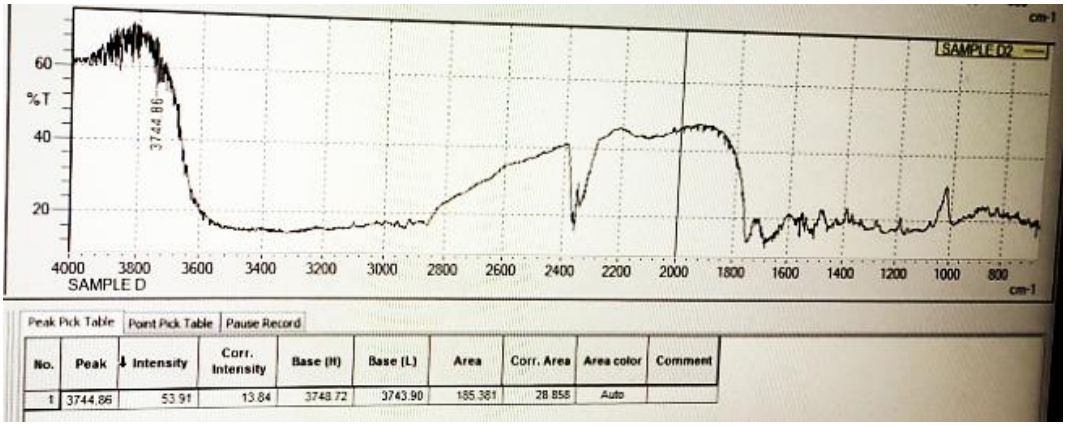

Figure No. 3: FTIR spectrum of Okra seed powder (plant drug)

b) Mixture of Okra seed powder and Talc:

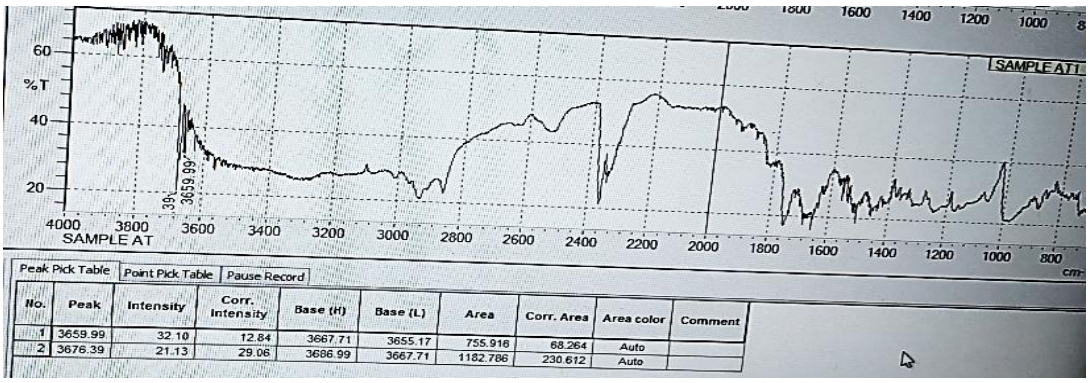

Figure No. 4: Compatibility study of Okra seed powder drug and Talc

Okra drug seed powder and Talc was done using the KBr pellet technique. Compatibility study of Okra drug seed powder with Talc on the basis of FTIR spectra is shown in figure No. 4. The spectrum denoted that there is no considerable difference in the absorption band position. It means that no side chemical interaction or incompatibility between Okra seed powder and talc.

c) Mixture of Okra seed powder and Sodium benzoate:

Compatibility study of Okra drug seed powder with Sodium benzoate based on FTIR spectra is shown in figure. And there are no vast changes observed in the pattern of peaks were seen. This indicates that Sodium benzoate compatible with drug (Okra seed powder). Thus this mixture can be used for experiment.

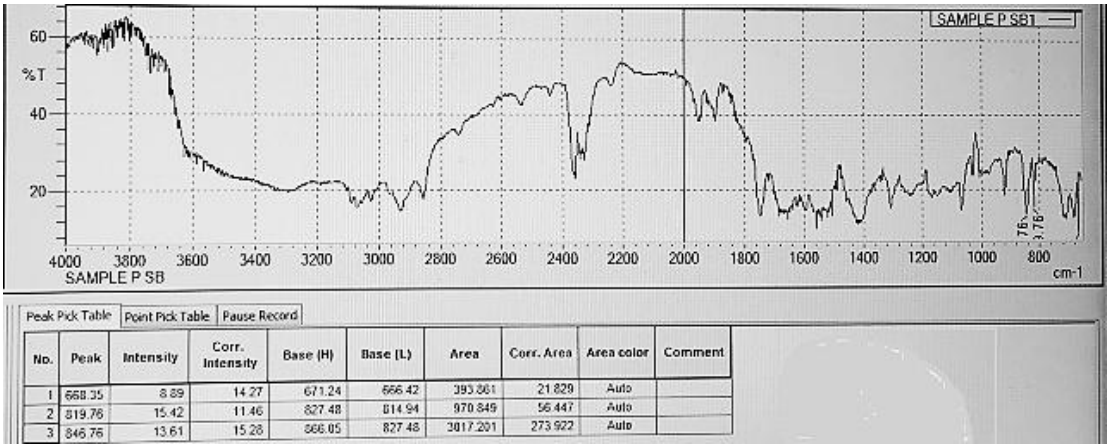

Figure No. 5: Compatibility study of Okra seed powder drug and Sodium benzoate

d) Mixture of Okra seed powder and Crospovidone:

For this mixture also it was observed that no major shifts in the individual main peaks. This implies that there was no interaction between Crospovidone and drug powder? Which is an indication of compatibility. The result is shown in figure.

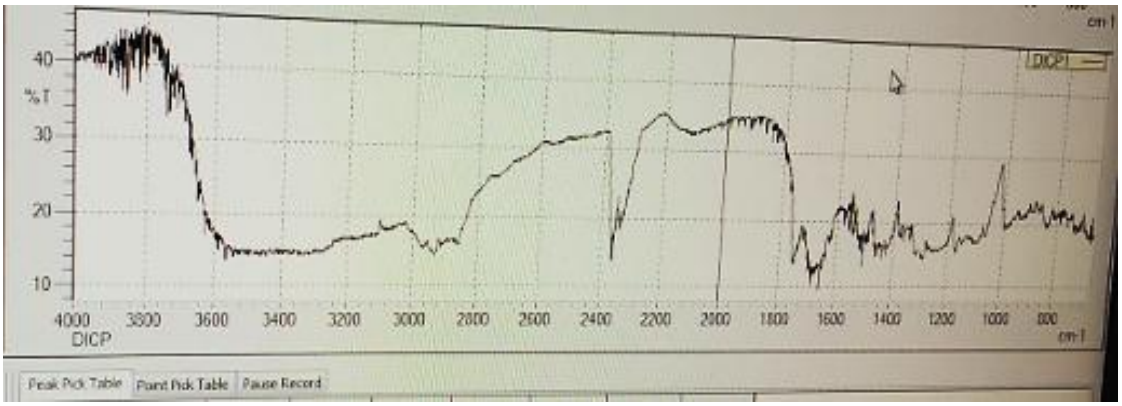

Figure No. 6: Compatibility study of Okra seed powder drug and Crospovidone

IR spectrum of Drug powder blend

Table No. 7: Wavenumber with functional groups

Sr. No.	Wavenumber (cm^{-1})	Functional groups
1.	668 cm^{-1}	C- Br stretching
2.	819 cm^{-1}	C-H bending
3.	846 cm^{-1}	C=C bending
4.	3659 cm^{-1}	C-H stretching
5.	3676 cm^{-1}	O-H stretching
6.	3744 cm^{-1}	O-H stretching

Result of Physicochemical characterisation of isolated Okra seed powder:

❖ Preliminary confirmatory test for Okra seed drug powder.

a. Bromine water test: No decoloration of Bromine water was seen which is indicates the absence of Tannins.

b. Shinoda test for Flavonoids: Pink or Red - Purple colour was seen to appear which indicates the presence of Flavonoids.

c. Ninhydrin test: Development of deep blue/purple colour was observed indicates the presence of amino acids (proteins).

d. Salkowski reaction: No reddish-brown colour at the lower layer (interface) was observed indicates the absence of steroids.

e. Ferric chloride: Dark green to Deep/Blue colour was seen to appear indicates the presence of Phenols.

1. Result of pre-formulation parameters of drug powder:

The powder blend of Okra seed drug powder and excipients were formed. And the powder blend was subjected to the pre-formulation studies to ensure accuracy of further process.

The result of same is given in Table No.8 and Table No.9 resp.

- **Result of pre-formulation parameters (Evaluation) of Okra seed powder (Trial Batch)**

Table No. 8: Results of Pre-Formulation (Evaluation) parameters of Okra seed powder (Trial Batch)

Parameters	TF(Batch)	TF2 (Batch)	TF3 (Batch)	TF4 (Batch)
Bulk Density (g/ml)	0.60 ± 0.001	0.63 ± 0.003	0.68 ± 0.002	0.60 ± 0.005
Tapped Density (g/ml)	0.54 ± 0.002	0.51 ± 0.001	0.52 ± 0.001	0.54 ± 0.001
Angle of Repose (Ɵ)	29.05±0.32	34.28±0.45	36.86±0.27	29.05±0.32
Car's Index (%)	9.82±0.291	19.56±0.056	20.94±0.303	9.82±0.219
Hausner's Ratio	1.11±0.004	1.24±0.001	1.20±0.005	1.14±0.004

Result of Pre-formulation (Evaluation) Parameters of Okra Seed Powder (Trial Batch)

Table No. 9: Results of Pre-Formulation (Evaluation) parameters of Okra seed powder (Optimized Batch)

Parameters	F1 (Batch)	F2 (Batch)	F3 (Batch)	F4 (Batch)
Bulk Density (g/ml)	0.43 ± 0.002	0.50 ± 0.004	0.51 ± 0.008	0.49 ± 0.006
Tapped Density (g/ml)	0.30 ± 0.004	0.39 ± 0.002	0.40 ± 0.003	0.33 ±0.008
Angle of Repose (Ɵ)	14.10 ± 0.15	18.29 ± 0.01	15.81 ± 0.199	22.09 ±0.30
Car's Index (%)	8.12 ± 0.181	14.38 ± 0.013	15.81 ± 0.199	10.24 ± 0.301
Hausner's Ratio	1.07 ± 0.003	1.18 ± 0.002	1.13 ± 0.007	1.10 ± 0.009

The result of bulk density, tapped density, angle of repose, Hausner's ratio and compressibility indicated that the flow property of the drug powder blend has passable flow property with good compressibility and is, therefore, suitable for direct compression method of tablet formulation.

2. Result of post-compressional parameters (Evaluation) of tablet Parameters of Okra Seed Powder of Trial batches

Table No. 10: Post-compression parameters of formulated Trial batches

Sr. No.	Formulation parameters	F1(Batch)	F2(Batch)	F3(Batch)	F4(Batch)
1.	Average wt.(mg)	248.9 ± 1.04	252.8 ± 1.2	246.05 ± 0.11	248.6 ± 0.24
2.	Thickness (mm)	0.502 ± 0.001	0.510 ± 0.002	0.515 ± 0.004	0.47 ± 0.005
3.	Hardness (kg/cm)	5.63 ± 0.14	4.71 ± 0.19	4.84 ± 0.11	5.43 ± 0.30
4.	Friability (%)	0.534 ± 0.024	0.784 ± 0.018	0.859 ± 0.026	0.812 ± 0.028
5.	Disintegration time (min)	15.8± 0.02	19.4± 0.16	20.01 ± 0.09	19.8 ± 0.02

- **Result of Post-compression (Evaluation) Parameters of Okra Seed Powder of Optimized Batches**

Table No. 11: Post-compression parameters of formulated optimised batches

Sr. No.	Formulation parameters	F1(Batch)	F2(Batch)	F3(Batch)	F4(Batch)
1.	Average wt.(mg)	252.4 ± 1.01	255.9 ± 1.4	248.10 ± 1.11	247.16 ± 1.14
2.	Thickness (mm)	0.498 ± 0.008	0.508 ± 0.001	0.510 ± 0.006	0.481 ± 0.002
3.	Hardness (kg/cm)	5.01 ± 0.09	5.69 ± 0.003	4.94 ± 0.008	4.98 ± 0.002
4.	Friability (%)	0.550 ± 1.01	0.680 ± 0.011	0.796 ± 0.016	0.800 ± 0.019
5.	Disintegration time (min)	13.08 ± 0.11	18.01 ± 0.10	16.9 ± 0.02	15.8 ± 0.9

The data obtained from post-compressional parameters such as weight variation, hardness, friability and drug content are given in Table No. 10 and 11 resp.

Weight variation was found to be within the USP limit. And in all formulations the hardness test indicated good mechanical strength but, formulation batch f1 had optimum strength.

3. Result of *in-vitro* drug release studies:

The disintegration test was following the method established by the USP. The tablet disintegration test apparatus (Electro lab disintegration tester DT2L) was used to determine the disintegration time for all formulations. Six tablets were placed individually in each tube of disintegration test apparatus. The phosphate medium was maintained at a temperature of 37 ± 2ºC and the time was noted for the entire tablet to disintegrate completely.

The tablet for all batches was given in Table No. 16. batch F2 denoted optimum disintegration time. However, the disintegration of the tablet is also accelerated due to the ability to absorb large amount of water when exposed to an aqueous environment.

The resulting tablets from formulation F1 complies the quality specifications provided by the USA Pharmacopoeia. Thus, the formulation developed in this study could be easily applied for the manufacture of herbal medicinal tablets by direct compression. Particularly, fluid

extracts with actives poorly soluble could be employed, thus ensuring their stability by avoiding heat and humidity factors during the manufacturing process.

4. Dissolution of Okra Seed Drug Powder Tablet:

The drug release profile of all formulations are shown in Table 12 and 13 resp. For conventional herbal tablets ideal drug release time to be considered is within 30 minutes of incorporation. And according to the dissolution study of the formulated Okra seed drug powder tablet, the drug release was found to be within 30 minutes. As the concentration of Povidone increased the drug release was also seen to be faster.

Table No. 12: *In-vitro* drug release of Okra seed powder Tablet (trial batches)

Time (Mins)	TF1	TF2	TF3	TF4
10	11.59 ± 0.24	11.02 ± 0.21	11.74 ± 0.11	11.15 ± 0.04
20	24.96 ± 0.32	24.32 ± 0.12	23.04 ± 0.09	24.85 ± 0.06
30	34.72 ± 0.36	34.98 ± 0.07	34.02 ± 0.03	35.05 ± 0.11
40	47.43 ± 0.21	48.12 ± 0.14	47.89 ± 0.14	48.99 ± 0.25
50	79.25 ± 0.30	80.01 ± 0.29	74.16 ± 0.13	80.86 ± 0.21
60	93.63 ± 0.44	94.12 ± 0.39	93.98 ± 0.36	95.12 ± 0.30

Table No. 13: *In-vitro* drug release of Okra seed powder Tablet (Optimized batches)

Time (Mins)	F1	F2	F3	F4
10	10.01± 0.023	10.27 ± 0.11	11.74 ± 0.11	11.15 ± 0.04
20	37.12 ± 0.21	31.22 ± 0.22	23.04 ± 0.09	24.85 ± 0.06
30	61.42 ± 0.16	59.79 ± 0.19	60.02 ± 0.10	58.95 ± 0.21
40	79.23 ± 0.31	78.12 ± 0.34	79.09 ± 0.27	78.99 ± 1.18
50	92.15 ± 0.40	88.11 ± 0.09	93.06 ± 0.30	91.86 ± 0.20
60	97.23 ± 0.54	97.01 ± 0.14	96.98 ± 0.26	98.03 ± 0.21

5. Result of stability studies.

The stability studies were carried out as per the procedure described earlier. There was no significant change in appearance, % drug release disintegration time and drug content of formulation F1 was found ideal Thus, the formulation can be considered stable.

Table No. 14: Physical Evaluation of formulated optimized batch during stability

Time Period	Thickness (mm)	Hardness (kg/cm2)	Friability (%)	Average Weight (mg)
15 days	0.519 ± 0.010	5.11 ± 0.07	0.559 ± 0.005	251.4 ± 1.07
30 days	0.556 ± 0.009	5.22 ± 0.16	0.502 ± 0.010	260.3 ± 1.16

SUMMARY AND CONCLUSION:

Medicaments in the form of solid dosage form especially tablets are always better option than powder, liquid or semisolid dosage form specifically when concern with herbal drug products. As quantitative accuracy cannot be maintained regularly, with liquid or semisolid dosage. Therefore, to overcome such problems, the formulation of such herbal powdered drug products into solid dosage form particularly tablet is carried out. Apart from this dispensing of powder drug into the form of tablet also increases the ease of medication along with quantitative accuracy of dose during every single intake of drug product.

Herbal based conventional tablet was formulated by using *'Abelmoschus esculentus'* (L.) Moench belonging to Family Malvacae; seed powder as the active ingredient. And all four formulations were prepared by using different concentrations of excipients but same concentration of Okra seed powder as it is an active drug. Many reports and documentation are mentioning the use Okra roots, pods and seed powder in ethanomedicines, Allopolyherbal medicines, and herbals. Also from the literature survey and reports it can be concluded that *'Abelmoschus esclulents'*(L.) Moench seed can be used for various illnesses and aliments Okra was reported to have various medicinal properties including antidiabetic activity. In different documents, it was mentioned that Okra seed can be helped in reducing blood sugar levels. While reported that, animal studies denoted reduced glucose absorption in rats administered with Okra seed powder.

In this formulation, it was observed that batch F3 produced the tablets with poor hardness and was also incapable of withstanding handling stresses due to the high friability observed. While formulation F4 had prolonged disintegration time. And among all four tablets formulation batches, F1 batch produced ideal formulation based on the result obtained from the quality assessment. It displayed good mechanical strength to withstand handling stresses and also a good disintegration profile to facilitate the release of active ingredients.

REFERENCES:

1. Gallo L, Ramírez-Rigo M, Piña J, Bucalá V. A comparative study of spray-dried medicinal plant aqueous extracts. Drying performance and product quality. Chem. Eng. Res. Des. 2015; 10:681-694.
2. Loyd V. Allen, Jr, Nicholos G. Popovich, Howard C. Ansel, "Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems", Eighth Edition, 2005, pp-228-245
3. Chanchal DK, Alok S, Kumar M, Bijauliya RK, Rashi S and Gupta S: A brief review on *Abelmoschus esculentus* Linn. Okra. Int J Pharm Sci Res 2018; 9(1): 58-66.doi: 10.13040/IJPSR.0975-8232.9(1).58-66.
4. Habtamu Fekadu Gemede, Negussie Ratta, Gulelat Desse Haki, Ashagrie Z. Woldegiorgis, Fekadu Beyene. Nutritional Quality and Health Benefits of "Okra" (*Abelmoschus esculentus*): A Review. International Journal of Nutrition and Food Sciences. Vol. 4, No. 2, 2015, pp. 208-215. doi: 10.11648/j.ijnfs.20150402.22
5. Naeem Erfani Mazd, Mohammad Reza Tabandeh, Ali Shahriari, Zahra Soleimani. Okra (Abelmoscus esculentus) Improved Islets Structure, and DownRegulated PPARs Gene Expression in Pancreas of High-Fat Diet and Streptozotocin-Induced Diabetic Rats. Cell J. 2018 Spring; 20(1): 31–40.
6. K. Joshi, Y. Ghodke, and B. Patwardhan, "Traditional medicine to modern pharmacogenomics: Ayurveda Prakriti type and CYP2C19 gene polymorphism associated with the metabolic variability," Evidence-Based Complementary and Alternative Medicine, vol. 2011, Article ID 249528, 5 pages, 2011.
7. "Traditional medicine". Archived from the original on 27 July 2008.
8. DaSilva, Edgar J.; Baydoun, Elias & Badran (2002). "Biotechnology and the developing world". Electronic Journal of Biotechnology. 5 (1): 64–92.
9. Diagnosis and classification of diabetes mellitus. American Diabetes Association. Diabetes Care. 2014 Jan; 37 Suppl 1: S81-90. [PubMed]
10.10. Review Definition, epidemiology, risk factors. Galtier F Diabetes Metab. 2010 Dec; 36(6 Pt 2):628-51. [PubMed]
11. Rohloof CM, Alessi TR, Yang B, Dahms J, Jhon P. Carr BS, Lutenbach SD. DUROS Technology delivers peptides and proteins at consistent rate continuously foe 3 to 12 Months. Journal of diabetes science and technology: 2008;2(3): 461- 467.
12. Sarla Saklani, Abhay P Mishra; pharmacognostic, phytochemical and antimicrobial screening of aphanamixis polystachya, an endangered medicinal tree. International Journal of Pharmacy and Pharmaceutical Sciences; Vol 4, Suppl 3, 2012
13. https://byjus.com/chemistry/ninhydrin-test/
14. S. M. Moshiur Rahman, Tushar Saha, Zia Uddin Masum2 and Jakir Ahmed Chowdhury; Evaluation of Physical Properties of Selected Excipients for DirectCompressible Tablet.Bangladesh Pharmaceutical Journal 20(1): 34-38, 2017.
15. https://shodhganga.inflibnet.ac.in/bitstream/10603/8541/18/18_chapter%206.pdf