RESEARCH

2016-2017

THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS), SIVAKASI – 626 123.

(Affiliated to Madurai Kamaraj University, Re-accredited with A Grade by NAAC,
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

Title of the Collaborative Activity : Paper Publication

Ionics
DOI 10.1007/s11581-017-2052-7

ORIGINAL PAPER

Lithium ion-conducting polymer electrolytes based on PVA–PAN doped with lithium triflate

F. Kingslin Mary Genova[1,2,3] · S. Selvasekarapandian[3] · N. Vijaya[2] · S. Sivadevi[2] · M. Premalatha[3] · S. Karthikeyan[4]

Received: 30 August 2016 / Revised: 1 February 2017 / Accepted: 26 February 2017

Abstract Blend polymer electrolytes with optimized composition (92.5 PVA:7.5 PAN) doped with lithium triflate ($LiCF_3SO_3$) have been prepared in different concentrations by solution casting technique, using DMF as solvent. The prepared electrolytes have been characterized by XRD, FTIR, DSC, AC impedance, and SEM techniques. The complex formation between the blend polymer and the salt has been confirmed by X-ray diffraction and FTIR analyses. Differential scanning calorimetry thermogram has shown a decrease in glass transition temperature with the addition of salt. It has been observed that the ionic conductivity of the doped blend polymer electrolyte increases as the salt concentration increases. The ionic conductivity has been found to be 4.0×10^{-5} S cm^{-1} for 92.5 PVA:7.5 PAN:50 M wt% $LiCF_3SO_3$ sample at room temperature. The temperature dependence of ionic conductivity has been studied with Arrhenius plot and the activation energies have been calculated. Primary lithium ion battery has been constructed with the configuration Zn + $ZnSO_4$ $7H_2O$/ 92.5 PVA:7.5 PAN:50 M wt% $LiCF_3SO_3$/ PbO_2 + V_2O_5 using the maximum conducting blend polymer, and its discharge characteristics have been studied.

Keywords Blend polymer · Lithium ion · XRD · FTIR · DSC

Introduction

Lithium ion-conducting polymer electrolytes with high ionic conductivity have been of great interest owing to their applications in electrochemical devices such as battery, fuel cells, supercapacitors, electrochromic displays, etc. [1]. Developing new lithium ion-conducting polymer electrolyte having higher ionic conductivity, mechanical strength, lower cost, etc. has been an important issue. Over the past few years, the blending of polymers has been intensively investigated. Many blend polymer electrolyte systems have been studied and reported in the literature [2–5]. PVA is a semicrystalline and biodegradable polymer containing a hydroxyl group attached to methane carbons which can be a source of hydrogen bonding. It has excellent film-forming nature, high tensile strength, and flexibility. PAN is a semicrystalline polymer having high strength and modulus of elasticity. It is a resinous, fibrous, or rubbery organic polymer which possess good mechanical strength. Its excellent mechanical properties are important in composite structures for military and commercial aircrafts. When these two polymers are mixed, the interactions between PVA and PAN are expected to occur through inter-chain hydrogen bonding between the hydroxyl group of PVA and nitrile group of PAN. This mixing of two polymers avails more number of polar groups for attachment of ions.

$LiCF_3SO_3$ is an impressive salt with a high acid strength, exhibiting great charge delocalization favorable to ionic dissociation in a solvating polymer matrix. When $LiCF_3SO_3$ is added to the polymer complex, the

This paper has been presented at the 15th Asian Conference on Solid State Ionics, November 27–30, 2016, Patna, India

✉ S. Selvasekarapandian
sekarapandian@rediffmail.com

[1] Research and Development Centre, Bharathiar University, Coimbatore, Tamil Nadu, India
[2] Department of Physics, The S.F.R. College for Women, Sivakasi, Tamil Nadu, India
[3] Materials Research Centre, Coimbatore, Tamil Nadu -641 045, India
[4] Department of Physics, Madras Christian College, Chennai, Tamil Nadu, India

Published online: 20 March 2017

Applied Polymer SCIENCE

Biopolymer agar-agar doped with NH_4SCN as solid polymer electrolyte for electrochemical cell application

S. Selvalakshmi,[1] N. Vijaya,[1] S. Selvasekarapandian,[2] M. Premalatha[2]
[1]Department of Physics, S.F.R. College for Women, Sivakasi, Tamil Nadu 626123, India
[2]Materials Research Center, Coimbatore, Tamil Nadu 641045, India
Correspondence to: S. Selvasekarapandian (E-mail: sekarapandian@rediffmail.com)

ABSTRACT: A new polymer electrolyte based on the biopolymer Agar-Agar doped with ammonium thiocyanate (NH_4SCN) has been prepared and characterized by FTIR analysis, X-ray diffraction measurements, AC impedance spectroscopy, transference number measurements, and DSC analysis. The Fourier transform infrared analysis confirms the complex formation between agar and NH_4SCN. The amorphous nature of the polymer electrolyte has been revealed from X-ray diffraction analysis. The highest ionic conductivity has been observed for the sample of composition 1:1 between Agar and NH_4SCN. As a function of temperature, the ionic conductivity of this sample exhibits Arrhenius behavior increasing from 1.03×10^{-3} S cm^{-1} at ambient temperature to 3.16×10^{-3} S cm^{-1} at 343 K. The transference number has been estimated by the dc polarization method, and it has been proven that the conducting species are predominantly cations. Using the highest conductivity polymer electrolyte, solid state electrochemical cell has been fabricated and cell parameters are reported. © 2017 Wiley Periodicals, Inc. J. Appl. Polym. Sci. **2017**, *134*, 44702.

KEYWORDS: amorphous; biodegradable; dielectric properties; differential scanning calorimetry; glass transition

Received 8 January 2016; accepted 7 November 2016
DOI: 10.1002/app.44702

INTRODUCTION

A significant change is occurring in the global polymer industries. Development of a new generation of biobased polymers, polymers derived from renewable resources, is progressing rapidly. In this polymers-based world, there are many applications for energy generation and storage where plastics are used with fabrication and are not eco-friendly. The widespread usage of such products has produced toxic pollution. The commercial batteries and electronic devices that we use today employ electrolytes which are high in conductivity, but are hazardous and nonbiodegradable, resulting in a great menace to the environment and living species.[1] Since two decades, different polymeric electrolyte systems have been extensively studied and most of them are based on poly(ethylene oxide),[2] poly(vinyl pyrrolidone),[3] poly(vinyl alcohol) (PVA),[4] poly(acrylonitrile),[5] poly(methyl methacrylate),[6] poly(vinyl chloride),[7] and other synthetic polymers.

Recently, researchers all over the world have started focusing on proton conducting polymer electrolyte for energy storage devices.[8–11] Additionally, they have started to prepare eco-friendly biodegradable biobased polymer electrolytes.[12–15] The biobased polymers are the polymers derived from the naturally occurring renewable sources. These bio-based polymer electrolytes are electrically efficient, cost-effective, and eco-friendly. These advantages have made the biobased polymer electrolytes a promising substitute for synthetic polymers in fuel cells. These electrolytes are also used in solid state devices, electrochromic devices and dye sensitized solar cells.[16]

Among natural polymers, polysaccharides are the best candidates due to their film forming capability and abundance in nature.[17] Starch, cellulose, chitosan, and agar-agar are some of the natural polymers. Noor and Isa[18] have reported proton conductivity value of 6.48×10^{-5} S cm^{-1} for carboxymethyl cellulose doped with ammonium thiocyanate. Khiar and Arof[19] have reported conductivity value of $3.89 \pm 0.79 \times 10^{-5}$ S cm^{-1} for Starch/Chitosan-NH_4NO_3 polymer electrolyte. Ng and Mohamad[20] have presented proton conductivity value of $9.93 \pm 1.90 \times 10^{-5}$ S cm^{-1} for plasticised Chitosan doped with NH_4NO_3. Proton conductivity value of 1.02×10^{-3} S cm^{-1} for Cellulose acetate/NH_4NO_3 has been reported by Monisha *et al.*[21] Biopolymer electrolyte based on Cellulose acetate in combination with NH_4SCN exhibiting proton conductivity of 3.31×10^{-3} S cm^{-1} has been reported by Monisha *et al.*[22] The loosely bound proton of the ammonium ion is responsible for conductivity in these polymer complexes. It is observed that the ionic radii of NO_3^- and SCN^- are 1.96 Å and 1.93 Å, respectively, with meagre difference and hence doping

Journal of Non-Crystalline Solids 433 (2016) 131–140

Contents lists available at ScienceDirect

Journal of Non-Crystalline Solids

journal homepage: www.elsevier.com/locate/jnoncrysol

Review

Investigations on proton conducting biopolymer membranes based on tamarind seed polysaccharide incorporated with ammonium thiocyanate

M. Premalatha [a,b], T. Mathavan [a,*], S. Selvasekarapandian [b,*], S. Monisha [a,b], D. Vinoth Pandi [c], S. Selvalakshmi [b,d]

[a] Research Department of Physics, N.M.S.S. Vellaichamy Nadar College, Madurai, Tamilnadu 625 019, India
[b] Materials Research Center, Coimbatore, Tamilnadu 641 045, India
[c] Department of Physics, Coimbatore Institute of Technology, Coimbatore, Tamilnadu 641 014, India
[d] The Standard Fireworks Rajaratnam College for Women, Sivakasi, Tamilnadu 626 123, India

ARTICLE INFO

Article history:
Received 5 July 2016
Received in revised form 23 August 2016
Accepted 6 October 2016
Available online xxxx

Keywords:
Biopolymer
Proton conducting membranes
Ionic conductivity
TNM measurement
Electrochemical device applications

ABSTRACT

Naturally available materials such as biopolymers and polysaccharides have gained much attention in the development of polymer electrolytes due to its biodegradability, film forming nature and non-toxicity. The proton conducting biopolymer membranes have been prepared by polysaccharides, tamarind seed polysaccharide (TSP) with different concentrations of ammonium thiocyanate (NH_4SCN) as dopant. Distilled water has been used as a solvent and solution casting technique has been employed to prepare the biopolymer membranes. The prepared biopolymer membranes have been characterized by different techniques such as X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy, differential scanning calorimetry (DSC), AC-impedance spectroscopy and transference number measurement (TNM). From XRD results, the crystalline or amorphous nature of the biopolymer membranes with increasing salt concentration (NH_4SCN) has been studied. The complex formation between the biopolymer-TSP and NH_4SCN has been investigated by FTIR analysis. The glass transition temperature of the prepared biopolymer membranes has been found using DSC technique. The highest conductivity is 2.85×10^{-4} S cm^{-1} for the composition of 1 g TSP: 0.4 g NH_4SCN at ambient temperature, which has been obtained by AC-impedance spectroscopic studies. The conduction of ions within the biopolymer membrane has been confirmed by TNM. The primary proton battery has been constructed with the highest conducting membrane 1 g TSP: 0.4 g NH_4SCN. Its open circuit voltage is 1.51 V. The discharge characteristics of the battery for a load 1 MΩ has been explained. The present investigation confirms that the NH_4SCN doped TSP biopolymer membrane has got the essential properties required for the electrochemical device applications.

Contents

* Corresponding authors.
E-mail addresses: tjmathavan@gmail.com (T. Mathavan), sekarapandian@rediffmail.com (S. Selvasekarapandian).

http://dx.doi.org/10.1016/j.jnoncrysol.2016.10.008
0022-3093/

Ionics
DOI 10.1007/s11581-016-1852-5

ORIGINAL PAPER

Proton-conducting biopolymer electrolytes based on pectin doped with NH_4X (X=Cl, Br)

N. Vijaya[1] · S. Selvasekarapandian[2] · M. Sornalatha[2] · K.S. Sujithra[2] · S. Monisha[2]

Received: 30 August 2016 / Revised: 25 September 2016 / Accepted: 29 September 2016

Abstract Research has been undertaken to develop polymer electrolytes based on biodegradable natural polymers such as cellulose acetate, starch, gelatin, and chitosan, which are being used as polymer hosts for obtaining new polymer electrolytes for their applications in various electrochemical devices such as batteries, sensors, and electrochromic windows. Pectin is a naturally available material which is extracted from the skin of citrus fruits. Pectins, also known as pectic polysaccharides, are rich in galacturonic acid. The present study focuses on the proton-conducting polymer electrolytes based on the biopolymer pectin doped with ammonium chloride (NH_4Cl) and ammonium bromide (NH_4Br) prepared by solution casting technique. The prepared membranes are characterized using XRD, FTIR, and AC impedance techniques to study their complexation behavior, amorphous nature, and electrical properties. The conductivity of pure pectin membrane has been found to be 9.41×10^{-7} S cm^{-1}. The polymer systems with 30 mol% NH_4Cl-doped pectin and 40 mol% NH_4Br-doped pectin have been found to have maximum ionic conductivity of 4.52×10^{-4} and 1.07×10^{-3} S cm^{-1}, respectively. The conductivity value has increased by three orders of magnitude compared to pure pectin membrane. The dielectric behavior of both the systems has been explained using dielectric permittivity and electric modulus spectra.

Keywords Biopolymer · Polymer electrolyte · Amorphous · Ionic conductivity · Dielectric permittivity

✉ S. Selvasekarapandian
sekarapandian@rediffmail.com

[1] Department of Physics, The S.F.R. College for Women, Sivakasi, Tamil Nadu 626123, India

[2] Materials Research Center, Coimbatore, Tamil Nadu 641045, India

Published online: 12 October 2016

Introduction

Polymer electrolytes play an important role as solid electrolyte in solid state devices. Polymer electrolytes have several advantages over their liquid counterparts such as reduced weight, no internal shorting, no leakage of electrolyte and non-combustible reaction products at the electrode surface, mechanically stable, and very flexible for packaging. An extensive research has been carried out to develop polymer electrolytes with appreciable ionic conductivity at room temperature, good mechanical and thermal stability in order to utilize them for solid state applications. Most of the polymer electrolytes have been developed using synthetic polymers such as poly(ethyleneoxide) (PEO), poly(vinyl alcohol) (PVA), poly(vinyl pyrrolidone) (PVP), and poly(ethylene glycol) (PEG) for their applications in various electrochemical devices. Proton-conducting polymer electrolytes have their possible applications in various electrochemical devices such as batteries, fuel cells, supercapacitors, and electrochromic windows [1–4]. Recently, research is being undertaken to produce products from naturally available materials to avoid the environmental issues in the field of polymer electrolytes. Biodegradable natural polymers that have already been used among others are polysaccharides like cellulose acetate [5, 6], starch [7–9], gelatin [10, 11], and chitosan [12–14] for obtaining new polymer electrolytes for their applications in various electrochemical devices. Biopolymer agar-based electrolytes [15–17] have also been reported.

Pectin, a naturally available material, is a polysaccharide that is largely present in the cell wall of plants [18]. Pectins, also known as pectic polysaccharides, are rich in galacturonic acid. Homogalacturonan is a linear chain of 1,4-linked α-D-galactopyranosyluronic acid residues, in which some of the carboxyl groups are methyl esterified [19]. At present, apple pomace and citrus peels are the main sources of commercially

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 07 | July-2016 www.irjet.net p-ISSN: 2395-0072

Vibrational, Electrical and Optical Studies on Pectin- based Polymer Electrolyte

S.Kavitha[1], N.Vijaya[1], R.Pandeeswari[1], M.Premalatha[2]

[1]*Department of Physics, S.F.R. College for Women, Sivakasi--626123, Tamil Nadu, India*

[2]*Materials Research Center, Coimbatore-641045, Tamil Nadu, India*

Abstract - *This work presents the synthesis and characterization of biopolymer pectin - based polymer electrolyte. Proton conducting polymer electrolytes consisting of pectin as host polymer and ammonium nitrate (NH_4NO_3) as complexing salt in different compositions have been prepared by solution casting technique using distilled water as solvent and characterized by FTIR, AC impedance spectroscopy and UV-Visible spectral analyses. The FTIR analysis reveals complexation behaviour of the electrolytes. The ionic conductivity of pure pectin is found to be 5.15×10^{-9} S cm^{-1} at ambient temperature. The highest conductivity of 6.64×10^{-5} S cm^{-1} has been obtained for the polymer electrolyte with 70 mol% pectin and 30 mol% NH_4NO_3 at ambient temperature. The conductivity of the electrolyte increases with increasing temperature for all compositions. UV- Visible analysis indicates that the bandgap energy decreases with the addition of NH_4NO_3.*

Key Words: biopolymer, FTIR, ionic conductivity, activation energy, modulus spectra, band gap energy.

1. INTRODUCTION

Solid polymer electrolytes (SPEs) are an important class of materials due to its application for the development of fuel cells, solid state batteries, sensors and electrochemical devices [1]. SPEs have the dimensional stability, processability, flexibility, electrochemical stability, safety and long life. So it is anticipated to replace the established organic sol–gel electrolyte [2]. Most of the SPEs have been developed using synthetic polymers, such as PVA [2], PVP [3], PAN [4], etc. The proton-conducting polymer electrolytes have received a great deal of interest because of their unique application as solid electrolytes in the electrochemical devices.

Recently, research on new materials from renewable sources as the possible electrolyte host has grown vigorously, since synthetic polymers are obtained from finite sources and are harmful to the environment. Natural polymers are well known for their biodegradation properties, richness in nature and low cost. The use of natural polymers in electrolytes could overcome the main shortcoming of synthetic ones, which are mostly insoluble in the solvents [5]. Generally, the addition of inorganic salts into a polymer matrix can improve its conductivity. The biopolymer pectin is a polymer of natural origin. Because of its excellent biodegradable and biocompatible nature, it is used for eco-friendly biodegradable applications in the pharmaceutical and biotechnology industry. It has been used successfully for many years in the food and beverage industry as a thickening agent, a gelling agent and a colloidal stabilizer. Pectin is commercially extracted from different citrus products like apple, pomace, and oranges under mildly acidic conditions [6]. It consists chiefly of partially methoxylated polysaccharide. It is water soluble with fairly good bio-degradable nature which can be exploited for designing polymer films. Ammonium salts are very good proton donors as per the literature survey [7]. Ammonium nitrate (NH_4NO_3) is a white crystalline solid at room temperature and pressure. Commonly, it is used in agriculture as fertilizer [8]. The present study is focused on the preparation and characterization of pectin doped with NH_4NO_3 polymer electrolyte films.

2. EXPERIMENTAL

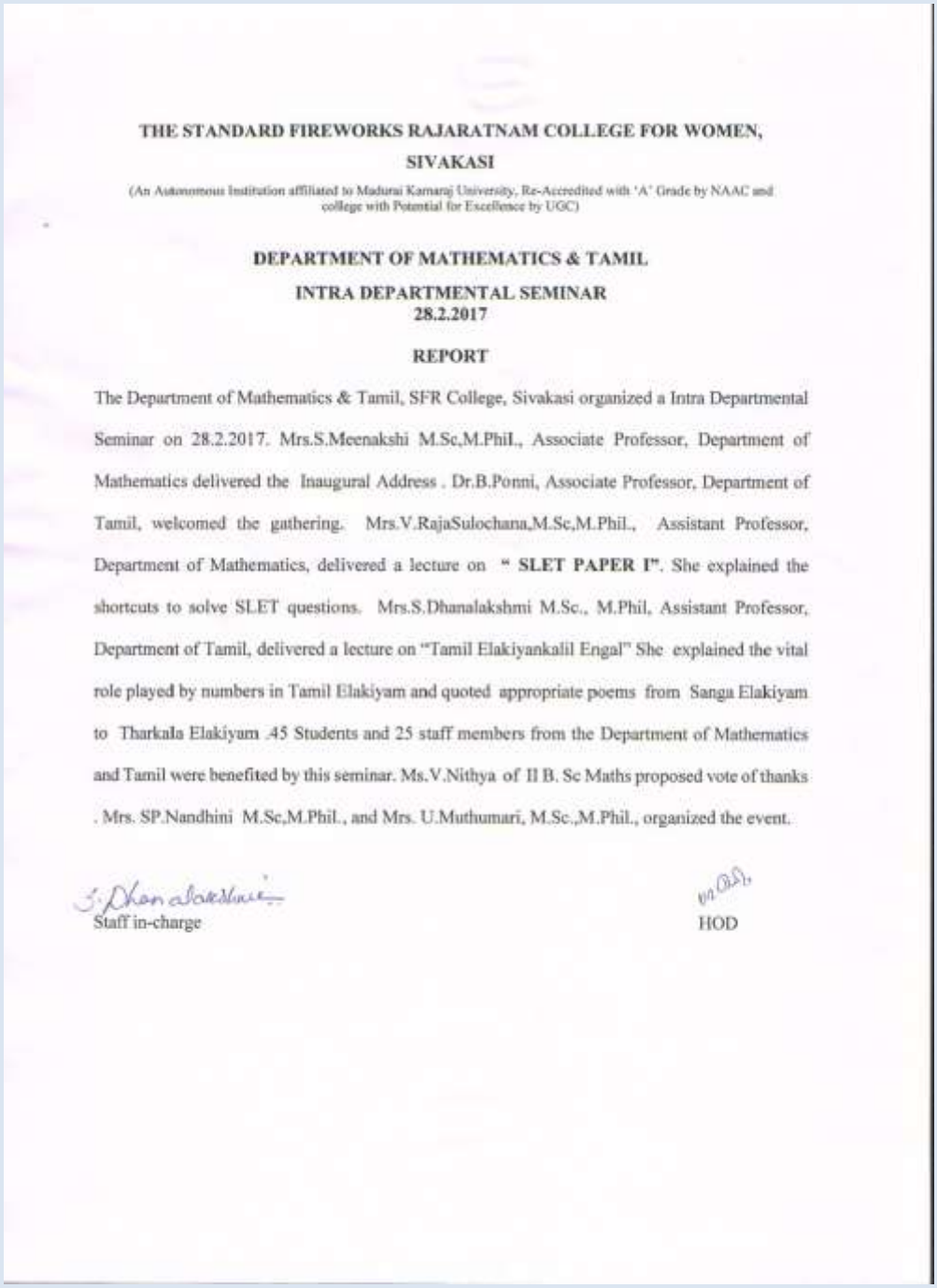
Polymer electrolytes have been prepared with pectin (Tokyo Chemical Industry Co Limited, Japan) and NH_4NO_3 (Spectrum, India) of various compositions such as (100:0), (90:10), (80:20), (70:30), and (60:40) in molar ratios using distilled water as solvent by solution casting technique. Appropriate quantities of pectin and NH_4NO_3 are dissolved in distilled water and the mixtures are stirred continuously in a magnetic stirrer for two days to get homogeneous solution. Finally, these solutions are casted in polypropylene petri dishes and evaporated at 50 °C in hot air oven. Free standing films of thickness of 0.003833-0.0098 cm have been obtained after 24 hours.

The FTIR spectra for polymer electrolytes have been recorded in transmission mode using a SHIMADZU-IR AFFINITY-1 spectrophotometer in the frequency range (400 – 4000 cm^{-1}). The electrical measurements have been performed on the electrolyte films in the frequency range of 42 Hz -1 MHz by applying 1 V sinusoidal signal over the temperature range from 303 K to 333 K by sandwiching them between aluminum blocking electrodes using HIOKI 3532 – 50 LCR Hi-Tester interfaced with a computer. The UV-Vis spectra are obtained from the UV-2400 PC series spectrometer for the samples within 200-900 nm range of UV- spectrum.

THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS), SIVAKASI – 626 123.

(Affiliated to Madurai Kamaraj University, Re-accredited with A Grade by NAAC,
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

Title of the Collaborative Activity : Guest Lecture on Numbers in Tamil Literature



THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN,

SIVAKASI

(An Autonomous Institution affiliated to Madurai Kamaraj University, Re-Accredited with 'A' Grade by NAAC and college with Potential for Excellence by UGC)

DEPARTMENT OF MATHEMATICS & TAMIL

INTRA DEPARTMENTAL SEMINAR
28.2.2017

REPORT

The Department of Mathematics & Tamil, SFR College, Sivakasi organized a Intra Departmental Seminar on 28.2.2017. Mrs.S.Meenakshi M.Sc,M.Phil., Associate Professor, Department of Mathematics delivered the Inaugural Address . Dr.B.Ponni, Associate Professor, Department of Tamil, welcomed the gathering. Mrs.V.RajaSulochana,M.Sc,M.Phil., Assistant Professor, Department of Mathematics, delivered a lecture on **" SLET PAPER I"**. She explained the shortcuts to solve SLET questions. Mrs.S.Dhanalakshmi M.Sc., M.Phil, Assistant Professor, Department of Tamil, delivered a lecture on "Tamil Elakiyankalil Engal" She explained the vital role played by numbers in Tamil Elakiyam and quoted appropriate poems from Sanga Elakiyam to Tharkala Elakiyam .45 Students and 25 staff members from the Department of Mathematics and Tamil were benefited by this seminar. Ms.V.Nithya of II B. Sc Maths proposed vote of thanks . Mrs. SP.Nandhini M.Sc,M.Phil., and Mrs. U.Muthumari, M.Sc.,M.Phil., organized the event.

Staff in-charge

HOD

THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS),
SIVAKASI – 626 123.

(Affiliated to Madurai Kamaraj University, Re-accredited with A Grade by NAAC,
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

Title of the Collaborative Activity : Encouraging student writers by publishing their literary writings in their journal

1976 முதல் 2008 வரை கியூபாவின் அதிபராக பதவி வகித்தார் காஸ்ட்ரோ.

கல்லூரிச் சோலை

சிவகாசி தி ஸ்டாண்டர்ட் ஃபயர் ஒர்க்ஸ் இராஜரத்தினம் மகளிர் கல்லூரி மாணவியர்களின் கவிதைகள்

முரண்

வானம் இருண்டது
எங்கும் இருள்பரவியது...
அழத் தொடங்கியது
அழகான வானம்
பெரிய பெரிய கண்ணீர்த்துளி
அவை
தாயின் மடியில் விழுந்தது...
என்ன ஒரு அதிசியம்!
பிள்ளை கண்ணீர் வடிக்க
தாய் மனம் குளிர்ந்து
வளம் பெறுகிறாள்..!

- கு. கிருஷ்ணவேணி,
முதுகலை இரண்டாமாண்டு கணிதம்.

ஹைகூ கவிதைகள்

எவ்வளவு தைத்தாலும்
சேர்க்க முடியாத உடை
பழைய நினைவுகள்.

- பொ. பாண்டிச்செல்வி.

சந்தனம் பூசவில்லை
இருந்தாலும் மணக்கிறது
அப்பாவின் வியர்வை!

- பொ. பாண்டிச்செல்வி,
முதுகலை இரண்டாமாண்டு கணிதம்.

என் தோட்டத்துக் கேணி

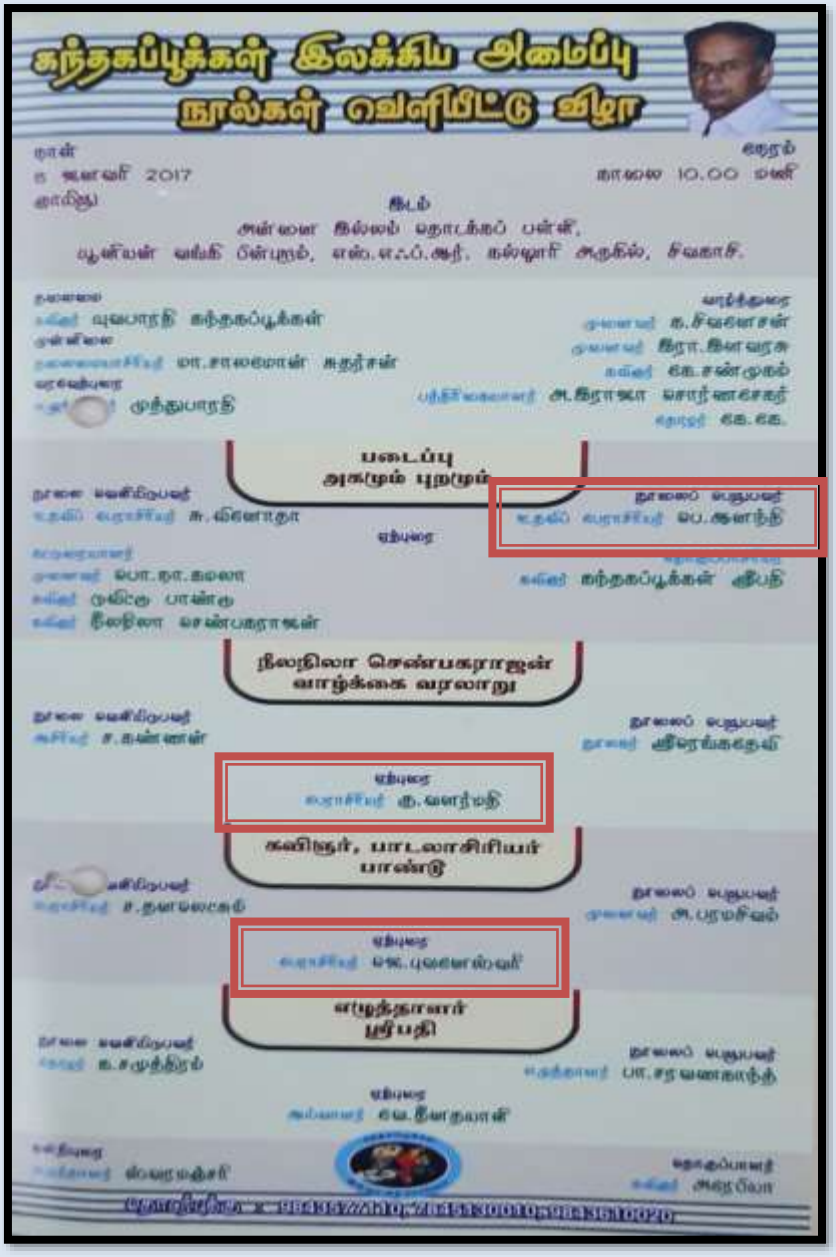
கேணி நிறைய
மாரி நனைத்த நீர்...
கேணி சுவற்றில் சின்னதொரு
கிளை!
தண்ணீரைத் தொட
முயற்சி செய்து
தோற்றுக் கொண்டிருந்தது
அந்த எருக்கஞ்செடியின் கிளைகள்!
கிளை ஒன்றும் விடாமல்
தங்கள் கூட்டை கட்டி
ஆடவிட்டிருக்குது
அந்த தூக்கணாங் குருவி!
உச்சியில் சூரியன் - அந்த நேரம்
கேணி கேக்கும் சங்கீதம்!
தூக்கணாங்குருவி கூச்சலும்
நீர் மேல் வந்து சலசலவென்று
உள்ளே செல்லும்
மீனின் சத்தமும்...
கேணியைச் சுற்றி
வளைத்த மரங்கள் - அதன்
கிளைகள் ஆடும் சத்தம்...
அந்த சத்தததை கேணி
சத்தமில்லாமல்
சங்கீதமாய்
கேட்டுக் கொண்டிருந்தது!

- கு. கிருஷ்ணவேணி,
முதுகலை இரண்டாமாண்டு கணிதம்.

THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS), SIVAKASI – 626 123.

(Affiliated to Madurai Kamaraj University, Re-accredited with A Grade by NAAC,
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

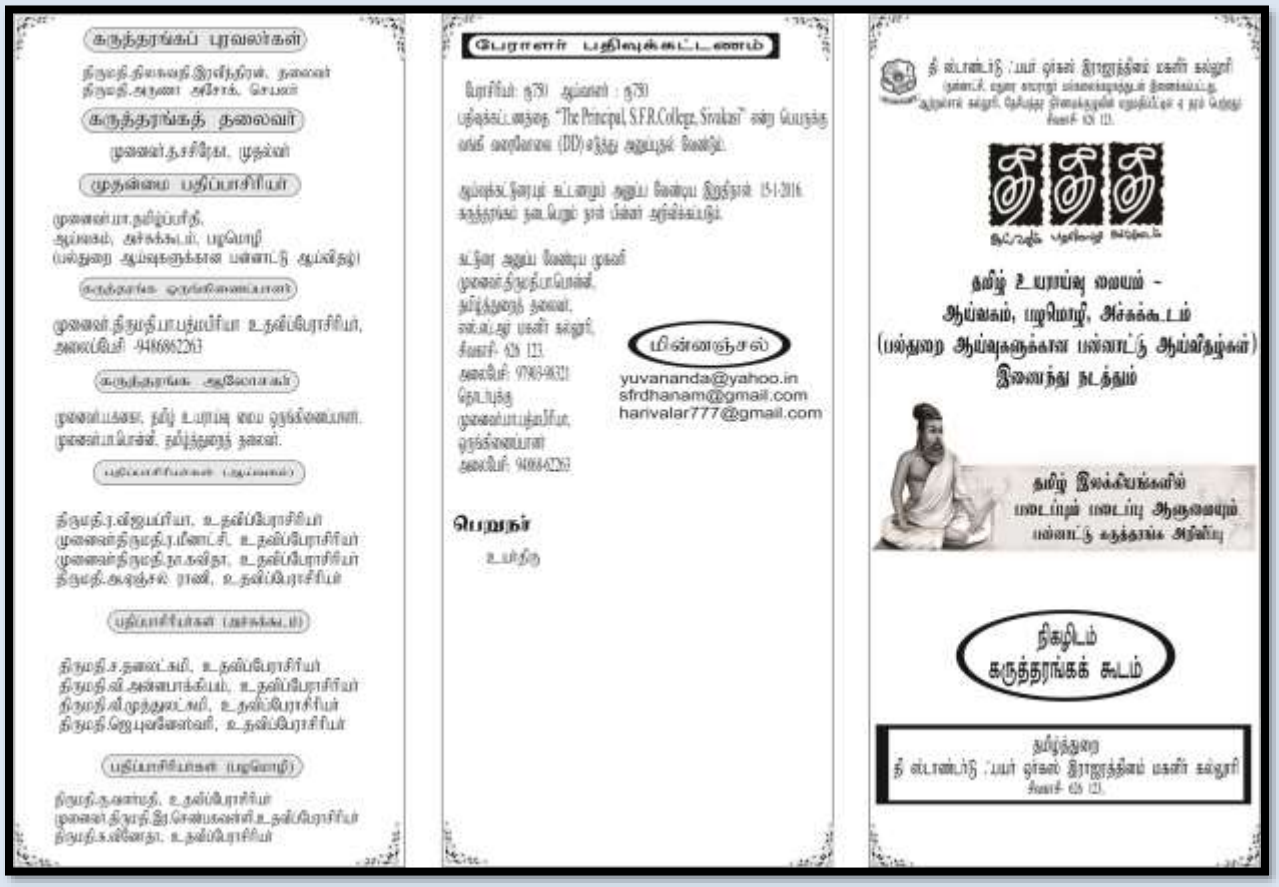
Title of the Collaborative Activity : Book Review programme .

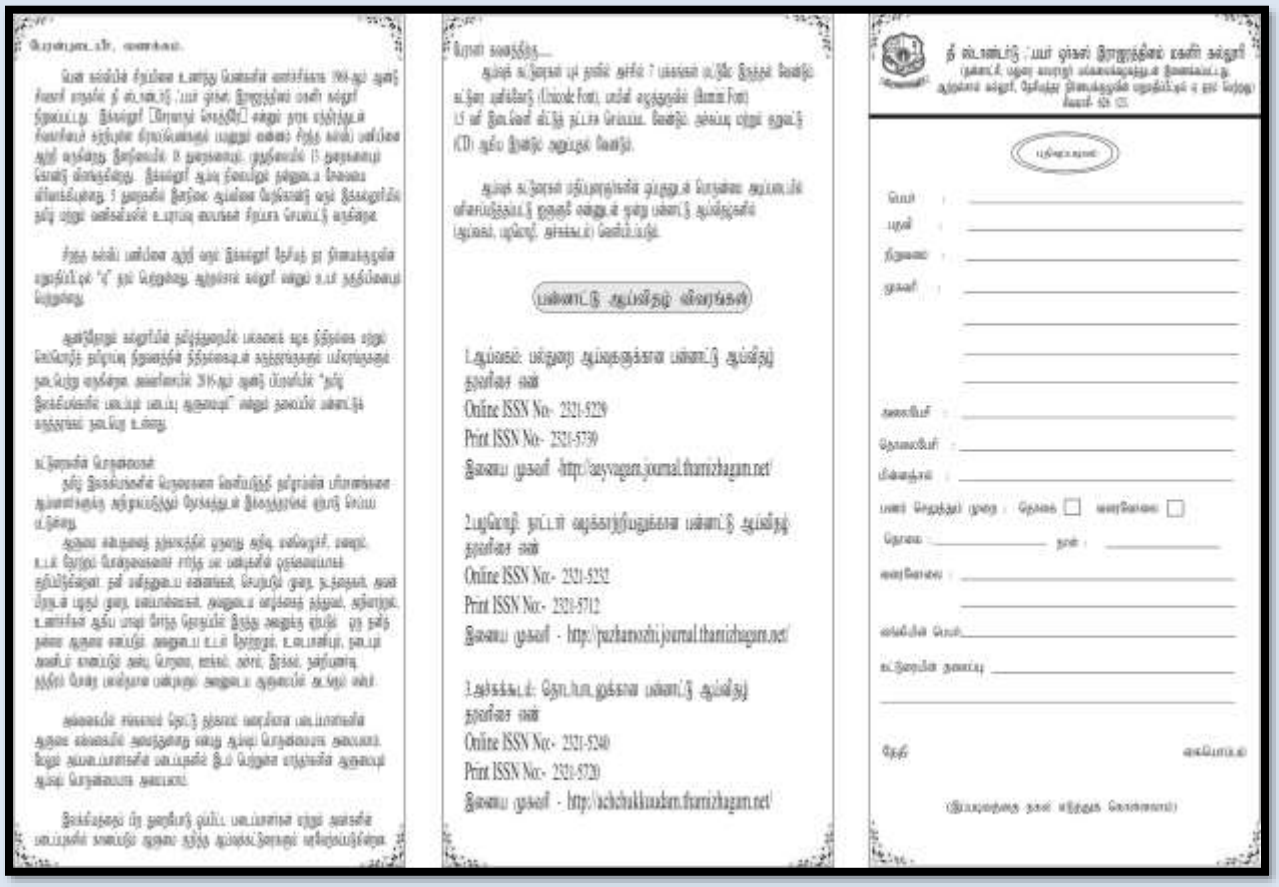


THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS), SIVAKASI – 626 123.

(Affiliated to Madurai Kamaraj University, Re-accredited with A Grade by NAAC,
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

Title of the Collaborative Activity : Paper Publication





தி ஸ்டாண்டர்டு ஃபயர்ஒர்க்ஸ் இராஜரத்தினம் மகளிர் கல்லூரி, (தன்னாட்சி)

(ஆற்றல்சால் கல்லூரி, தேசியத் தர நிர்ணயக் குழுவின் மறுமதிப்பீட்டில் 'A' தரம் பெற்றது)

சிவகாசி

மாநில அளவிலான ஒருநாள் கருத்தரங்கம்

செய்தி அறிக்கை

சிவகாசி, எஸ்.எஃப்.ஆர்.மகளிர் கல்லூரியின் தமிழ்த்துறையினர் ஜீலை2016 அன்று "தமிழ் இலக்கியங்களில் படைப்பும் படைப்பாளுமையும்" என்ற தலைப்பில் மாநில அளவிலான ஒருநாள் கருத்தரங்கம் நடைபெற்றது. கல்லூரி முதல்வர் முனைவர் த.சசிரேகா அவர்கள் நிகழ்வுக்குத் தலைமை தாங்கினார். கருத்தரங்க ஒருங்கிணைப்பாளரும் தமிழ்த்துறை உதவிப்பேராசிரியருமான முனைவர்.மா.பத்மபிரியா அவர்கள் ஆய்வாளர்களை வரவேற்று உரையாற்றினார். பல்வேறு கல்லூரிகளைச் சார்ந்த ஆய்வாளர்கள் படைப்பாளர்களது ஆளுமைத்திறமை இலக்கியப் படைப்புக்களில் எங்ஙனம் பிரதிபலிக்கின்றன என்பதனை ஆய்வியல் கோட்பாடுகளுடன் இணைத்து ஆய்வுக்கட்டுரைகளை வழங்கினர். தமிழ்த்துறைத்தலைவர் முனைவர் பா.பொன்னி அவர்கள் இக்கருத்தரங்கினை நன்முறையில் ஏற்பாடு செய்திருந்தார். இக்கருத்தரங்கில் தமிழ்த்துறை மாணவியர் மட்டுமின்றி பிறகல்லூரி தமிழ்த்துறை சார்ந்த 93 ஆய்வாளர்களும் 14 பேராசிரியப்பெருமக்களும் கலந்து கொண்டு பயன் அடைந்தனர்.

ஒருங்கிணைப்பாளர்

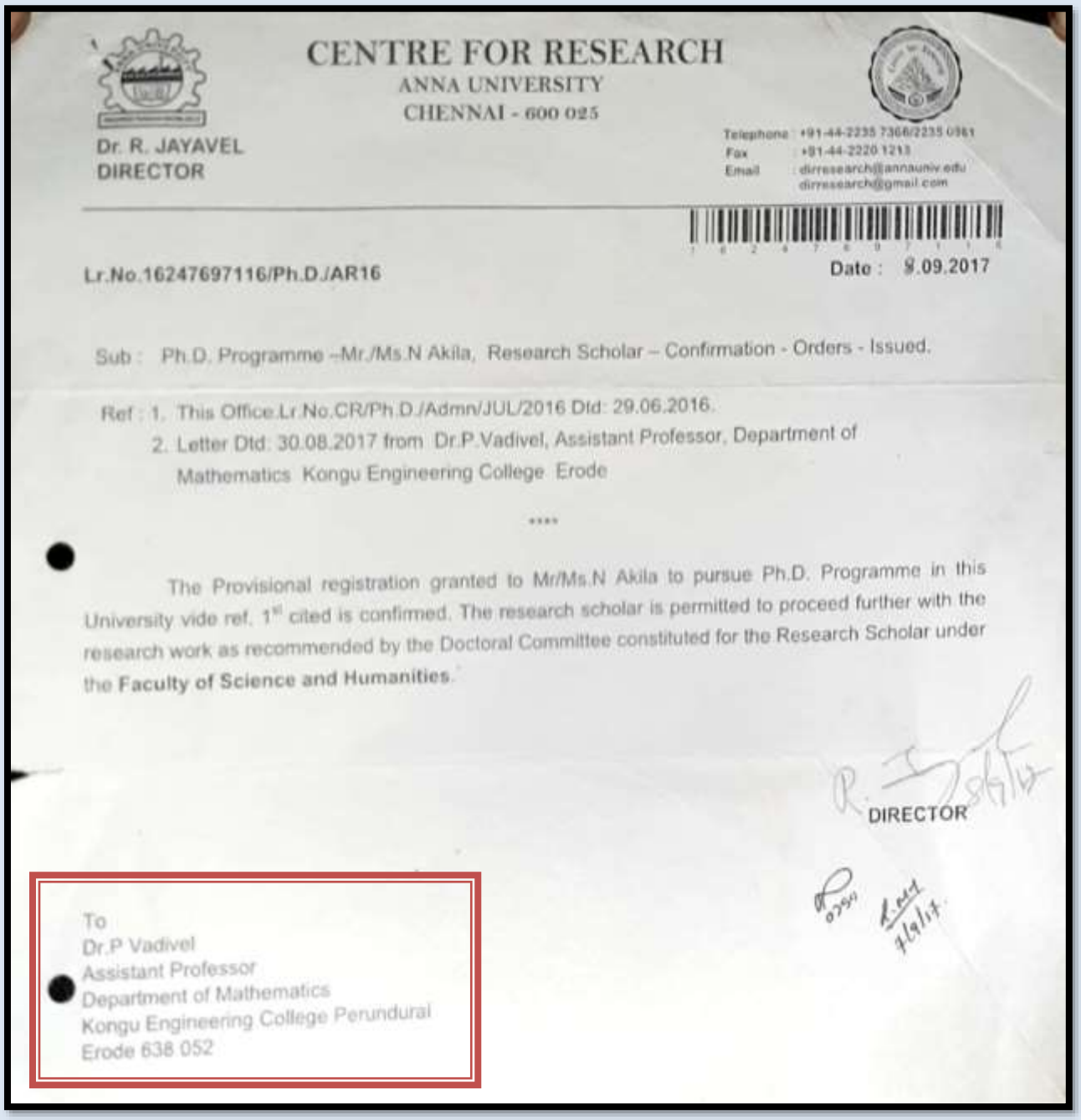
தமிழ்த்துறைத் தலைவர்

முதல்வர்

THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS), SIVAKASI – 626 123.

(Affiliated to Madurai Kamaraj University, Re-accredited with A Grade by NAAC,
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

Title of the Collaborative Activity: Pursuing Ph.D



CENTRE FOR RESEARCH
ANNA UNIVERSITY
CHENNAI - 600 025

Dr. R. JAYAVEL
DIRECTOR

Telephone : +91-44-2235 7366/2235 0961
Fax : +91-44-2220 1213
Email : dirresearch@annauniv.edu
dirresearch@gmail.com

Lr.No.16247697116/Ph.D./AR16 Date : 8.09.2017

Sub : Ph.D. Programme –Mr./Ms.N Akila, Research Scholar – Confirmation - Orders - Issued.

Ref : 1. This Office.Lr.No.CR/Ph.D./Admn/JUL/2016 Dtd: 29.06.2016.
2. Letter Dtd: 30.08.2017 from Dr.P.Vadivel, Assistant Professor, Department of Mathematics Kongu Engineering College Erode

****

The Provisional registration granted to Mr/Ms.N Akila to pursue Ph.D. Programme in this University vide ref. 1st cited is confirmed. The research scholar is permitted to proceed further with the research work as recommended by the Doctoral Committee constituted for the Research Scholar under the **Faculty of Science and Humanities**.

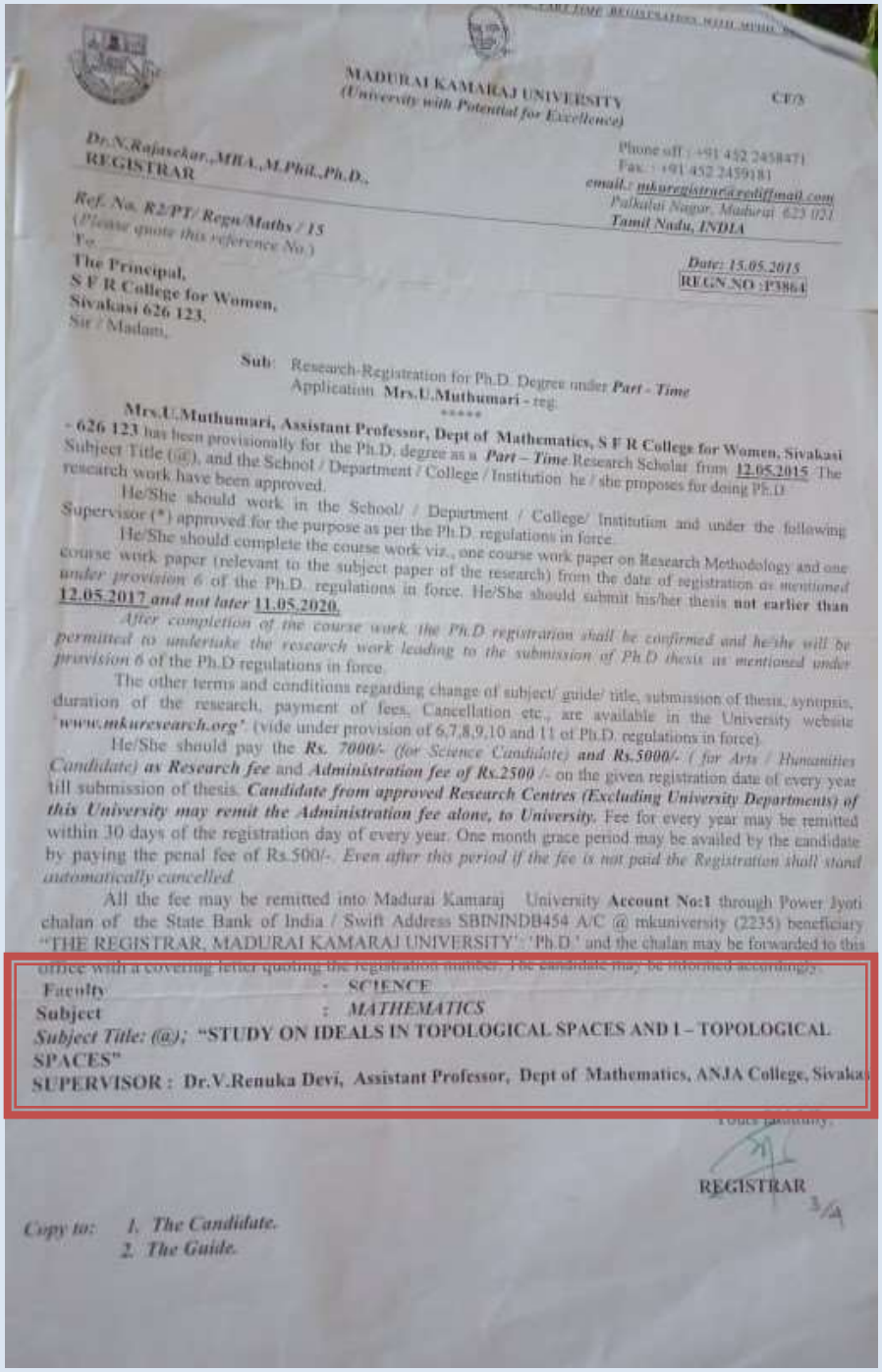
DIRECTOR

To
Dr.P Vadivel
Assistant Professor
Department of Mathematics
Kongu Engineering College Perundural
Erode 638 052

THE STANDARD FIREWORKS RAJARATNAM COLLEGE FOR WOMEN (AUTONOMOUS), SIVAKASI – 626 123.

(Affiliated to Madurai Kamaraj University, Re-accredited with A Grade by NAAC,
College with Potential for Excellence by UGC and Mentor Institution under UGC PARAMARSH)

Title of the Collaborative Activity: Pursuing Ph.D.,



MADURAI KAMARAJ UNIVERSITY
(University with Potential for Excellence)

CE/3

Dr.N.Rajasekar, MBA., M.Phil., Ph.D.,
REGISTRAR

Phone off : +91 452 2458471
Fax : +91 452 2459181
email : mkuregistrar@rediffmail.com
Palkalai Nagar, Madurai 625 021
Tamil Nadu, INDIA

Ref. No. R2/PT/ Regn/Maths / 15
(Please quote this reference No.)

Date: 15.05.2015
REGN.NO :P3864

To,
The Principal,
S F R College for Women,
Sivakasi 626 123.
Sir / Madam,

Sub: Research-Registration for Ph.D. Degree under ***Part - Time***
Application **Mrs.U.Muthumari** - reg.

*****

Mrs.U.Muthumari, Assistant Professor, Dept of Mathematics, S F R College for Women, Sivakasi - 626 123 has been provisionally for the Ph.D. degree as a ***Part – Time*** Research Scholar from 12.05.2015 The Subject Title (@), and the School / Department / College / Institution he / she proposes for doing PR.D research work have been approved.

He/She should work in the School/ / Department / College/ Institution and under the following Supervisor (*) approved for the purpose as per the Ph.D. regulations in force.

He/She should complete the course work viz., one course work paper on Research Methodology and one course work paper (relevant to the subject paper of the research) from the date of registration as *mentioned under provision 6* of the Ph.D. regulations in force. He/She should submit his/her thesis **not earlier than 12.05.2017 *and not later*** 11.05.2020.

After completion of the course work the Ph.D registration shall be confirmed and he/she will be permitted to undertake the research work leading to the submission of Ph.D thesis as mentioned under provision 6 of the Ph.D regulations in force.

The other terms and conditions regarding change of subject/ guide/ title, submission of thesis, synopsis, duration of the research, payment of fees, Cancellation etc., are available in the University website '***www.mkuresearch.org***' (vide under provision of 6,7,8,9,10 and 11 of Ph.D. regulations in force).

He/She should pay the ***Rs. 7000/- (for Science Candidate) and Rs.5000/- (for Arts / Humanities Candidate) as Research fee*** and ***Administration fee of Rs.2500*** /- on the given registration date of every year till submission of thesis. ***Candidate from approved Research Centres (Excluding University Departments) of this University may remit the Administration fee alone, to University.*** Fee for every year may be remitted within 30 days of the registration day of every year. One month grace period may be availed by the candidate by paying the penal fee of Rs.500/-. *Even after this period if the fee is not paid the Registration shall stand automatically cancelled.*

All the fee may be remitted into Madurai Kamaraj University **Account No:1** through Power Jyoti chalan of the State Bank of India / Swift Address SBININDB454 A/C @ mkuniversity (2235) beneficiary "THE REGISTRAR, MADURAI KAMARAJ UNIVERSITY': 'Ph.D.' and the chalan may be forwarded to this office with a covering letter quoting the registration number. The candidate may be informed accordingly.

Faculty : SCIENCE
Subject : *MATHEMATICS*
Subject Title: (@); **"STUDY ON IDEALS IN TOPOLOGICAL SPACES AND I – TOPOLOGICAL SPACES"**
SUPERVISOR : Dr.V.Renuka Devi, Assistant Professor, Dept of Mathematics, ANJA College, Sivaka

Yours faithfully,

REGISTRAR

Copy to: *1. The Candidate.*
2. The Guide.