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X ray diffraction study of a crystal obtained in *Lagenandra toxicaria* Dalz.

P ANNIE SULOCHANA SELVAKUMARI*

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Key words

X-ray Diffraction
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ABSTRACT

Lagenandra toxicaria Dalz. of family Araceae is endemic to peninsular India. It is a semi aquatic herb, found in marshes and along water courses, often growing gregariously in semi evergreen forests at the altitude of 350–1200 m. By tradition the plant is used in the preparations of ointments for skin itch and the rhizome is used in renal and cardiac ailments. Rhizomes are considered carminative, tonic, diuretic and used in bilious complaints. The juice of the fresh plant is applied to wounds for quick healing. Traditionally the plant is also said to have insecticidal properties. This paper focuses on the X ray diffraction data of a crystal obtained from this medicinally valued plant. The crystal was identified as potassium chloride that is likely to account for the diuretic property of L. toxicaria.

INTRODUCTION

There are about 12 species of *Lagenandra*, mainly in Sri Lanka [11], one species in North East India and four species in South India [7]. *Lagenandra toxicaria* Dalz. of Araceae is endemic to peninsular India [10]. It is a semi aquatic herb, found in marshes and along watercourses, often growing gregariously in semi evergreen forests at the altitude of 350 – 1200 m. By tradition the plant is used in the preparations of ointments for skin itch and the rhizome is used in renal and cardiac ailments [6]. Rhizomes are considered carminative, tonic, diuretic and used in bilious complaints. The juice of the fresh plant is applied to wounds for quick healing [13]. Traditionally the plant is also said to have insecticidal properties [8]. Effective utilization of any information requires its systematic evaluation. Recently, the plant was subjected to scientific studies and the rhizome oil of *L. toxicaria* has been shown to have antibacterial activity against the three human pathogens, namely *Staphylococcus aureus, Escherichia coli* and *Klebsiella pneumoniae* [7] by agar disc diffusion technique [5]. The rhizome oil was found to be more or less equally effective with that of the standard antibiotic chloramphenicol in the *in vitro* condition. The rhizome oil of *L. toxicaria* as well as possesses insecticidal and germicidal properties [2]. The oil was evaluated for its insecticidal activity against the storage pest *Tribolium castanaem* Herbst., by filter paper impregnation method and the LC_{50} value was found to be 0.069% in 24 hours [4]. Low concentration (0.5µl/ml) of the oil in water totally inhibited the germination of seeds (*Cicer*

*Corresponding author, Email: anniessp@yahoo.co.in
Associate Professor of Botany, St. John's College, Palayamkottai, Tamil Nadu, 62002, India.

arietinum, *Oryza sativa* and *Vigna radiata*), in the evaluation of germicidal activity carried out by the method of Rao and Singh [12]. The methanol extract of *L. toxicaria* (Rhizome) was subjected to column chromatographic technique. The oil obtained, was subjected to GC-MS analysis and the chemical constituents present in the oil were identified as methyl ester of 2-hydroxy benzoic acid, diethyl phthalate, oleic acid, palmitic acid ethyl ester and dioctyl phthalate. Diethyl phthalate was found to be the major constituent (89.46j) [13]. This paper focuses on the X ray diffraction study of a crystal obtained from this medicinally valued *Lagenandra toxicaria* Dalz.

MATERIALS AND METHODS

Isolation of the crystals

The rhizomes of *Lagenandra toxicaria* were collected from Karayar, a Tirunelveli hill. The rhizomes were cleaned with water, chopped, dried under shade and ground into powder. 100 g of the powder was successively extracted with two litres of benzene (8 hours / 3 times / 80°C) followed by two litres of methanol (8 hours / 3 times / 65°C), using a three litre round bottom flask fitted with a water condenser. The extract was concentrated after distilling the solvent under reduced pressure. The methanol extract of *Lagenandra toxicaria* was concentrated by distillation and kept at room temperature for a few hours, yielded colourless, tiny cubic crystals (100 mg / 100 g). The crystals **(LT)** were isolated from the extract and washed with methanol three times.

Characterization of the crystal

Usual qualitative analyses did not show the presence of organic compounds. The crystals were found to be soluble in water and the crystals were subjected to qualitative inorganic analyses. The crystal was also subjected to X-Ray Diffraction study using Enraf Nonius CAD4-F Diffractometer and was identified as potassium chloride.

RESULTS AND DISCUSSION

The results of X ray diffraction study of the crystal obtained from the methanol extract of *Lagenandra toxicaria* is presented in Table 1. The crystal obtained from the methanol extract of *Lagenandra toxicaria* **(LT-6)** was water-soluble. When treated with silver nitrate solution a curdy white precipitate, completely soluble in ammonia was obtained indicating the presence of chloride. Aqueous solution when treated with perchloric acid formed white precipitate. Aqueous solution when treated with picric acid formed yellow precipitate. Paste of the crystal made with concentrated HCl, when introduced to flame produced lilac colour, which indicates the presence of potassium. Moreover, from the result of XRD data, it can be concluded that the crystal is a body centered cubic crystal of KCl.

Unlike other elements, potassium does not enter into the composition of any of the major constituents of plant cells such as proteins, chlorophyll, fats and carbohydrates. Potassium is however, required by plants in fairly large amounts and occurs primarily as soluble inorganic salts and occasionally as salts of organic acids [9]. Potassium plays an important role in photosynthesis and helps in the building up of carbohydrate supplies in plants. In potassium deficient plants, alterations in metabolism occur which led to the accumulation of toxic nitrogenous compounds such as diamine and putresine [15]. Potassium acts as an activator for a number of complex enzyme systems and encourages root development in plants. Potassium plays a significant role in the regulation of transpiration and water conditions in the plant cell. It is specially required for opening of stomata by light; no other physiological ion can substitute for potassium in this crucial role [14]. In fact, plant life would not be possible without this element. In medicine, high potassium content in plant samples has diuretic properties. The plant is poisonous in the unprocessed form, and self-medication with this wild plant is not advisable.

Result: Cell value conformed to cubic system potassium chloride.

Table 1 – XRD data of compound LT

Nr S	H	K	L	Dev-Ang	dTh	dPh	dCh	0.0158875
1 H	0.004	4.001	0.002	0.0632	-0.005	-0.010	-0.063	0.0007347
2 H	0.003	2.001	-2.001	0.0669	-0.005	0.008	-0.066	0.0005800
3 H	3.999	4.001	-0.001	0.0151	0.002	-0.001	0.015	0.0002557
4 H	4.000	3.999	2.000	0.0125	0.003	0.000	-0.013	0.0002424
5 H	4.001	4.000	3.999	0.0098	-0.001	0.013	-0.003	0.0001922
6 H	4.000	6.000	1.999	0.0052	0.001	0.006	0.001	0.0001176
7 H	-2.006	3.998	-4.003	0.0618	-0.008	0.023	0.059	0.0010948
8 H	-1.996	2.001	-6.000	0.0361	0.004	-0.005	-0.036	0.0006866
9 H	0.000	6.000	0.001	0.0126	-0.001	-0.012	-0.002	0.0002157
10 H	1.999	4.000	-3.998	0.0125	0.006	-0.012	0.003	0.0003372

Reciprocal axis matrix			Direct axis matrix		
0.048598	-0.027239	-0.148798	1.924205	0.460708	5.969409
0.011774	0.156573	-0.024762	-1.076970	6.196543	-0.136618
0.150947	-0.003304	0.049875	-5.894936	-0.983879	1.974643
Niggli-values		Sigma direct axis matrix			
39.5487	39.5757	39.6175	0.004285	0.001979	0.003533
-0.0178	-0.0089	-0.0330	0.001633	0.000754	0.001346
0.002044	0.000944	0.001686			
Cell parameters		Sigma cell parameters			
6.2888	6.2909	6.2942	0.0036	0.0008	0.0020
90.0257	90.0129	90.0479	0.0171	0.0411	0.0227
-0.000448	-0.000225	-0.000835	0.000298	0.000718	0.000397
Volume =	249.0137	0.1660			

Index-Status: HHHHHHHHHH////////////////

CD0> LO

From to: 1 25

1H	0.	4.	0.	*	13.04	S 10.17	13.69	-1.47	**S	-2 0.72	3866.7
2H	0.	2.	-2.	*	9.18	S -28.40	15.22	-17.81	**S	-1 0.86	4695.7
3H	4.	4.	0.	*	18.61	S -25.18	0.07	54.42	**S	1 0.89	11897.3
4H	4.	4.	2.	*	19.78	S -2.53	-1.08	61.81	**S	1 0.93	9110.5
5H	4.	4.	4.	*	23.00	S 20.44	2.50	61.08	**S	1 1.04	5780.4
6H	4.	6.	2.	*	24.97	S 0.62	9.51	46.30	**S	1 1.08	3812.4
7H	-2.	4.	-4.	*	19.77	S -14.98	34.21	-43.16	**S	1 0.89	9838.8
8H	-2.	2.	-6.	*	21.94	S -43.66	37.11	-46.47	**S	1 1.07	7742.1
9H	0.	6.	0.	*	19.77	S 10.17	20.48	-1.55	**S	1 0.89	9820.9
10H	2.	4.	-4.	*	19.76	S -40.31	17.66	7.00	**S	1 0.90	11217.4

CD0> INDEX
Enter number of short vectors to be printed [0]
Orientation matrix:

R11= 0.297522	R12= 0.054547	R13= -0.194536
R21= 0.049197	R22= -0.312955	R23= -0.046973
R31= -0.099766	R32= 0.007270	R33= -0.602857

Determinant= 2
Index-Status: HHHHHHHHHH///////////////

Nr	S	H	K	L	Dev-Ang	dTh	dPh	dCh	0.0317751
1	H	0.002	2.001	0.001	0.0632	-0.005	-0.010	-0.063	0.0007347
2	H	0.002	1.001	-1.000	0.0669	-0.005	0.008	-0.066	0.0005800
3	H	1.999	2.000	0.000	0.0151	0.002	-0.001	0.015	0.0002557
4	H	2.000	1.999	1.000	0.0125	0.003	0.000	-0.013	0.0002424
5	H	2.000	2.000	2.000	0.0098	-0.001	0.013	-0.003	0.0001922
6	H	2.000	3.000	1.000	0.0052	0.001	0.006	0.001	0.0001176
7	H	-1.003	1.999	-2.001	0.0618	-0.008	0.023	0.059	0.0010948
8	H	-0.998	1.000	-3.000	0.0361	0.004	-0.005	-0.036	0.0006866
9	H	0.000	3.000	0.001	0.0126	-0.001	-0.012	-0.002	0.0002157
10	H	0.999	2.000	-1.999	0.0125	0.006	-0.012	0.003	0.0003372

Reciprocal axis matrix			Direct axis matrix		
0.097196	-0.054478	-0.297595	0.962103	0.230354	2.984704
0.023549	0.313147	-0.049523	-0.538485	3.098271	-0.068309
0.301894	-0.006607	0.099750	-2.947468	-0.491940	0.987321

Niggli-values			Sigma direct axis matrix		
9.8872	9.8939	9.9044	0.002143	0.000990	0.001767
-0.0044	-0.0022	-0.0083	0.000816	0.000377	0.000673
0.001022	0.000472	0.000843			

Cell parameters			Sigma cell parameters		
3.1444	3.1455	3.1471	0.0018	0.0004	0.0010
90.0257	90.0129	90.0479	0.0171	0.0411	0.0227
-0.000448	-0.000225	-0.000835	0.000298	0.000718	0.000397

Volume = 31.1267 0.0208
Index-Status: HHHHHHHHHH///////////////

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