

Formulation and Evaluation of Anti-Diabetic Tablet from Insulin Plant (*Costus Igneus*)

Gaurav Jadhav¹, Dipali Pagire², Vaibhav Jadhav³

¹Student, Pratibhatai Pawar college of pharmacy, Wadala Mahadeo.

²M. Pharm-(Quality Assurance) & Assistant Professor, Pratibhatai Pawar college of pharmacy, Wadala Mahadeo.

³M. Pharm-(Pharmacognosy) & Assistant Professor, Pratibhatai Pawar college of pharmacy, Wadala Mahadeo.

Abstract:

In this research article we prepare tablet formulation of *Costus igneus* plant i.e., Insulin plant by its ethanolic leaves extract and mixing with suitable excipients.

Extract was prepared by collecting *Costus igneus* plant leaves and go for shade drying for 4-7 days, after drying its crushed by mill to form powder and taken for extraction.

After extraction we prepare powder for taking different chemical qualitative test and laboratory flow properties such as; (Angle of repose, Loose bulk density, Tapped bulk density , Compressibility index) and after checking flow properties and then punch tablet by direct compression method we take two forms of tablet formula changes in main API one is extract and other is only powder and go for evaluation study such as; (Color ,Weight variation Test ,Hardness, Friability, Disintegration Time, Thickness)

Keywords: *Costus igneus* ; extraction ; Preformulation ; tablet formulation; evaluation.

Introduction:

Costus igneus Nak (syn. *Costus pictus* D. Don, *Costus mexicanus* Liebm ex Petersen or *Costus congenitus* Rowle), usually known as fiery *Costus*, Step ladder or Spiral flag or Insulin plant, is natural to South and Central America and India also. This is a recent introduction to India from America as an herbal cure for diabetes and hence frequently called as ‘insulin plant. It is extensively grown in gardens as ornamental plant in South India and likewise run wild in many places, It is used in India to control diabetes, and it is known that diabetic people eat one leaf daily to retain their blood glucose low. Leaves of *C. igneus* were one among the plants known to be successfully used for treating diabetes by the tribal people of Kolli hills of Namakkal district, Tamilnadu and Ahmednagar district Maharashtra.[1]

➤ Taxonomical classification of insulin plant

Botanical name:[8]	<i>Costus igneus</i> N.E.Br
Domain:	Eukaryota
Kingdom:	Plantae
Subkingdom:	Viridaeplantae
Phylum:	Tracheophyta

Subphylum:	Euphyllophytina
Infraphylum:	Radiatopses
Class:	Liliopsida
Subclass:	Commelinidae
Superorder:	Zingiberanae
Order:	Zingiberales
Family:	Costaceae
Subfamily:	Asteroideae
Tribe:	Coreopsideae
Genus:	Costus
Specific epithet:	igneus

Table 1: Taxonomical classification of insulin plant [1]

➤ **Vernacular name:**

Languages	Names
English	Spiral Ginger, Spotted Spiral Ginger, Painted Spiral Ginger
Marathi	Honi , Pushkarmula
Urdu	Bijasar, Dam al akhwain
Bengali	Piasal
Hindi	Banda, Bija-sal, Peisar , jarul, Keukand
Kannada	Kempu honne
Malayalam	Honne, Karintakara, Vengai, Venna-maram
Telugu	Peddavesiga, Yeangesha
Sanskrit	Asana, Bandhukapushpa
Tamil	Neyccarikamaram, Venkai-c-ciray , Kostam
Gujarati	Pakarmula

Table 2: Vernacular name of Costus igneus

➤ **Morphology :**

It is a perennial, upright, spreading plant about two feet tall, with the tallest stems falling over and two-faced on the ground. Leaves are simple, alternate, entire, oblong, evergreen, 4-8 inch in length with parallel venation. The large, smooth, dark green leaf of this tropical evergreen have light purple undersides and are spirally arranged around stem, forming attractive, arching clump arising from underground rootstock. Beautiful, 1.5-inch diameter, orange flowers are produced in the warm month, appearing on cone-like heads at the tips of branches.[1] Fruits are inconspicuous, not showy, less than 0.5 inch, and green-colored [Figure 1].



Fig.1 Insulin plant (*Costus igneus*)

Table 3: Major constituents of essential oil[1]

Stem oil (%)	Leaf oil (%)	Rhizome oil (%)
Hexadecanoic acid (28.3)	Hexadecanoic acid (24.51)	Hexadecanoic acid (25.26)
9,12-octadecadienoic acid (18.33)	2-pentanol (22.48)	9,12-octadecadienoic acid (7.74)
Dodecanoic acid (5.62)	Dodecanoic acid (3.96)	Dodecanoic acid (16.56)
Linalyl propanoate (6.03)	β -ionone (8.69)	Tetradecanoic acid (10.20)
Tetradecanoic acid (4.82)	Farnesyl acetone (7.04)	Linalool (8.48)
A-eudesmol (3.55) γ-eudesmol (3.21) 4-ethoxy phenol (3.06)	A- ionone (8.01)	α -terpineol (4.44)

Table 4: Various Marketed products of *Costus igneus* [2]

PLANT NAME	PRODUCT NAME	CATEGORY	MANUFACTURER
<i>Costus igneus</i>	Insulin Plant Leaf powder 180g	Dietary supplement	TheInsulinPlant.com, USA
	Kostam Keerai (<i>Costus igneus</i>) Capsule 500mg	-	Agroline Mori tantraa
	Diabestop 500mg Capsule	Food supplement	Herbs & Nutri Pharma
	Glucobeet plus Capsule 500mg	Blood sugar supportive Supplement	Orange organic pharma
	Daun Insulin	20 Herbal tea bags	Tigadaun

➤ **Advantages of *Costus igneus* plant:**

1. It helps to lower blood glucose level
2. It promote and help digest food material
3. It helps to boost immunity
4. It helps in to maintain health
5. It have antioxidant activity.

➤ **Data and material:**

- **Apparatus:** Soxhlet apparatus
- **Chemicals:** insulin plant leaves powder, ethanol / methanol (70%)

➤ **Extraction of *Costus igneus*:**

1. By Soxhlet extraction:

Plant extract *Costus igneus* Nak plant material was collected from Ahmednagar district, Maharashtra, India, The plant was identified by a pharmacognosy'st Mr. Vaibhav Jadhav sir, The plant was cleaned in distilled water (dH₂O) to make the plant dirt-free. Subsequently, the plant was shade dried at optimum temperature (37°C).

Then it made into powder using a mechanical grinder, and passed through a 20-mesh sieve to have homogenous size, and were weighed separately.

The powdered samples (10 g) were separated and extracted with ethanol using a Soxhlet apparatus as illustrated in Fig. 2. The extraction was carried out for 8 h at a room temperature of 30 °C. The extract were filtered and concentrated using a rotary evaporator at 70 °C and then used for further analysis.

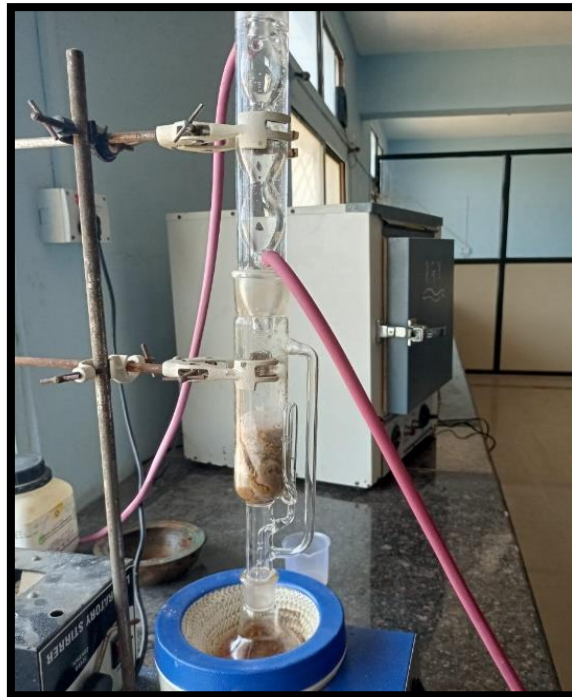


Fig no.2 extraction by Soxhlet apparatus

2. Extraction of plant material by maceration :

Costus igneus were collected, washed thoroughly in tap water and dried in room temperature for 15-30 days.

The dried leaves were powdered and 20 g leaf powder soaked in 200 ml of Petroleum ether for 3 days. The extracts were filtered through Whatman No.1 filter paper.

Similar process was repeated twice with fresh solvent and the filtrate was collected together. Similar procedure were followed for other solvents like Dichloromethane, hexane and benzene. The extract was stored at the refrigerator for further studies.

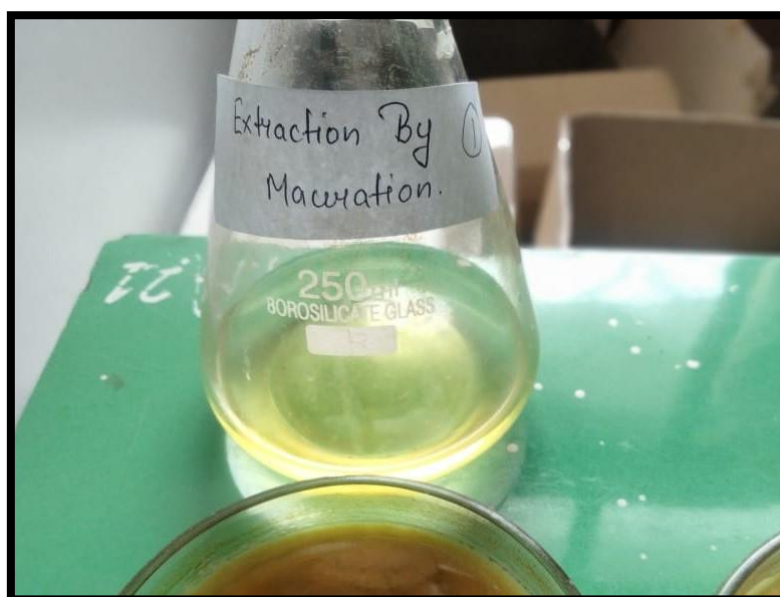


fig no. 3 extraction by maceration

Table 5 :Qualitative chemical test for Costus igneus extract

Sr. no.	Test	Result
1.	<p>Test for tannins</p> <p>About 0.5 g of the powdered sample was boiled in 20 ml of water in a test tube and then filtered. A few drops of 0.1% ferric chloride was added and observed for brownish green or a blue-black color.</p>	Pass
2.	<p>Test for flavonoids</p> <p>Methanolic extract of 1 ml was taken in a test tube with 0.5 ml of alcohol, a pinch of Magnesium, and a few drops of a concentrated HCl was added. The appearance of red color indicates the presence of flavonoids.</p>	Pass
3.	<p>Terpenoids (Salkowski test)</p> <p>5.0 ml extract was shaken with 2.0 ml chloroform (CHCl₃) and concentrated H₂SO₄(aq) (2.0 ml) was added along the sides of the test tube. A reddish-brown coloration of the interface can be considered as the presence of terpenoid.</p>	Pass
4.	<p>Alkaloids</p> <p>1.0 mg of extract was dissolved in 10.0 ml of dilute hydrochloric acid (HCl) and filtered. The filtrate was separately treated with Dragendorff's, Mayer's, and Wagner's reagents to test for the presence of alkaloids.</p>	Pass
5.	<p>Mayer's test</p> <p>To one portion of the filtrate, 1.0 ml of Mayer's reagent (potassium mercuric iodide solution) was added. Cream colored precipitate formation indicates the presence of alkaloids</p>	Pass
6.	<p>Saponins (Froth test)</p> <p>The Extract was shaken with distilled water (10.0 ml) in a test tube. The formation of frothing, which persists in warming in a water bath for 5 min, showed the presence of saponins</p>	Fail
7.	<p>Anthocyanosides</p> <p>1 ml of extract was taken in a test tube and treated with 5 ml diluted HCl(aq). Pale pink color solution confirms the presence of anthocyanosides</p>	Pass
8.	<p>Reducing sugars</p> <p>1.0 ml of plant extract was acidified with dilute HCl and neutralized with dilute NaOH. Then the solution was heated with Fehling's A and B solutions. The appearance of the red precipitate can be considered as the indication for positive results.</p>	Fail
9.	<p>Test for steroids</p> <p>Two ml of acetic anhydride was added to a 0.5 g methanolic extract of each sample with 2 ml sulphuric acid. The change of color from violet to blue or green in samples indicates the presence of steroids.</p>	-

Result of qualitative test

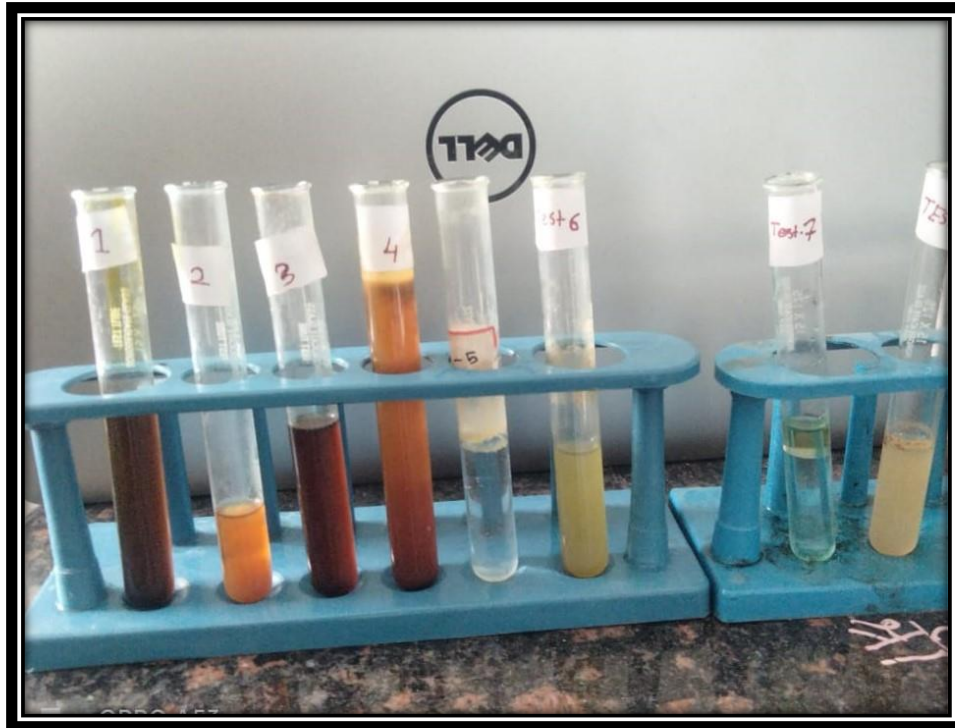


Fig no.4: Qualitative chemical test for Costus igneus plant

➤ **Evaluation of parameters**

• **Preformulation studies**

1. **Angle of repose**

By using funnel method, angle of repose was determined. In a funnel, the accurately weighed blend was taken. The funnel height was set agreed in a manner that the funnel tip just touches the “apex of the heap” or “head of blend”. Through the funnel “the drug excipient blend” was allowed to flow freely on to the surface. Table 6 shows the relationship between Angle of Repose and Powder Flow. The diameter of the powder cone and angle of repose were calculated by using the following equation –

$$\mathbf{\tan \theta = h/r}$$

Where **h** = height of powder cone formed, **r** = radius of the powder cone formed

Table 6 - Relationship between angle of repose (θ) and powder flow

Height (h)=2.8 cm

9cm diameter and 4.5 radius

$$\mathbf{r= 4.5}$$

$$\begin{aligned} \mathbf{\tan \theta} &= \mathbf{h/r} \\ &= \mathbf{2.8/4.5} \\ &= \mathbf{0.62} \end{aligned}$$

$$\mathbf{\theta = \tan^{-1}(0.62)}$$

$$\mathbf{\theta = 30^\circ}$$

Table 6: standard table of angle of repose

Angle of Repose (θ)	Type of flow
25	Excellent
25-30	Good
30-40	Passable
>40	Very poor

2. Loose bulk density

By pouring a weighed quantity of blend into graduated cylinder and measuring the volume and weight . 4.8 gm in 25 ml measuring cylinder

$$\text{Loose Bulk Density} = \text{Weight of the powder} / \text{volume of the packing} \\ = 4.8 / 25$$

$$\text{Loose Bulk Density} = 0.192 \text{ w/v}$$

3. Tapped bulk density

A known mass of drug excipient blend was placed in a graduated cylinder. The cylinder was tapped on to a hard surface from the height of 10 cm at two second interval. Tapping was continued, “until no further change in volume was noted”.

4 gm In 25 ml measuring cylinder
= tap volume 25ml = 17.5 ml

$$\text{Tapped Bulk Density} = \text{Weight of the powder} / \text{volume of the tapped packing} \\ = 4.8 / 19.5$$

$$\text{Tapped Bulk Density} = 0.2526$$

Table 8 - Grading of powders for their flow properties

4. Compressibility index

The Compressibility index of the blends was determined by Carr’s compressibility index. Table 7 shows grading of powders for their flow properties

$$\text{Compressibility index (\%)} = (\text{Tapped Bulk Density} - \text{Loose Bulk Density}) \times 100 / \text{Tapped Bulk Density}$$

$$= (0.2526 - 0.1920) \times 100 / 0.2526 \\ = (0.0606) \times 100 / 0.2526 \\ = (0.2399) \times 100$$

$$\text{Compressibility index (\%)} = 23.99 \%$$

Table 7: - Grading of powders for their flow properties

Consolidation Flow index (Carr’s index)	Flow
5-15	Excellent
12-16	Good
18-21	Fair to Passable
23-35	Poor
33-38	Very poor
<40	Very Very poor

Preformulation parameters were determined for the Pharmaceutical dosage form was depicted in **Table 8**

➤ **Formulation of antidiabetic tablet**

In the present study dried powder of ethanolic extract of *Costus igneus* leaves & its powder was formulated into tablet dosage form in two types by direct compression method. Formulation has the following composition and two formulas A & B resp.

• **Formula: A**

Formulation Ingredients (A)	Role	Quantity in (mg) each tablet
Costus igneus extract powder	API	210 mg
Starch	Binder and disintegrant	60 mg
Magnesium Stearate	Lubricant	25 mg
Lactose	diluent	55 mg
Talc	Glidant	10mg
Sodium benzoate	Disintegrant	5 mg
Methyl cellulose	Viscosity inducer	35 mg
Methyl Parabens	preservative	0.1 %

➤ **Another formulation of *Costus igneus* tablet without plant extract**

• **Formula B**

Formulation Ingredients (B)	Role	Quantity in (mg) each tablet
Costus igneus powder	API	350 mg
Starch	Binder and disintegrant	70 mg
Magnesium Stearate	Lubricant	25 mg
Lactose	diluent	55 mg
Talc	Glidant	10mg
Sodium benzoate	Disintegrant	5 mg
Methyl cellulose	Viscosity inducer	35 mg
Methyl Parabens	preservative	0.1 %

NOTE:

Formula A for direct administration by oral route and

Formula B has taking by dissolve in 5 ml water and given or administer by orally .

- **Physical evaluation of Tablets**

All the formulated tablet were subjected to following evaluation parameter:

1. Colour and appearance

For the colour and appearance – “the compressed tablets were examined”.

White

2. Weight variation test

By casually selecting and weighing 20 tablets, “the average weight was determined”. Individually, each tablet was also weighed. In each case “deviation from the average weight was calculated and expressed as percentage. Not more than two of the tablets from the “sample size” deviate from the average weight by a “greater percentage” and none of the tablets deviate by more than “double that percentage”.

3. Hardness and Friability test

By using calibrated hardness tester (Monsanto) and Roche friabilitor (4 min at 25 rpm) tests respectively, hardness and friability were tested for the tablets.

Formula A give hardness about 11-12.5 kg

And formula B gives hardness about 11 kg

4. Disintegration test for tablets

Glass of plastic tube [80-100 mm] long with an internal diameter [28 mm] and external diameter [30-31 mm] fitted at the lower end with a disc of rust proof wire gauge. Six tablets were placed in the tube, the tube was raised and lowered in such a manner that the complete up and down movement was repeated [28 to 32] per min. The tablets were disintegrated when no particle remains above the gauge, which readily pass through mesh (10 mesh screen).

RESULTS AND DISCUSSION

Table – 8: Preformulation parameters

Sr.No.	Parameters	Result
1	Angle of repose	30 ⁰ C
2	Loose bulk density	0.192 g/cm ³
3	Tapped bulk density	0.2526 g/cm ³
4	Compressibility index	23%

Table 9 - Physical parameters

Sr.No	Parameters	Result for (A)	Result for (B)
1	Colour	White	white
2	Weight variation Test	± 4%	±6%
3	Hardness	12.5	10-11
4	Friability	0.9 %	1.3 %
5	Disintegration Time	2.5 min.	1.5 min

Conclusion

In this research article we prepare antidiabetic tablet and give its Preformulation and evaluation study, we formulate tablet by two formulas some minor change in our API. And we determine different properties and give results and we conclude that in Preformulation study Costus igneus plant leaves powder has slightly good flow property, Formula A have high disintegration value than formula B also hardness and other properties.

References:

1. Prakash L. Hegde, Harini A. Rao, Prasanna N. Rao¹, A review on Insulin plant (Costus igneus Nak), Pharmacognosy Reviews | January-June 2014 | Vol 8 | Issue 15.
2. Flowerlet Mathew^{1*}, Bimi Varghese² A Review on Medicinal Exploration of costus igneus the insulin plant, Int. J. Pharm. Sci. Rev. Res, January - February 2019; Article No. 10, Pages: 51-57
3. Younis Ahmad Hajam a,[†] Rajesh Kumar b, Mohd Salim Reshi c, Dhiraj S. Rawat b, Abdullah F. AlAsmari d, Nemat Ali d, Yousif Salah Mohamed Ali d, Mohd Ishtikhar, Administration of Costus igneus Nak leaf extract improves diabetic-induced impairment in hepatorenal functions in male albino rats, Journal of King Saud University – Science 34 (2022) 101911
4. Harpreet Singh*, Sudhanshu Arora, Munish Mani, Kamal Kr Mahaur, Phool Chandra, Development of multicomponent formulation of herbal drugs for evaluation of Antidiabetic activity, Der Pharmacia Lettre, 2014, 6 (1):219-223
5. Akhila J. Shetty, Divya Choudhury¹, Rejeesh², Vinod Nair³, Maria Kuruvilla⁴, Shashidhar Kotian⁵, Effect of the insulin plant (Costus igneus) leaves on dexamethasone-induced hyperglycemia, International Journal of Ayurveda Research | April-June 2010 | Vol 1 | Issue 2,
6. John reddy Peasari, Sneha sri Motamarri, Karthikeya Srinivasa Varma, P. Anitha, Ravindra Babu Potti, Chromatographic analysis of phytochemicals in Costus igneus and computational studies of flavonoids, www.elsevier.com/locate/imu