

Volume 9, Issue 4(6), April 2020
**I n t e r n a t i o n a l J o u r n a l o f M u l t i d i s c i p l i n a r y
E d u c a t i o n a l R e s e a r c h**

**Published by
Sucharitha Publications
Visakhapatnam
Andhra Pradesh – India
Email: victorphilosophy@ gmail.com
Website: www.ijmer.in**

Editorial Board

Editor-in-Chief

Dr. K. Victor Babu

Associate Professor, Institute of Education
Metu University, Metu, Ethiopia

EDITORIAL BOARD MEMBERS

Prof. S.Mahendra Dev

Vice Chancellor
Indira Gandhi Institute of Development
Research, Mumbai

Prof.Y.C. Simhadri

Vice Chancellor, Patna University
Former Director
Institute of Constitutional and Parliamentary
Studies, New Delhi &
Formerly Vice Chancellor of
Benaras Hindu University, Andhra University
Nagarjuna University, Patna University

Prof. (Dr.) Sohan Raj Tater

Former Vice Chancellor
Singhania University, Rajasthan

Prof.R.Siva Prasadh

IASE
Andhra University - Visakhapatnam

Dr.V.Venkateswarlu

Assistant Professor
Dept. of Sociology & Social Work
Acharya Nagarjuna University, Guntur

Prof. P.D.Satya Paul

Department of Anthropology
Andhra University – Visakhapatnam

Prof. Josef HÖCHTL

Department of Political Economy
University of Vienna, Vienna &
Ex. Member of the Austrian Parliament
Austria

Prof. Alexander Chumakov

Chair of Philosophy
Russian Philosophical Society
Moscow, Russia

Prof. Fidel Gutierrez Vivanco

Founder and President
Escuela Virtual de Asesoría Filosófica
Lima Peru

Prof. Igor Kondrashin

The Member of The Russian Philosophical
Society
The Russian Humanist Society and Expert of
The UNESCO, Moscow, Russia

Dr. Zoran Vujisiæ

Rector
St. Gregory Nazianzen Orthodox Institute
Universidad Rural de Guatemala, GT, U.S.A

Prof.U.Shameem

Department of Zoology
Andhra University Visakhapatnam

Dr. N.V.S.Suryanarayana

Dept. of Education, A.U. Campus
Vizianagaram

Dr. Kameswara Sharma YVR

Asst. Professor
Dept. of Zoology
Sri. Venkateswara College, Delhi University,
Delhi

I Ketut Donder

Depasar State Institute of Hindu Dharma
Indonesia

Prof. Roger Wiemers

Professor of Education
Lipscomb University, Nashville, USA

Dr.Kattagani Ravinder

Lecturer in Political Science
Govt. Degree College
Mulugu Telangana

Dr.B.S.N.Murthy

Department of Mechanical Engineering
GITAM University,Visakhapatnam

Dr. Mustapha Inul Manuha

Institute of Indigenous Medicine
University of Colombo, SL.

Dr.S.V Lakshmana Rao

Coordinator
A.P State Resource Center
Visakhapatnam

Dr.S.Kannan

Department of History
Annamalai University
Annamalai Nagar, Chidambaram

Dr. B. Venkataswamy

H.O.D., & Associate Professor
Dept. of Telugu, P.A.S. College
Pedanandipadu, Guntur, India

Dr.E. Ashok Kumar

Department of Education
North- Eastern Hill University, Shillong

Dr.K.Chaitanya

Department of Chemistry
Nanjing University of Science and
Technology
People's Republic of China

Dr.Sandeep Narula

Dept. of Management Sciences
IIHMR University, Jaipur

Dr. Bipasha Sinha

S. S. Jalan Girls' College
University of Calcutta, Calcutta

Prof. N Kanakaratnam

Dept. of History, Archaeology & Culture
Dravidian University, Kuppam
Andhra Pradesh

Dr. K. John Babu

Department of Journalism & Mass Comm
Central University of Kashmir, Kashmir

Dr.T.V.Ramana

Department of Economics, Andhra University
Campus, Kakinada

Dr.Ton Quang Cuong

Dean of Faculty of Teacher Education
University of Education, VNU, Hanoi

Prof. Chanakya Kumar

Department of Computer Science
University of Pune,Pune

Prof. Djordje Branko Vukelic

Department for Production Engineering
University of Novi Sad, Serbia

Prof. Shobha V Huilgol

Department of Pharmacology
Off- Al- Ameen Medical College, Bijapur

Prof.Joseph R.Jayakar

Department of English
GITAM University
Hyderabad

Prof.Francesco Massoni

Department of Public Health Sciences
University of Sapienza, Rome

Prof.Mehsin Jabel Attaya

Al-Mustansiriyah University
College of Education
Department of Mathematics, Iraq

Prof. Ronato Sabalza Ballado

Department of Mathematics
University of Eastern Philippines, Philippines

Satheesha H

Mettu University
Mettu, Ethiopia

Dr.J.B.Chakravarthi

Assistant Professor
Department of Sahitya
Rasthriya Sanskrit Vidyapeetha, Tirupati

Dr.Ni Luh Putu Agustini Karta

Department of Tourism
Triatma Mulya Institute of Economy
Bali, Indonesia

© Editor-in-Chief, IJMER®

Typeset and Printed in India

www.ijmer.in

IJMER, Journal of Multidisciplinary Educational Research, concentrates on critical and creative research in multidisciplinary traditions. This journal seeks to promote original research and cultivate a fruitful dialogue between old and new thought.

C O N T E N T S

Volume 9	Issue 4(6)	April 2020
----------	------------	------------

S. No		Pg.No
1.	Moratorium Under Indian Insolvency Regime Binoy J. Kattadiyil and CS Swati Agarwal	1
2.	Household Savings in India: An Economic Analysis Anila.C, KM Francis and Sabu PJ	7
3.	Analyzing Techniques of Samuel Beckett in Krapp's Last Tape Dipesh Patel	14
4.	Problems of Educationally Backward Muslim Minority in Government Elementary School Garuda Dhawja Barik and S.Jyotirani	20
5.	Critical Reading of 'The Flood' by Thakazhi Sivasankara Pillai Peena Thanky	33
6.	Status of Women Entrepreneurship in India P.M.Sharmila	42
7.	Land use Pattern in Climatic Physiological Zones of Kerala Shijitha M, K.M.Francis and Sabu PJ	50
8.	Financial Institutions and its Role in Developing MSME'S in India in Present Context Shrikanth Ganapati Naik and Jayadatta S	58
9.	Service Quality and Patient Satisfaction – A Empirical Study on Private Healthcare Industry in Tamil Nadu K. Suresh	71
10.	तलाक के परिणामस्वरूप शिशु मन की समस्याओं का चित्रण 'आपका बंटी' उपन्यास केविशेष सन्दर्भ में तृष्णा दत्त	82
11.	Development of Environmental Principle - A Legal Study PSS Gowri Shangar and Bhagavath Harini V. J	91
12.	Challenges Faced In Marketing by Agro Producers Through Agricultural Produce Marketing Committee's: An Empirical Study From The State of Maharashtra Yogesh Khandre and U Y Memon	97
13.	Surface Coating: Another Possibility for Table Grapes Preservation J. J. Jankar, V.N. Pawar, A. K.Sharma, A.K.Sahoo and R.C.Ranveer	108

14.	Synthesis, Molecular Modeling and Anticancer Activities Against MCF-7 Cell Lines of 2-Ethoxy Chalcones: Structure-Activity And Relationship Ravi Ramlu Vidule, Madhav Marotirao Kendre, Ravindra Pramod Deshpande, Phanithi Prakash Babu, Mohammad Abdul Baseer and Laxmikant Kamble	115
15.	Effect of Eisenia Fetida Vermiwash on the Growth of Dianthus Plant Vaishali M. Bansod	128
16.	Influence of NaCl Salinity on Activity of Glutamine Synthetase (GS) and Glutamate Dehydrogenase (Gdh) in The Leaves of Crotalaria L. Species Pratima Kadam	133
17.	Dielectric Behaviour of Allyl Amine (AA) and 2-Methoxy Ethanol (2-Me), at 9.85 Ghz Microwave Frequency S.S. Meshram, A.S. Goswami-Giri, U.B. Tumberphale and P. G. Gawali	139
18.	Flora of Ethnbotanical Plants of Raigad District Mah. India Naikade Shantaram.M	153
19.	Plant Disease Defense Hormone Salicylic Acid Presence Along with Auxins in whey of Cassia Tora. L Influence on Rhizobiumgrowth with Emphasis on Cytokininsinvitro Jadhav Rajesh K, Castelino Deena And Gandhi Aditi	159
20.	Butterfly and Bird Diversity and Their Associated Habitats in Different Terrains of Kebali Village- Lower Dibang Valley and East Kameng, North East, Arunachal Pradesh, India Manisha N. Kulkarni	167
21.	Poetic Form – A Tool For Enhancing Teaching Learning Experience of Physiology Topics for Higher Secondary Students Shilpa K. Patil-Bhonde	171
22.	Aftermaths of Sand Dredging Activity on Benthic Fauna of Vaitarna River, Maharashtra, India Shilpa K. Patil – Bhonde and R. P.Athalye	177
23.	Microwave Dielectric Properties of Aqueous Solution of Polymers using Time Domain Technique M.B. Swami, P.G. Hudge and A.C. Kumbharkhane	186
24.	Novel Method for Synthesis of Non-Steroidal Anti-Inflammatory Drug- A Green Approach Rathod Kalpana R, Banerjee Shivani P and Mayur Bhamare	198
25.	Novel Method of Synthesis of Schiff Bases: An Alternative Green Approach Banerjee Shivani. P, Rathod Kalpana R and Gholap Vrushali	205

DIELECTRIC BEHAVIOUR OF ALLYL AMINE (AA) AND 2-METHOXY ETHANOL (2-ME), AT 9.85 GHZ MICROWAVE FREQUENCY

S.S. Meshram

Department of Physics
B.N.Bandodkar Science College
Thane, (MS) India

A.S. Goswami-Giri

Department of Chemistry
B.N.Bandodkar Science College
Thane, (MS) India

U.B. Tumberphale

Department of Physics
N.E.S. Science College
Nanded, (MS) India

P. G. Gawali

Department of Physics
B.S. College, Basmath, Dist. Hingoli
(MS) India

Abstract

The liquid dielectrics mainly serve as impregnates for high voltage cables, capacitors and act as heat transfer agents that is for cooling in transformers. Using Surber's technique of measuring reflection coefficient from air dielectric boundary of the liquid dielectric constant (ϵ') and dielectric loss (ϵ'') of Allyl Amine (AA) with 2-Methoxy Ethanol for different mole fractions of AA, have been measured at single microwave frequency 9.85 GHz at 30°C. Density (ρ), viscosity (η) and squared refractive index (n_D^2), including pure liquids are reported. Dielectric constant (ϵ') and Dielectric Loss (ϵ'') used to evaluate loss tangent ($\tan\delta$), molar polarization (P_{12}) and excess dielectric parameters. Dielectric and excess parameters are being used to explain the formation of complexes in the system. The intermolecular hydrogen bonding interaction between Allyl Amine (AA) AND 2-Methoxy Ethanol (2-ME), has been investigated by FT-IR spectroscopy. The information about dielectric behaviour of material gives superior understanding in the selection of solid and liquid insulating materials. These results confirm that the mixtures form hydrogen-bonded structures, which are strongly influenced by the numbers of hydroxyl groups and carbon atoms of the alcohol molecules and vary with the concentrations of the mixtures.

Keywords: Complex formation, X-band microwave bench, Allyl Amine (AA), 2-Methoxy Ethanol (2-ME)

Introduction

Dielectric analysis of binary mixtures exhibited composition and formation of complexes by interacting between the molecules. Molecules change its

characteristics when it forms the complexes. Dielectric evaluations assisted for detection of the interaction between molecules along with its orientation and thermodynamic properties¹. According to literature, researcher paid attention towards the amines as one of the constituent components in the binary mixtures and suggest the strong interaction between the alcohols and amine molecules.²⁻⁸ Bhupesh G. Nemmaniwar⁵ observed solute-solvent molecular associations in 2-chloroaniline (2CA) + 2-methoxyethanol (2ME) and 2-chloroaniline (2CA) + 2-ethoxyethanol. U.Tumberphale⁹ investigated the significant role of dielectric of binary mixtures for the multiple complex formations formation and they also proposed the strong interaction between 2-Alkoxyethanols with Aniline molecules. The formation of 1:1 complexes in ethyl methyl ketone and ethylenediamine and methyl isobutyl ketone and ethylenediamine at 9.44 GHz frequencies at 30°C⁴. The heterogeneous interaction between the unlike molecules when studied the complex permittivity spectra of 2-butoxyethanol in anilines¹⁰. When thermodynamic evaluation of the binary mixture of diisopropylamine (DIIPA) + 2-methyl-1-propanol+2-propanol and + 1-butanol evaluated, the presence of strong molecular interactions was observed between the molecules¹¹. In both systems N, N-dimethylacetamide + methanol N,N-dimethylacetamide + ethanol⁷. Multiple frequency capacitance-voltage (C-V) measurements of Allyl amine (AA) with water was carried out by Yifan Xu et al 2004¹¹. They observed that during film deposition, the insulator dielectric constant was increased by radio frequency (RF) pulsed plasma polymerization¹¹. Dielectric Constant measurements are not possible with deposited film layers, which are very thin insulating sheets sometimes used to prevent material from adhering to a mold or platen¹².

With this background, present paper is focused on the molecular interaction between binary mixtures of polar liquids. The possible formation of AA and 2-ME complex may be due to molecular association between these liquids. The aliphatic 2-ME is amphoteric in nature having (-O-) and hydroxyl (-OH-) group in the same molecule¹³ while Allyl amine is a stable organic compound and the simplest unsaturated amine having extensive pharmaceutical applications. The presence of (-O-) and (-OH-) groups in 2-ME form intra and intermolecular hydrogen bonds disturb the binary mixture condition Because ,in solid states, the amino group of aniline's derivatives has more than two absorption bands.¹⁴ In physiologically important systems, hydrogen bonding is responsible for biological activity. Hydrogen bonding is formed between functional group and an atom or group of atoms in the same or different molecules¹⁵⁻¹⁷. Hence, FTIR spectroscopic studies have been carried out on the binary mixture of AA and 2-ME. Therefore, the dielectric behaviour of 2-ME and AA mixture is given deep sense of interest to analyse the molecular interactions and the formation of complexes in the mixture.

Materials and Methods:

AR grade Allyl Amine (AA) and 2-Methoxy Ethanol (ME) from S.D fine chemicals where used without further purification.

Binary mixtures with different mole fraction of Allyl Amine in the mixture were prepared and kept for six hours in well stoppered bottles to ensure good thermal equilibrium. The density (ρ) and viscosity (η) of pure components and their mixtures were measured at room temperature by pycometer and oswals's vicometer, respectively.

The refractive indices for Sodium-D-lines were measured by Abbe's Refractometer. The Dielectric constant measurements were carried out from the X-band microwave bench of oscillating frequency 9.85 GHz using Surber's technique at 30°C¹⁸. FTIR spectra of polar mixtures in different concentration were carried out by Thermofischer Scientific Nicolet iS5.

Calculations:

The values of (ϵ') and (ϵ'') for low loss liquids are calculated according to Hestone, W. H. et al ;1950¹⁹

$$\epsilon' = \left[\frac{\lambda_0}{\lambda_c} \right]^2 + \left[\frac{\lambda_0}{\lambda_d} \right]^2 \text{ ----- (1)}$$

$$\epsilon'' = \frac{2}{\pi} \left[\frac{\lambda_g}{\lambda_d} \right] \left[\frac{\lambda_0}{\lambda_d} \right]^2 \left[\frac{\partial \rho}{\partial n} \right] \text{ ----- (2)}$$

The free energy of activation E_a is obtained using relation²⁰

$$\eta = \frac{hN}{V} e^{\frac{E_a}{RT}} \text{ ----- (3)}$$

Where,

η is viscosity and V is molar volume of the liquids.

And Molar polarization were obtained using²¹

$$P_{12} = \left(\frac{\epsilon' - 1}{\epsilon' + 2} \right) \left[\frac{M_1 x_1 + M_2 x_2}{\rho} \right] \text{ ----- (4)}$$

The excess parameters are calculated by the formula defined by

$$\Delta Y = Y_m - (X_1 Y_1 + X_2 Y_2) \text{ ----- (5)}$$

Where,

ΔY -Excess parameter and Y_m Dielectric parameters for mixture.

The subscripts m , 1 and 2 represents mixture, component 1 and component 2 respectively.

X_1 and X_2 is mole fraction of the 2 components.

The values of Mole fraction (x) of Allyl Amine AA and (X_B) 2-ME, density (ρ), refractive index (n), dielectric constant (ϵ'), dielectric loss (ϵ''), loss tangent ($\tan \delta$), activation Energy (E_a) and molar polarization (P_{12}) for binary mixture measured at 30°C which is represented in Table-1.

The excess dielectric parameters provide significant information regarding interaction between the polar-polar liquid mixtures. The values of Mole fraction (x) of Allyl Amine AA and 2-ME and its binary mixtures, excess parameter like dielectric constant ($\Delta\epsilon$), dielectric loss ($\Delta\epsilon''$), loss tangent ($\Delta\tan\delta$), activation Energy (ΔE_a) and molar polarization (ΔP_{12}) for binary mixture at 30°C were reported in Table 2. The feasible associations between AA-solvent and 2-ME-2-ME molecules exhibited different prospective which is completely absent in pure state of liquids. With the aid of excess values, the deviations from ideal behaviour are articulated by different parameters such as dielectric constant and refractive index.

Table-1 Mole fraction (X_A) of Allyl Amine AA and (X_B) 2-ME and its binary mixture, density (ρ), refractive index (n), dielectric constant (ϵ'), dielectric loss (ϵ''), loss tangent ($\tan\delta$), activation Energy (E_a) and molar polarization (P_{12})

X_A	X_B	Density ρ	Viscosity η cp	ϵ'	ϵ''	$\tan \delta$	P_{12} cm ³ /mole	E_a Kcal/mole	N_D^2
0	1	0.9591	1.52246	9.06152	0.79940	0.08822	57.82596	3.40644	1.97240
0.1317	0.8698	0.9403	1.47475	9.49182	0.90874	0.09574	57.63767	3.38729	2.00070
0.2578	0.7422	0.9157	1.33396	8.47029	0.77287	0.09124	54.93758	3.32687	1.98370
0.3847	0.6153	0.8854	1.18454	8.28683	0.42953	0.05183	54.54411	3.25550	1.99787
0.5103	0.4897	0.8464	1.01818	7.77268	0.76413	0.09831	54.05569	3.16436	1.99795
0.6346	0.3654	0.8302	0.77051	7.93830	0.96538	0.12161	53.75659	2.99650	2.00075
0.7576	0.2424	0.8038	0.6068	7.61249	1.06539	0.13995	52.28085	2.85251	1.31442
0.8794	0.1206	0.7897	0.53120	6.88519	1.01215	0.14700	49.67696	2.77238	2.02069
1	0	0.7610	0.41301	6.38018	1.02394	0.16049	48.45093	2.62083	2.01785

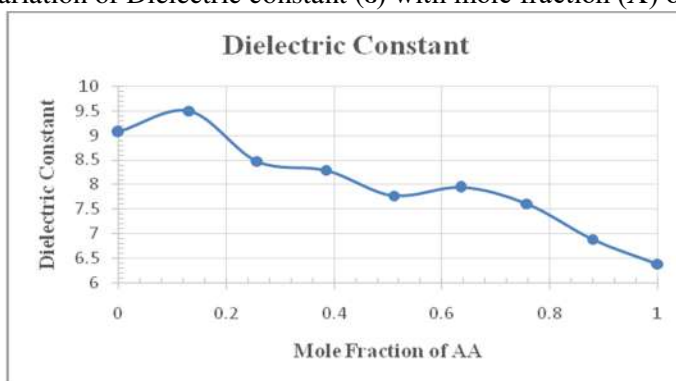
Table-2 Mole fraction (x) of Allyl Amine AA and 2-ME, excess parameter like dielectric constant ($\Delta\epsilon$), dielectric loss ($\Delta\epsilon''$), loss tangent ($\Delta \tan \delta$), activation Energy (ΔE_a) and molar polarization (ΔP_{12}) for binary mixture at 30⁰ C.

X_A	X_B	$\Delta \eta$	$\Delta\epsilon$	$\Delta\epsilon''$	$\Delta \tan \delta$	ΔP_{12}	ΔE_a
0	1	0	0	0	0	0	0
0.1317	0.8698	0.0975	0.7780	0.0793	-0.0021	1.0512	0.0823
0.2578	0.7422	0.1032	0.1000	-0.0844	-0.0156	-0.3942	0.1230
0.3847	0.6153	0.0889	0.2568	-0.4563	-0.0642	0.4401	0.1508
0.5103	0.4897	0.0619	0.0794	-0.1499	-0.0268	1.1669	0.1588
0.6346	0.3654	-0.0480	0.5785	0.0235	-0.0125	2.0704	0.0886
0.7576	0.2424	-0.0824	0.5825	0.0958	-0.0032	1.7847	0.0412
0.8794	0.1206	-0.0192	0.1817	0.0153	-0.0048	0.3591	0.0568
1	0	0	0	0	0	0	0

Result and Discussion

The density, viscosity, molar polarization and activation energy are decreasing with increase in mole fraction of Allyl Amine in the binary mixture. Density of pure AA is less than that of pure 2-ME. The variation of Dielectric constant (ϵ) with mole fraction (X) of AA in the mixture is depicted in figure1. Dielectric constant non-linearly increases with decrease minima by increased mole fraction of AA, which suggest formation of the hydrogen bonded complex.²²

Figure 1 Variation of Dielectric constant (ϵ) with mole fraction (X) of AA



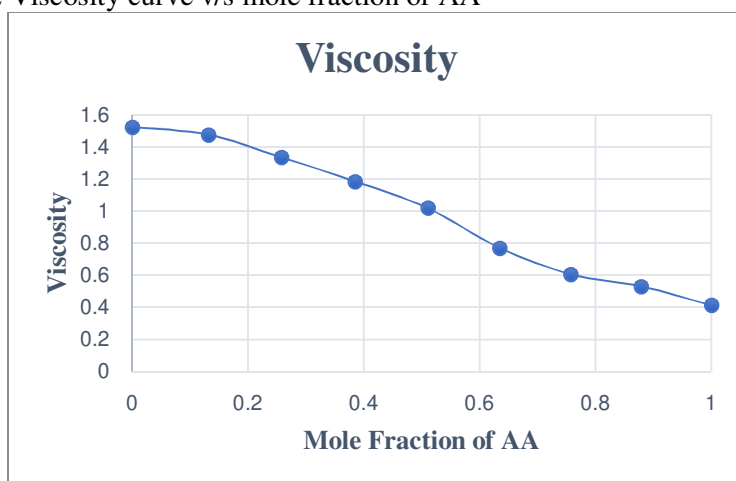
The ϵ value exhibited in decreasing wave format by increase in AA concentration. The ϵ values proliferated initially when added AA and reaches to a maximum at approximately $X=0.1317$, AA mole fraction with minimum at $X=0.5103$, followed by maximum at $X=0.6346$ and then declining. The

mixture, ϵ values are significantly lower compared to the ϵ values of 2-ME at low AA concentration range, showing stronger hetero-association than the self-association in alcohol molecules. The dielectric constant varies non-linearly as a function of amine concentration in binary systems, due to H-bond interaction between the mixture constituents.

Though Allyl Amine and 2-ME has equal number of carbon atom in their molecular structure, the dielectric constant decreases non-linearly with the increase in the mole fraction of AA. Pure 2-ME has higher dielectric constant. However, R.J. Sengwa (2006)²³ reported that equal number of the carbon atoms in molecular structure of different molecules with hydroxyl groups having high dielectric constant.

According to Figure 2, Viscosity curve indicates that due to solute-solvent interaction, viscosity decreases with increase in the mole fraction of AA²⁴. The formation of associates compared with the composition range of the binary mixture is held together by comparatively lesser intermolecular dipole-dipole interactions in the complex.

Figure 2 Viscosity curve v/s mole fraction of AA



The variation of dielectric loss and loss tangent figure (3) and figure (4) with mole fraction of AA shows the 2 maxima (λ_{\max}) and single minima is at $X=0.3847$. In case of 2, 3 DCA + 2EE and aniline + 2-Aloxyethanol, the formation of adduct complex is also at the minima. The wobbling nature of the mixture may be due to $-O-$ and $-OH$ group in 2-ME results in multiple complexions²⁵⁻²⁷.



Figure 3 variation of dielectric loss v/s mole fraction of AA

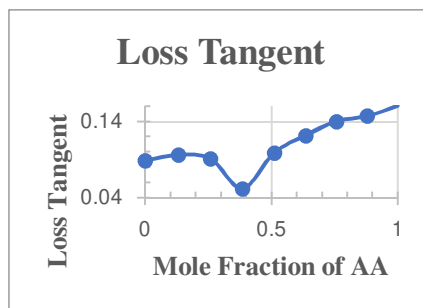
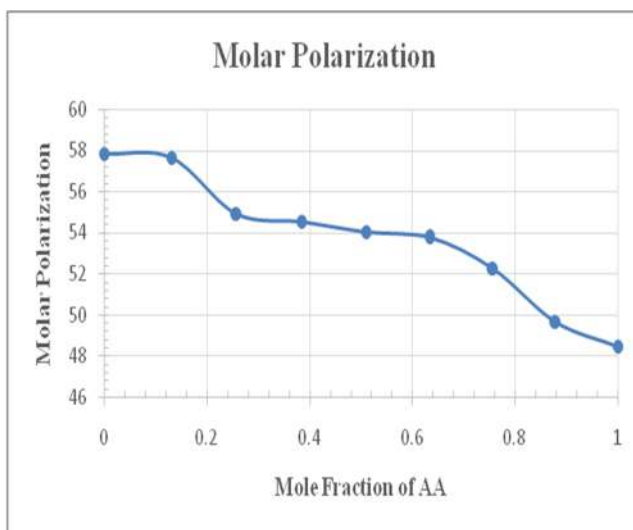


Figure 4 loss tangent v/s mole fraction of AA

Non-linear decrease in molar polarization (figure 5) indicates that the degree of polarity of the solution decreases with increase in mole fraction of AA. Molar polarization is representing 2 regions at high and low concentration. The intersection of the straight line represents separate regions that indicates the point of concentration in which maximum formation of complex at $X=0.3847$ mole fraction of AA¹⁸. The variation of excess dielectric constant $\Delta\epsilon$ nonlinearly decreases with minima at $X=0.5103$.

Figure 5 Molar polarization v/s Mole fraction of AA



Excess Parameters

The excess dielectric constant $\Delta\epsilon$, excess dielectric dielectric loss ($\Delta\epsilon''$), loss tangent ($\Delta \tan \delta$), excess activation Energy (ΔE_a) and excess molar polarization (ΔP_{12}) values of pure and binary mixtures of AA and 2-ME are calculated for various mole fractions at room temperatures. The excess dielectric constant $\Delta\epsilon$ indicates the strength and nature of intermolecular interactions in binary liquid mixtures. Observation of variation of the excess dielectric constant ($\Delta\epsilon$) of AA with 2ME binary mixtures are positive and less in magnitude. According to Ch. V. V. Ramana²⁸, dielectric constant ($\Delta\epsilon$) > 0 indicates that there is an increase in number of effective dipoles contributed in the mixture dielectric polarization, results in formation multimers and dimmers. The positive excess dielectric constant ($\Delta\epsilon$), figure (6) also suggest that the effective number of dipoles in the mixture might be greater than the corresponding average number in the pure liquids, probably due to the creation of new structure leading to a higher macroscopic permittivity^{29,30}

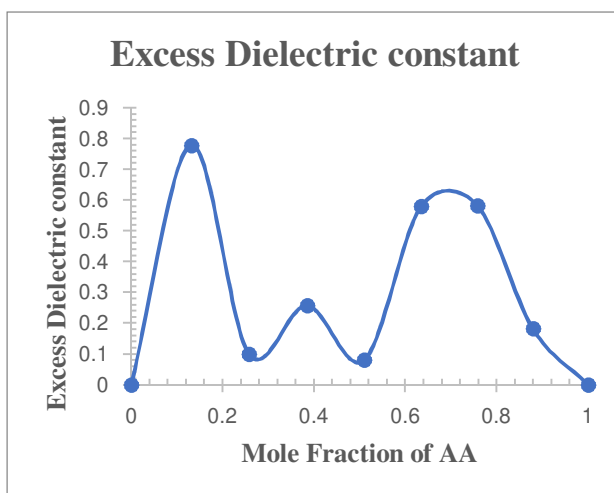


Figure 6 The variation of excess dielectric constant $\Delta\epsilon$ with mole fraction of AA+2-ME

The variation of excess dielectric loss ($\Delta\epsilon''$) is observed in figure 7 showing negative for the low molar concentration region and positive for the high molar concentration region of AA showing minima at $X=0.3847$. The dielectric loss is regarded due to molecular motion which is governed by the complex forces of molecular interactions. Variation in excess loss tangent figure 8 supports this showing minima at $X=0.3847$ and is negative for entire molar concentration region of AA.

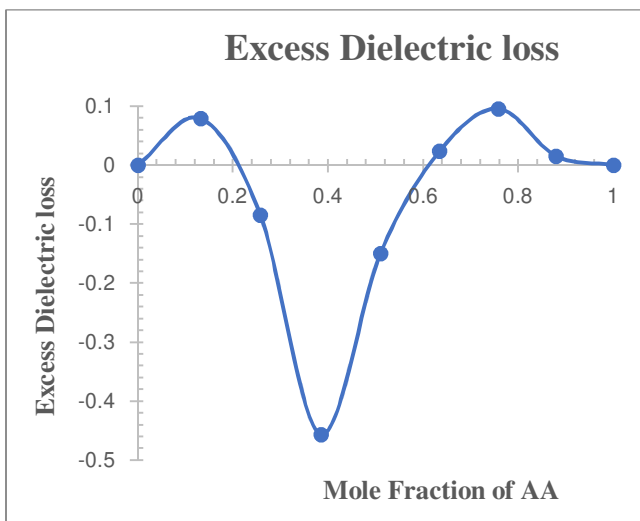


Figure 7 Excess dielectric loss ($\Delta\epsilon$) with mole fraction of AA+2-ME

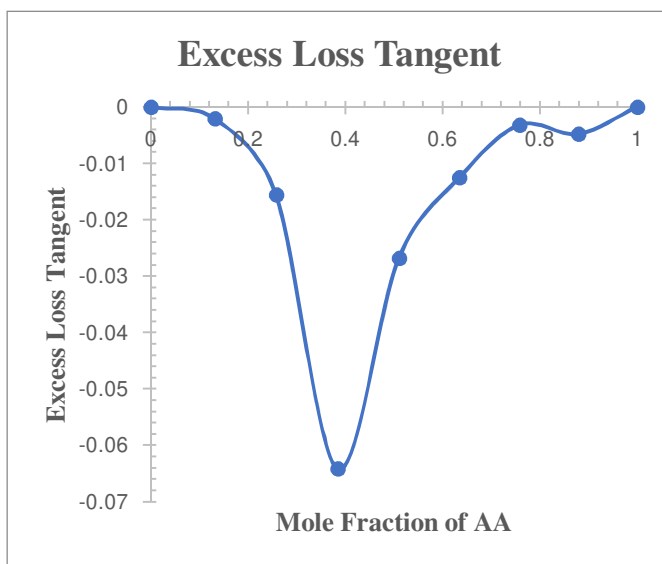


Figure 8 Excess loss tangents with mole fraction of AA+2-ME

According to Solimo and Riggio³¹ positive values of excess viscosity due to strong specific interaction causes complex formation and negative value of

excess viscosity are observed for system of different molecular size in which the dispersion forces are dominant.

Excess viscosity figure 9, is initially positive upto $X=0.5103$ and later on becomes negative as the mole fraction AA increases. This may be due to strong specific interaction and system of different molecular size in which the dispersion forces are dominant giving an estimation of the intermolecular interaction³².

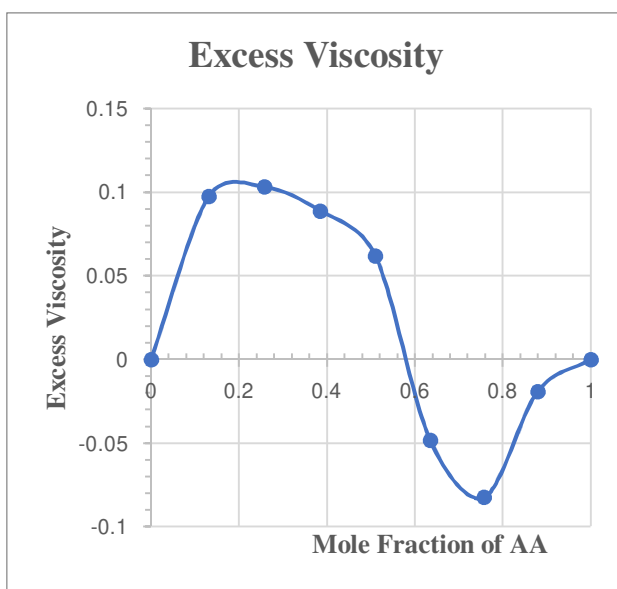


Figure 9 Excess viscosity v/s mole fraction AA+2-ME

Excess Activation energy ΔE_a , noted in figure 10 is positive indicating strong interaction between AA and 2-ME molecules. Maxima occur at about $X=0.3847$ and $X=0.5103$. $\Delta \epsilon$ designates that there is a strong interaction between solute and solvent^{9, 33}. The similar was observation were noted in case of propane diol (PD) and Etyhylene diamine (EDA) molecules³².

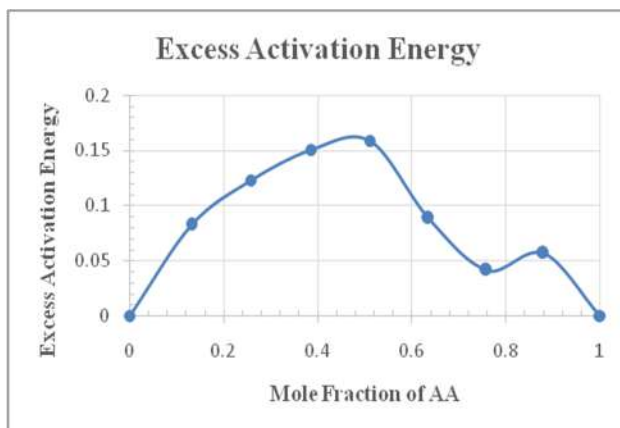
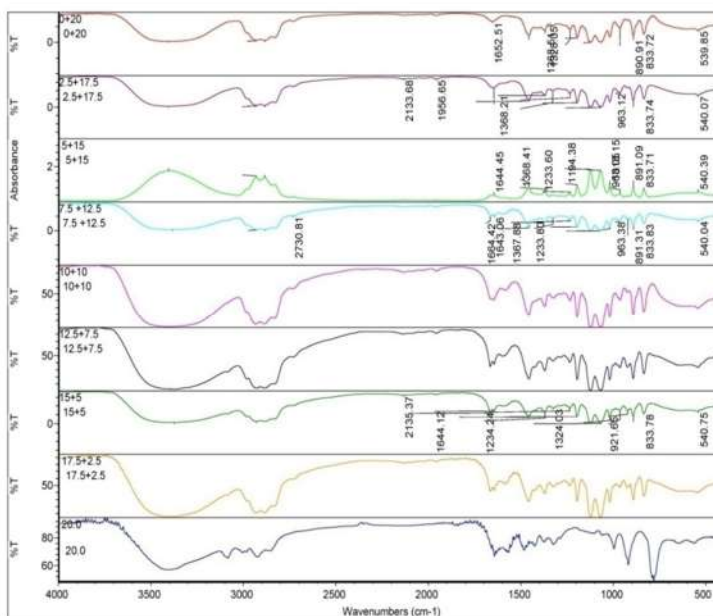


Figure 10 The Plot of excess activation energy (ΔE_a) with mole fraction of AA+2-ME

FT-IR Spectral Analysis

The figure 11 shows the FT-IR spectra of AA in 2-ME at room temperature between 3000 cm^{-1} and 3800 cm^{-1} , in the range of the hydroxyl stretching vibration, these spectra strongly influenced by H-bonding. Small variation in frequency shift is observed indicating solute – solvent interaction. No significant change in the hydroxyl group bands with various concentrations, the spectrum is a strong indication of intra molecular (internal) hydrogen bonding³⁴. Lump at 2730.81 cm^{-1} gradually disappeared at $X=0.3847$ indicating complex formation. In the absence of 2-ME, characteristic carbonyl band has been observed at 1652 cm^{-1} by increasing concentration of 2-ME decreases the intensity of the original band. The bands due to linear bonded methoxy CO is observed in the 2000–2170 cm^{-1} . The bands observed at 1956 cm^{-1} is due to the formation of intermolecular bond between AA and 2ME. New band appear at the frequency of 1643.08 cm^{-1} when the concentration of AA is higher. This behavior indicates the existence of 1:1 and 1:2 complexes³⁵, observed the same behavior of p-chlorophenol in carbon tetrachloride at 25°C. Characteristic carbonyl band has been observed at 1664-1641 cm^{-1} that is in the range of 1500 and 1750 cm^{-1} of the carbonyl stretching vibration. The Fourier-transform infrared spectroscopy (FTIR) analysis of AA+2-ME proved the presence of amines, alcohols, Nitro compounds, carboxylic acids, esters, ethers and hydroxyl group. The spectrum clearly indicates multiple functionality, occurring mutual interaction.³⁶

Figure 11 FTIR Spectra of AA and 2-ME at various concentration (0+20, 2.5+17.5, 5+15, 7.5+12.5, 10+10, 12.5+7.5, 15+5, 17.5+2.5 and 20+0)



Conclusions

Values of dielectric parameter, viscosity, activation energy have been reported for different mole fractions of AA. Dielectric loss, loss tangent, excess parameters like excess dielectric loss ($\Delta\epsilon$), excess loss tangent suggests possibility of complex formation at $X=0.3847$ and $X=0.5103$ which is confirmed by the molar polarization curve. Excess activation energy indicates strong interaction between unlike molecules. The molar polarization curve and FTIR suggests approximately 1:2 type complex formations in the mixture. This positive excess permittivity of the mixtures also suggests any significant intermolecular interaction is effectively present at room temperature.

The FTIR spectra of binary mixture have been recorded and analyzed which clearly indicates multiple functionality, occurring mutual interaction between AA and 2-ME. The above evaluation is advances in biomedical, pharmaceutical and industrial application.

Acknowledgement:

The authors are greatly thankful to N.E.S. Science College, Nanded-431605, Maharashtra India for providing laboratory facilities, support and B N Bhandarkar College of Science, Thane for providing FTIR facility.

Declaration of interest statement:

We wish to confirm that there are no known conflicts of interest associated with

this publication and there has been no significant financial support for this work that could have influenced its outcome.

References

1. Bhupesh Nemmaniwar , Vijaykumar Panchalb , Potaji Kadam Dielectric Behavior of Binary Mixture of 2, 3-Dichloroaniline with 2-Methoxyethanol at 200 C International Journal of Sciences: Basic and Applied Research (IJSBAR) (2014) Volume 17, No 2, pp 183-195)
2. Chelliah N and Sabesan R, Indian J. Pure Appl. Phys. 32 (1994) 425 .
3. Tripathy S, Roy G S and Swain B B Indian ,J. Pure Appl. Phys. 31(1993) 828 .
4. Singh P J and Sharma K S , Pramana – J. Phys. 46 (1996)259.
5. Bhupesh G. Nemmaniwar, Namdeo V. Kalyankar and Potaji L. Kadam ,Orbital Elec. J. Chem. 5 (1): (2013) 1.
6. P. Jeevanandham, S. Kumar, P. Periyasamy, A. C. Kumbharkhane, Adv. Phys. Chem. (2014) 1.
7. F. Hevia, A. Cobos, J. A. Gonzalez, I. G. de la Fuente, L. F. Sanz, J. Chem. Eng. Data 61 (2016) 1468.
8. K. L. Pattebahadur, P. B. Undre, A. G. Mohod, S. D. Deshmukh, S. S. Patil, P. W. Khirade, Ferroelectrics 519 (2017) 23.
9. U. Tumberphale, R. Kawale, B. Narwade, N. Pawar, G. Karhale and G. Kalamse, International Journal of Physics and Mathematical Sciences Vol. 2 (2), (2012) 28-32.
10. Gyan Prakash Dube and Krishna Kumar J. Chem. Eng. Data 2016, 61, 6, 1967-1980
11. Yifan Xu, Paul R. Berger, Jai Cho & Richard B. Timmons Capacitance-voltage characterization of pulsed plasma polymerized allylamine dielectrics for flexible polymeric field effect transistors Journal of Electronic Materials volume 33, pages 1240–1247 (2004)
12. Huan L. Lee (2017) Dielectric Constant measurements are not possible with deposited film layers, which are very thin insulating sheets sometimes used to prevent material from adhering to a mold or platen (Huan L. Lee The Handbook of Dielectric Analysis and Cure Monitoring Ambient Technologies © 2017 by Ambient Technologies LLC)
13. Alejandre AG, Larrubia MA, Ramirez J, Basla G, Vibrational spectroscopy, 41, (2006) 42.
14. Ramaekers R, Mas G, Adamoncz L, Dkhissi A, J. Mol. Struct., , 560, (2001) 205.
15. B. G. Nemmaniwar Ahmed Hemida Journal of Engineering Research and Application www.ijera.com Vol. 8(12), (2018), 51.
16. A. P. Maharolkar, Y. Sudkes, S. Kamble, N. D. Tidar, A. G. Murugkar, S. S. Patil, P. W. Khirade, and S. C. Mehrotra, Int. J. Chem., 2(2), (2010), 250.
17. R. J. Sengwa, Indian journal of pure and applied physics vol 41, (2003) 295
18. P. J. Singh and K. S. Sharma Pramana Journal of Physics Volume 46, (4), (1996), 259.
19. Heston, W. H.; Franklin, A. D.; Hennely, E. L.; Smyth, C. P. J. Am. Chem. Soc. 1950, 72, 3443
20. Fort R J and Moor W R, Trans Faraday Soc., 62, (1966) 1112.



21. BG Lone; PB Undre; SS Patil; PW Khirade and SC Mehrotra, J. Mol. Liq. 141,(2008) 47.
22. VV Navarkhele; MK Bhanarkar, J. Physics and Chemistry of Liquids, 48,(2010) 89
23. R.A. Meyers. John Coates Coates Consulting, Newtown, USA Interpretation Of Infrared Spectra, A Practical Approach Encyclopedia of Analytical Chemistry (Ed.) Copyright Ó John Wiley & Sons Ltd,1-23
24. R.J.Sengwa, Madhvi, Abhilasha and Sonu Sankhala Indian Journal of pure and applied physics.Volume 44,(2006), 942.
25. Mallick and M Malathi Indian journal of Physics. <https://doi.org/10.1007/s12648-018-1225-1>
26. Kinart C M and Klimczak M, J Mol Liq., 2009, 148(2-3), 132-139;DOI:10.1016/j.molliq.2009.07.009,
27. Bhupesh Nemmaniwar and Pothaji Kadam*Chemical Science Transactions DOI:10.7598/cst2014.839 2014, 3 (3), 995-1000
28. Ch. V. V. Ramana,1 A. B. V. Kiran Kumar,2 M. Ashok Kumar,3 and M. K. Moodley1 Hindawi Publishing Corporation Journal of Chemistry Volume 2013, Article ID 687106, 4 pages <http://dx.doi.org/10.1155/2013/687106>
29. BG Lone; PB Undre; SS Patil; PW Khirade and SC Mehrotra, J. Mol. Liq. 141,(2008) 47.
30. VV Navarkhele; MK Bhanarkar, J. Physics and Chemistry of Liquids, 48,(2010) 89
31. Solimo H N, Riggio R, Davolio F and Katz, Can J Chem., 1975, 53, 1258-1262.
32. Rekha Pande and G.M.Kalmase Int. J. Chem .Sci 3(1),2005,155-160.
33. N. P. Pawar, U. B. Tumberphale, R. S. Kawle, V. G. Kalamse and A. G. Chavan. Bionanofrontier, Vol.8(3), (2015), 315.
34. R.A. Meyers. John Coates Coates Consulting, Newtown, USA Interpretation Of Infrared Spectra, A Practical Approach Encyclopedia of Analytical Chemistry (Ed.) Copyright Ó John Wiley & Sons Ltd,1-23
35. P. Krishnamurthi P., Ramalingam H. B. and *Raju K Pelagia Research Library. ISSN: 0976-8610 CODEN (USA): AASRFC. Advances in Applied Science Research, 6(12) (2015)44.
36. A. Anis Fathima spectroscopic studies on molecular interactions in binary liquid mixtures a.anis fathima madurai kamaraj university May 2008 synopsis of the thesis submitted to madurai kamaraj university in partial fulfilment of the requirements for the degree of doctor of philosophy in physics