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DECLARATION

I hereby declare that the thesis entitled “X-RAY CRYSTALLOGRAPHIC STUDIES ON SOME BIOLOGICALLY IMPORTANT COMPOUNDS” submitted to the University of Madras for the award of the degree of DOCTOR OF PHILOSOPHY is the original and independent work carried out by me during the period 2000-2006 under the supervision of Dr. D. VELMURUGAN, Professor, Department of Crystallography and Biophysics, University of Madras and that the thesis has not formed the basis for the award of any other degree, diploma, associateship, fellowship or any other similar titles.

(P. G. ARAVINDAN)

Date : 14/03/06

Chennai – 600 025.
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REFERENCES
This thesis reports the results of crystal structure analysis on some biologically important compounds and details the studies on crystal packing of these. The research work was carried out by the candidate during the period 2000-2006 under the guidance of Dr. D. Velmurugan, Professor, Department of Crystallography and Biophysics, University of Madras, Guindy campus, Chennai – 600 025.

The thesis consisting of six chapters deals with the crystallographic work on some carbazole, ether bridge, stilbene, thiacyclophane, acridinedione and spiro pyrrolidine derivatives. For seven compounds [four compounds in chapter 4 and compound I, II and VII of chapter 6] diffraction data were collected using Enraf -Nonius CAD4 diffractometer and for the other 12 compounds diffraction data were collected using SMART CCD. The studies on the structure and conformation would provide valuable information in understanding the molecular structure and molecular packing.

Chapter 1 describes the crystal structure of three N-ethyl carbazole derivatives and also the conformation of molecule adopted by various substitutions. There are several types of aromatic interactions observed in the crystal packing such as weak C-H...π and π...π interactions in compound I, π...π interactions in compound II, halogen...π interactions in compound III.

Chapter 2 discusses about two ether bridged compounds with substitution of aldehyde group in compound I and nitro group in compound II. The ether compounds are useful to metal ion selectivity, artificial membranes
and nitro substituted ether compounds are used as dyes and battery intermediates in the industrial oriented applications. In the crystal packing, the different substitutions cause two dimensional network formed by C-H⋯O and π⋯π interactions in compound I and C-H⋯O hydrogen bond in compound II.

Chapter 3 deals with the crystal structure of trans stilbene [methyl 4-(4-ethoxybenzylidenemethyl)-3,5-dinitrobenzoate] which was carried out as part of our studies on stilbene derivatives. The conformation of the molecule and crystal packing are explained in detail in this chapter. Zigzag ladder formation with the helical pattern formed by C-H⋯O hydrogen bond with nitro group and also stacking of C-H⋯O dimeric hydrogen bond supporting the helical pattern are also detailed.

Chapter 4 focusses on the flexible conformation and crystal packing of various thiacyclopophane derivatives. Four thiacyclopophane derivatives are discussed in this chapter. The two isomeric thiacyclopophanes are : (i) Dithiacyclopophane (Compound I) and (ii) Tetrathiacyclopophanes (Compound II, III, IV). Self assembly of the molecule is also discussed. In isomeric thiacyclopophanes of compounds III and IV, substitution of methoxy group plays an important role in deciding the self assembly property. The packing of the isomeric [5.5] para thiacyclopophane molecule clearly demonstrates that the orientation of the methoxy groups plays a vital role in the formation of vertical stack of rectangular tunnel shape.

Chapter 5 details the conformation, crystal packing and comparative study of two acridinedione derivatives (Compound I and Compound II). The
orientation of the central ring of acridinedione and conformation of the ring depends on the presence of the hydrogen atom at N position. Solvent molecule plays a role in forming three centered hydrogen bonds in the crystal packing such as, N-H...O, O-H...O and O-H...N hydrogen bonds. As part of our analysis on acridinedione derivatives, a comparative study is also carried out.

Chapter 6 deals with the crystal structure analysis on seven spiro pyrrolidine derivatives and also a comparative study of seven crystal structures with earlier reported structures. The conformations of pyrrolidine ring of the seven compounds are discussed. Several short contacts are observed due to bulky substitution at the spiro junction. In the molecular packing, N-H...O, C-H...O and weak interactions (C-H..π and π...π) are observed in the seven crystal structures. The comparative study of seven compounds reported in this thesis with earlier reported structures reveals the stretching of bond lengths at spiro junctions due to the bulky substitutions. Packing details are also provided.

The necessary tables and figures are numbered in each chapter. The figures are provided at the appropriate places in the text. The tables are provided at the end of each chapter. The references cited in the text have been arranged in alphabetical order at the end of the thesis. The F∞/Fc listings of all the structures reported in this thesis are contained in the CD-ROM enclosed herewith.
Based on the above investigations, the following papers have already been published/ being prepared for publication.

**Published papers:**

1. 3-Chloro-3-(9-ethyl-6-methyl-9H-carbazol-3-yl)propenal.

2. C-halogen...π interactions in 4 – Chloro – 2 - (9-ethylcarbazol-3-yl)quinoline-1(2H)-carbaldehyde.

3. 3,4:9,10-Dibenzo-1,12-diformyl-5,8-dioxododecane.

4. 1,2-Bis(2,4-dinitrophenoxy)ethane.

5. Methyl 4-(4-methoxybenzylidenemethyl)-3,5-dinitrobenzoate.

6. 9, 17-Dioxo-1,3-dithiatetracyclo[18. 2. 2. 2\textsuperscript{23}. 2\textsuperscript{24}. 1\textsuperscript{25}]heptacosan-5, 7, 11,13, 15 (25), 18, 20, 23, 26 none.

7. 3,3,6,6-Tetramethyl-9-(4-pyridyl)-3,4,6,7,9,10-hexahydro-, 8 (2H, 5H) - acridinedione monohydrate.

8. 1'- N-methyl - 4'- phenyl-H-fluorene - 9- spiro - 3'- pyrrolidine-spiro-2'-spiro-3''-1H-indol-2''(3''H)-one.
9. 5"Benzyldiene-1',1"'-dimethyl - 4' - phenylacenaphthene-2-spiro-2'-%
pyrrolidine-3'-spiro-3''-piperidine-1,4'''-dione

10. Synthesis and structural study of thiacyclophanes utilizing dibromides and methane dithiolate.

11. Crystal Structure of a 3,3,6,6-Tetramethyl-9-(4-pyridyl)-3,4,5,6-
tetrahydro-1,8(2H,5H)-acridinedione

12. 1-N-methyl - spiro[2.3''] - oxindole-spiro [3.2'']-indane-1''-3''-
dione-4'''-[p- methyl benzyl]pyrrolidine

**Manuscript under preparation:**

1. Crystal structure of 9-ethylcarbazole-3-aldehyde
**P.G. Aravindan, S. Selvanayagam, D. Velmurugan, K. Ravi Kumar, R. Nagarajan & P. T. Perumal.**

2. 1-N-methyl-spiro [2.3'] 5',7'- dibromo – oxindole-spiro[3-2']oxindol-4'- [p-methyl benzoyl]pyrrolidine

3. Flavan-4’-one spiro[3.3']-N-methyl-(4-p-methoxyphenyl)pyrrolidine spiro [acenapthen-1-1’’-one]. 3-p-methoxy benzylidene flavan-4-one

4. Crystal structures of 1-N-methyl-spiro[2.2']acenaphthenequinone-
3-benzoyl-4-phenyl pyrrolidine and Spiro [2.2']
acenaphthenequinone -3-benzoyl-4-phenyl pyrrolizidine Derivative.
**P. G. Aravindan**, D. Velmurugan, M. Poornachandran & R. Raghunathan