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Inhibition of Mineralization of Urinary Stone Forming Minerals by Medicinal Plants

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Abstract: The inhibition of mineralization of urinary stone forming minerals by medicinal plant *i.e. chenopodium album linn*, has been investigated. The inhibition efficiency was studied. Increased intake of fruits juice and seed extract of our plant would be helpful in urinary stone prophylaxis.

Keywords: Urinary Stone, Urolithiasis, *chenopodium album linn*, Medicinal plant

Introduction

A number of people suffer from problems due to urinary stones (calculi). Areas of high incidence of urinary calculi include the British Isles, Scandinavian countries, Northern Australia, Central Europe, Northern India, Pakistan and Mediterranean countries. Saurashtra region, Gujarat has higher prevalence of urinary stones. According to an estimate, every year 600,000 Americans suffer from urinary stones. In India, 12% of the population is expected to have urinary stones, out of which 50% may end up with loss of kidneys or renal damage. Also, nearly 15% of the population of northern India suffers from kidney stones. Fewer occurrences of urinary calculi are found in southern India, which may be due to regular dietary intake of tamarind.

Kidney stones are the commonest universal complaints¹. Kidney stones modify the victim's behavior with great fear of intense pain and threaten with failure of the kidneys. In modern medicine no satisfactory effective therapy is still available to dissolve or to prevent

recurrence of urinary stones. Only three effective drugs-allopurinol, D-penicillamine and acetazolamide are available against uric acid and cystine stone, although several drugs / therapies such as thiazides, cellulose phosphate, magnesium oxide and pyridoxine etc. have been tried. On the other hand the traditional system of Indian medicine "Ayurveda" recommends several medicinal plants²⁻⁸ for the treatment of Urolithiasis. Urolithiasis disease exists in 'endemic' proportions in some parts of our country. Urinary stones contain both crystalloid and colloid components. The crystalloid components are mainly calcium oxalate, calcium phosphate, calcium carbonate, magnesium-ammonium phosphate, uric acid and cysteine. In the present work we have estimated the inhibition efficiency of medicinal plant *i.e. chenopodium album linn*, on the mineralization of calcium oxalate, calcium carbonate and calcium phosphate.

Experimental

Materials and Methods

All the chemicals used were of AR grade. Crystalloid forming solutions, *viz.*, solution of *calcium acetate*, disodium oxalate, sodium carbonate and *trisodium phosphate*, were prepared in distilled water.

Plant material for the present work was collected locally and was identified botanically. Leaves were carefully removed from the plants and allowed to dry in the sun light. The dried leaves were made into a powder and extracted with 95% ethanol. The extract was concentrated. The residue was suspended in water. Seed extract was prepared by the following procedure.

Juice of the fruits was extracted with help of an ordinary fruit juicer. The thick juice obtained, were passed through a mesh and then suction filtered through ordinary filter paper. All the juice was used diluted to a known concentration.

Four experimental models namely 'simultaneous flow static model' (S.S.M.), 'simultaneous flow dynamic model' (S.D.M.), 'reservoir static model' (R.S.M.) and 'reservoir dynamic model' (R.D.M.) were designed.¹¹

The medicinal plant was collected from hills area and botanically identified⁹. The experiments were carried out in the laboratory. Simultaneous blank experiments were also carried out for evaluating the inhibition efficiency of inhibitor. All the experiments were conducted at room temperature. Percentage efficiency of inhibitor was calculated¹⁰.

Results and Discussion

Inhibition efficiencies of leaves, seeds and fruits of the medicinal plant have been investigated in different models. The results are recorded in Table 1. Study of the tables and charts suggests that the fruit juice and seed extract of the medicinal plant (*chenopodium album linn*) is moderate to good inhibitor of *calcium oxalate*, *calcium carbonate* and *calcium phosphate* mineralization. Sequestering of this insoluble calcium salts by the fruit juice might be due to effective single or mixed ligand chelation by the hydroxyl acids present in them. The hydroxyl acids are expected to form metal ion complexes with calcium. The presence of hydroxyl acids in urine may decrease the amount of ionized calcium available for calcium oxalate precipitate. Relatively poor inhibition of mineralization of calcium oxalate, calcium phosphate and calcium carbonate precipitation by leaves extracts might be due to a higher pK value of carbonic acid leading to replacement and precipitation of calcium salts of inhibitors rather than soluble mixed chelation¹¹. Calcium oxalate is a stubborn constituent of

urinary calculi being highly insoluble. It has very poor solubility in the leaves extract as such; however, if the fruit juices are present in the milieu before the formation of calcium oxalate, they may prevent the precipitation of the latter by exerting the specificity of their inhibitor towards calcium ions.

Table - 1 Inhibition of (1) Calcium oxalate (2) Calcium phosphate and (3) Calcium carbonate Mineralization by Medicinal Plant

Model	Inhibition Efficiency %			Inhibition Efficiency %			Inhibition Efficiency %		
	(1)			(2)			(3)		
	Fruit Juice	Seed Extract	Leaves Extract	Fruit Juice	Seed Extract	Leaves Extract	Fruit Juice	Seed Extract	Leaves Extract
SSM	33	57	8	38	22	14	53	29	24
SDM	44	54	3	39	10	19	57	49	29
RSM	47	60	12	54	22	16	75	43	21
RDM	39	40	19	22	8	14	29	31	25
Average	41	53	11	38	16	16	54	38	25

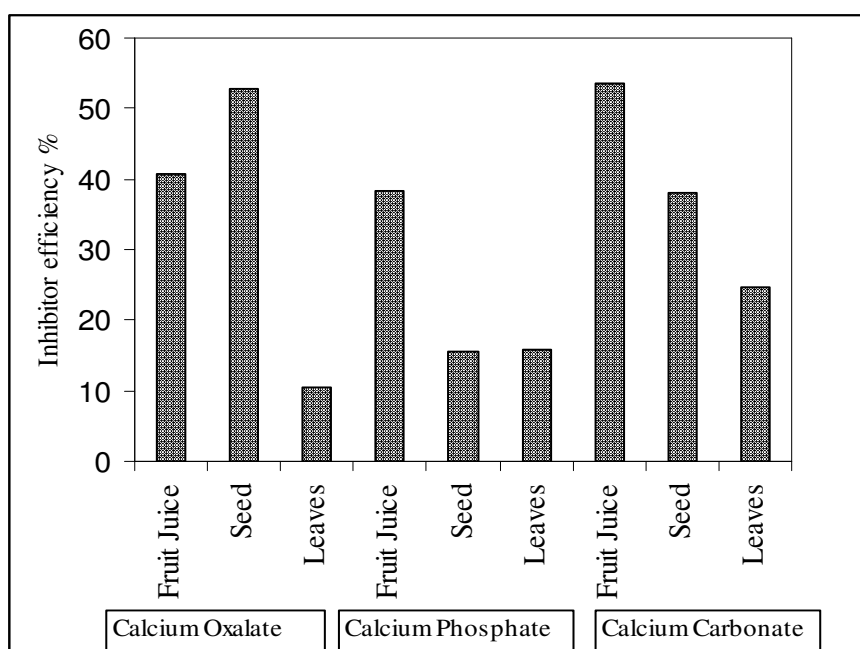
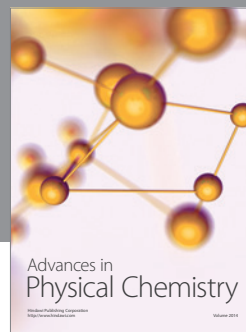
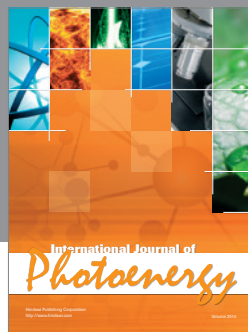
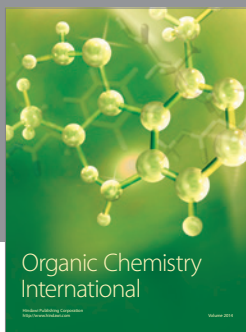
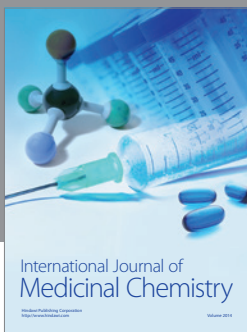


Figure - 1

A comparative study of different models indicates that the reservoir dynamic model is the most effective one in the inhibition of calcium oxalate mineralization. This might be due to mass effect. An *ab-initio* presence of large concentration of juice (in the reservoir) leads to minimize the free Ca^{2+} ions for precipitation as insoluble salts. Most of the fruits contain hydroxyl polybasic acids. Our present study suggests that the increased intake of fruits juice and seed extract of our plant, (*chenopodium album linn*) would be helpful in urinary stone prophylaxis.

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