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INSIGHTS INTO ANTIUROLITHIATIC PROFILE OF *Costus igneus* - AN *IN VITRO* APPROACH

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ABSTRACT

With the advancement of modern medicine, there has been a diabolical shift in the field of treatment. Traditionally, folks have resorted to plants grown in their backyard for remedial properties. Costus igneus is primarily a part of dietary landscape in ayurvedic culture for its antidiabetic properties. Urolithiasis is a polygenic disorder with complex etiologic. The aim of this research work is to inspect the antiurolithiatic activity of stem as well as leaf in both aqueous and alcoholic preparations. To assess the same; nucleation, aggregation & titrimetric methods were employed in the parameter domain.

KEYWORDS: *Urolithiasis, Insulin plant, Nucleation, Aggregation.*

INTRODUCTION[12]

Kidney stones are small, hard deposits that form in one or both kidneys. The stones are made up of minerals or other compounds found in urine. Kidney stones vary in size, shape, and colour. To be cleared from the body (or "passed"), the stones need to travel through ducts that carry urine from the kidneys to the bladder (ureters) and be excreted. Depending on their size, kidney stones generally take days to weeks to pass out of the body. Kidney stones can also result in blood in the urine (hematuria) or kidney or urinary tract infections. Kidney stones can cause abdominal or back pain (known as renal colic). Renal colic usually begins sporadically but then becomes constant and can lead to nausea and vomiting. The site of pain can change as the stone moves through the urinary tract. Some small stones pass through the kidney and urinary tract with little discomfort, while larger ones can block the flow of urine

and impair kidney function. Unusually large stones or stones that are difficult to pass can be medically removed.

Although there are many types of kidney stones, four main types are classified by the material they are made of. Up to 75 percent of all kidney stones are composed primarily of calcium.

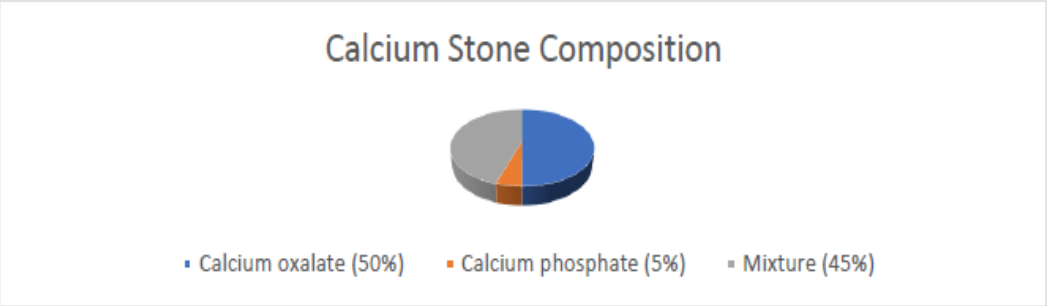


Figure 1: Calcium Stone Composition.

Stones are formed when urine becomes saturated. This imbalance can occur when there is an increased amount of the material in the urine, a reduced amount of liquid urine, or a combination of both. People are most likely to develop kidney stones between ages 40 and 60, though the stones can appear at any age.

Plant Description[1] [2] [13]

Costus igneus is a perennial, upright, tropical evergreen plant belongs to the family *Costaceae*. Possesses evergreen leaves which are simple, alternate, entire and oblong, having 4-8 inches length with parallel venation. The large, smooth, dark greens leaves possess light purple undersides and are spirally arranged around stems, forming attractive, arching clumps arising from underground rootstocks.

Figure 2: *Costus igneus* plant.

The plant shows the presence of natural substances such as protein, iron and antioxidant components such as ascorbic acid, β-carotene, α-Tocopherol, glutathione, phenols, flavonoids (diosgenin, quercetin), steroids, alkaloids, and terpenoids. These phytoconstituents are of utmost significance for inhibiting urinary stone formation.[10][11]

MATERIALS AND METHOD

SAMPLE PREPARATION

The plant was obtained from a residence of Lower Parel, Mumbai. The leaves and stems of *Costus igneus* were separated manually, washed with distilled water and dried in oven for a week at 50^0C. Then dried leaves and stem were crushed untiled fine powdered using mortar and pestle. Aqueous and alcoholic extract of stem and leaves were prepared.

Following assays were performed using Himalaya Cystone© as standard –

1. Nucleation Assay[3][4][5]

Plant extract was incubated with crystal solution and colorimetric analysis was carried out to evaluate the inhibition potential of plant in regards to crystal formation.

2. Aggregation Assay[3][4][5]

Employed to assess the crystal growth in the presence of plant extracts.

3. Titrimetric Analysis[3][6][7][8][9]

Dissolution of crystals by plant extract is determined. Semi-permeable membrane from egg was prepared by placing egg in 10% acetic acid **(Dissolution Bag)**. Crystals were incubated with plant extracts in dissolution bag and titration with 1N KMnO4 was done.

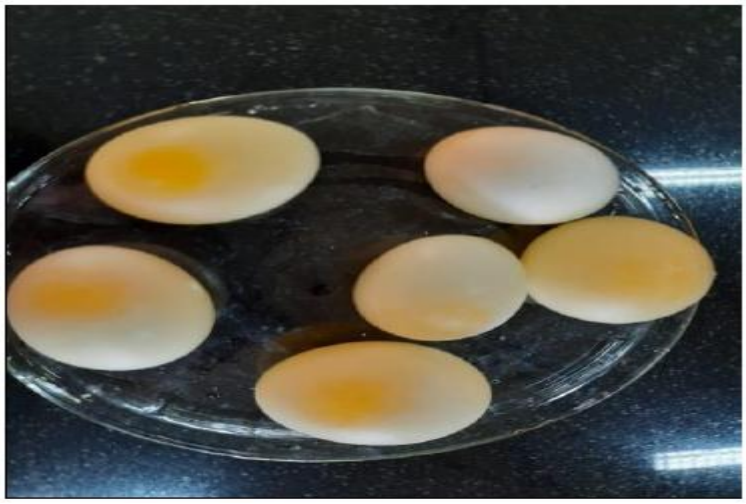
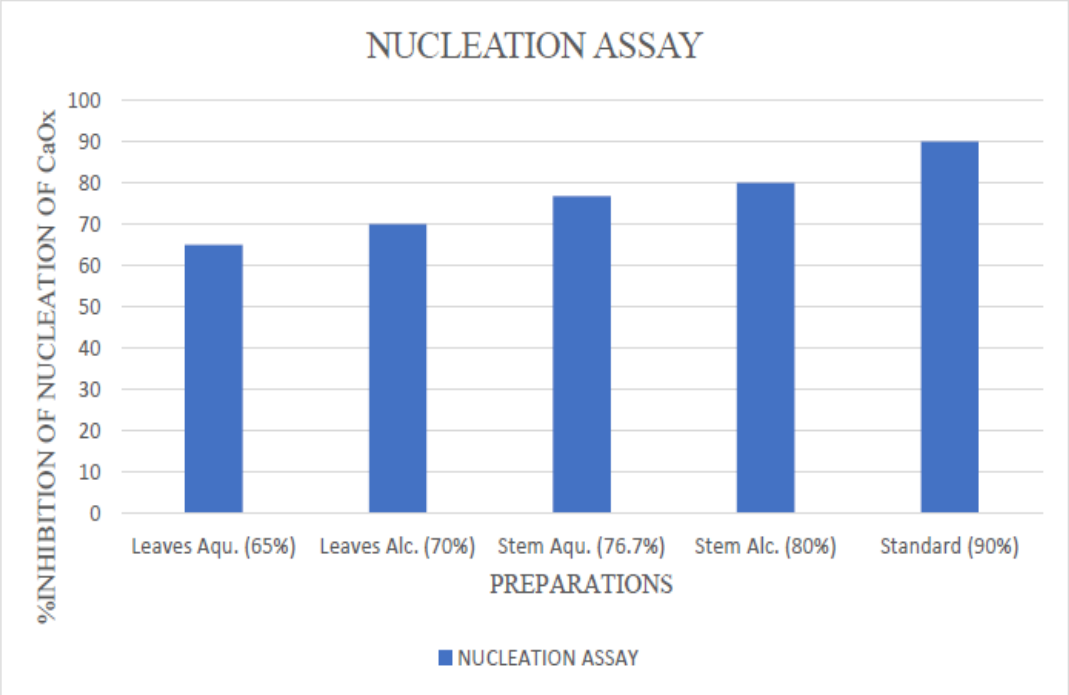


Figure 3: Semi-permeable membrane (Dissolution bag).

Figure 4: Set up of Dissolution Bag for Incubation.

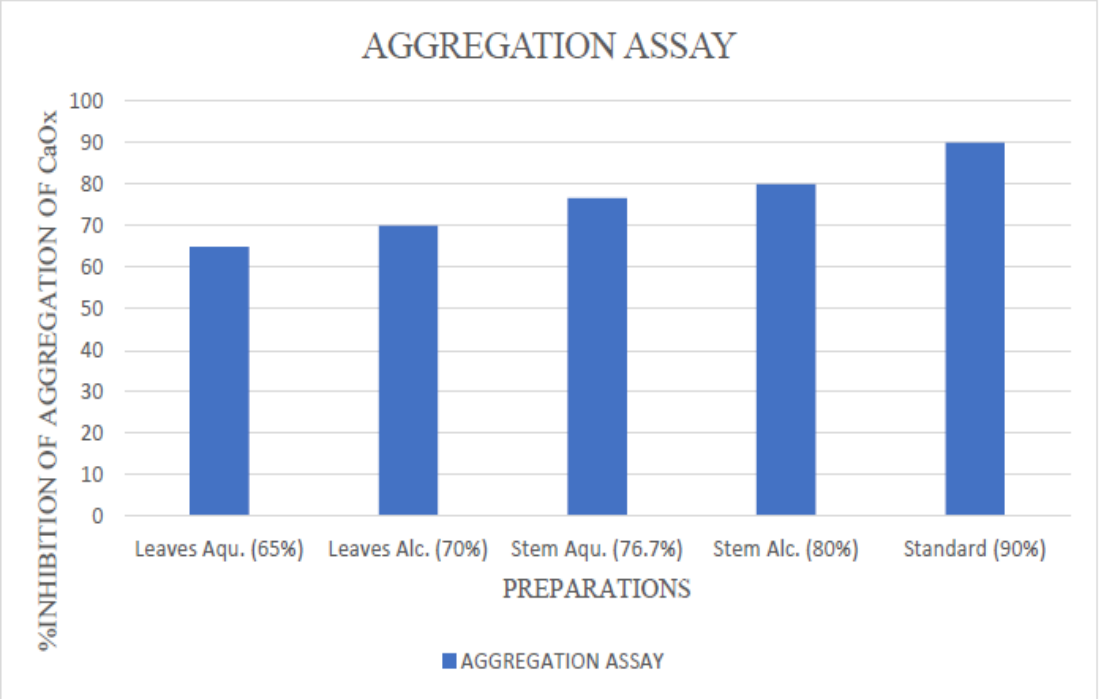
RESULT

I. Nucleation Assay



Graph 1: Comparative profile of nucleation assay across various preparations.

II. Aggregation Assay



Graph 2: Comparative profile of aggregation assay across various preparations.

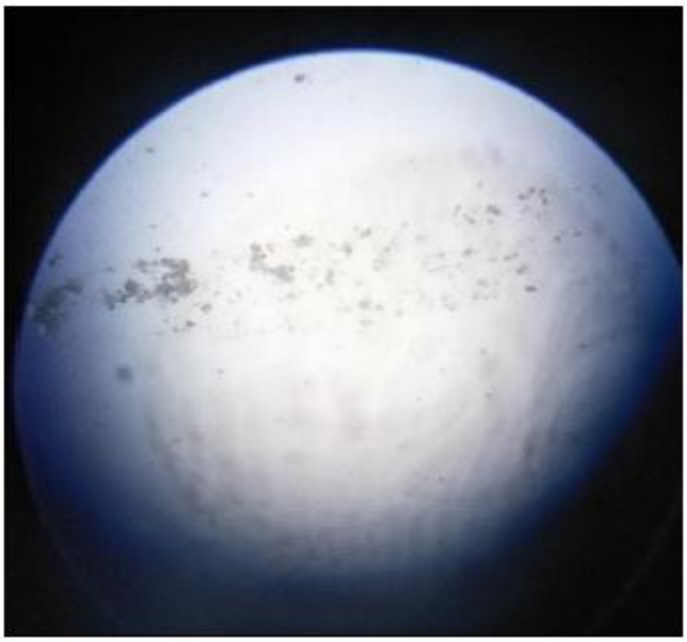
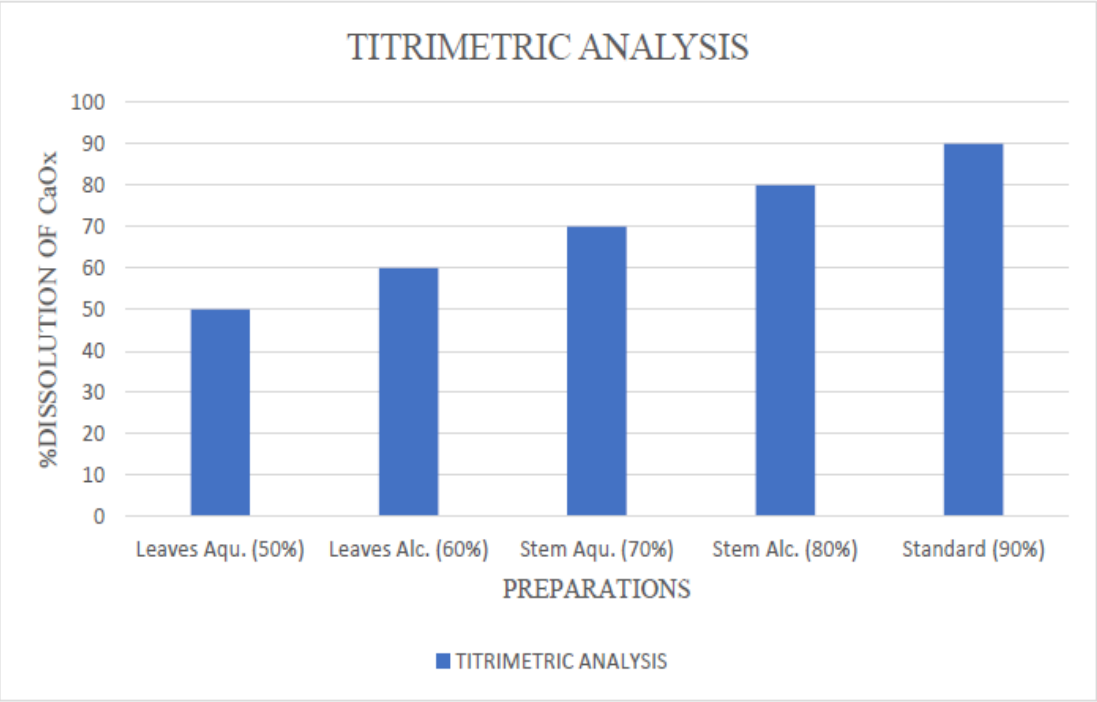


Figure 5: Microscopic evaluation (100X) of aggregation assay.

III. Titrimetric Analysis



Graph 3: Comparative profile of titrimetric analysis across various preparations.

CONCLUSION

- Addition of $Na_2C_2O_4$ solution to the reaction mixture consisting of $CaCl_2$ resulted in the formation of numerous CaOx crystals. Presence of plant extracts in the reaction mixture showed not only reduction in nucleation & but also in aggregation of preformed CaOx crystals.
- The stem has significantly higher *antiurolithiatic* potential than the leaves. Alcoholic extract was significantly potent in antiurolithasis compared to aqueous extract.
- This study evaluates the antiurolithiatic activity of aqueous and alcoholic extract of *Costus igneus* leaves and stem. The highest percentage i.e. 80.04% of calcium oxalate {CaOx} dissolution was observed in ethanolic extract followed by Aqueous extract which had a percentage dissolution of calcium oxalate was 75.60% The stem aqueous and alcoholic extracts of *C. igneus* shows highest rate of CaOx crystal dissolution i.e. 84.20% and 86.38% respectively. The alcoholic extracts of leaves and stem were found to be effective in dissolution. It was observed that stem extracts show highest dissolution of CaOx than leaves extracts.
- Since alcoholic preparation showed predominatly better results than aqueous preparations, if future prospects were considered the drug with alcohol as a vehicle should be considered.

DISCUSSION

CaOx urolithiasis is the most prevalent type of all urinary stone diseases. The study was designed to address these key events involved in CaOx stone formation as a means to investigate the efficacy of aqueous and alcoholic extract of leaves and stem of *Costus igneus* as an antiurolithiatic, using Himalaya Cystone as standard. Nucleation basically marks a thermodynamically driven event of phase change wherein dissolved substances in a supersaturated solution spontaneously crystallize. Similar phase change and formation of CaOx crystals was witnessed while carrying out nucleation assay. Significant inhibition in the nucleation of CaOx crystals was observed in presence of plant extracts. Aggregation of crystals marks the process wherein numerous crystals in the solution come together and adhere forming large crystal agglomerates. Aggregation is a key determinant of crystal retention as large crystal agglomerates are the ones that produce renal tubular obstruction thereby promoting stone formation. Plant extracts showed significant inhibitory effect on aggregation. In vitro urolithiasis by titration has been performed on the selected plant extracts by calculating percentage dissolution of CaOx crystal.

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