B.S. Abdur Rahman

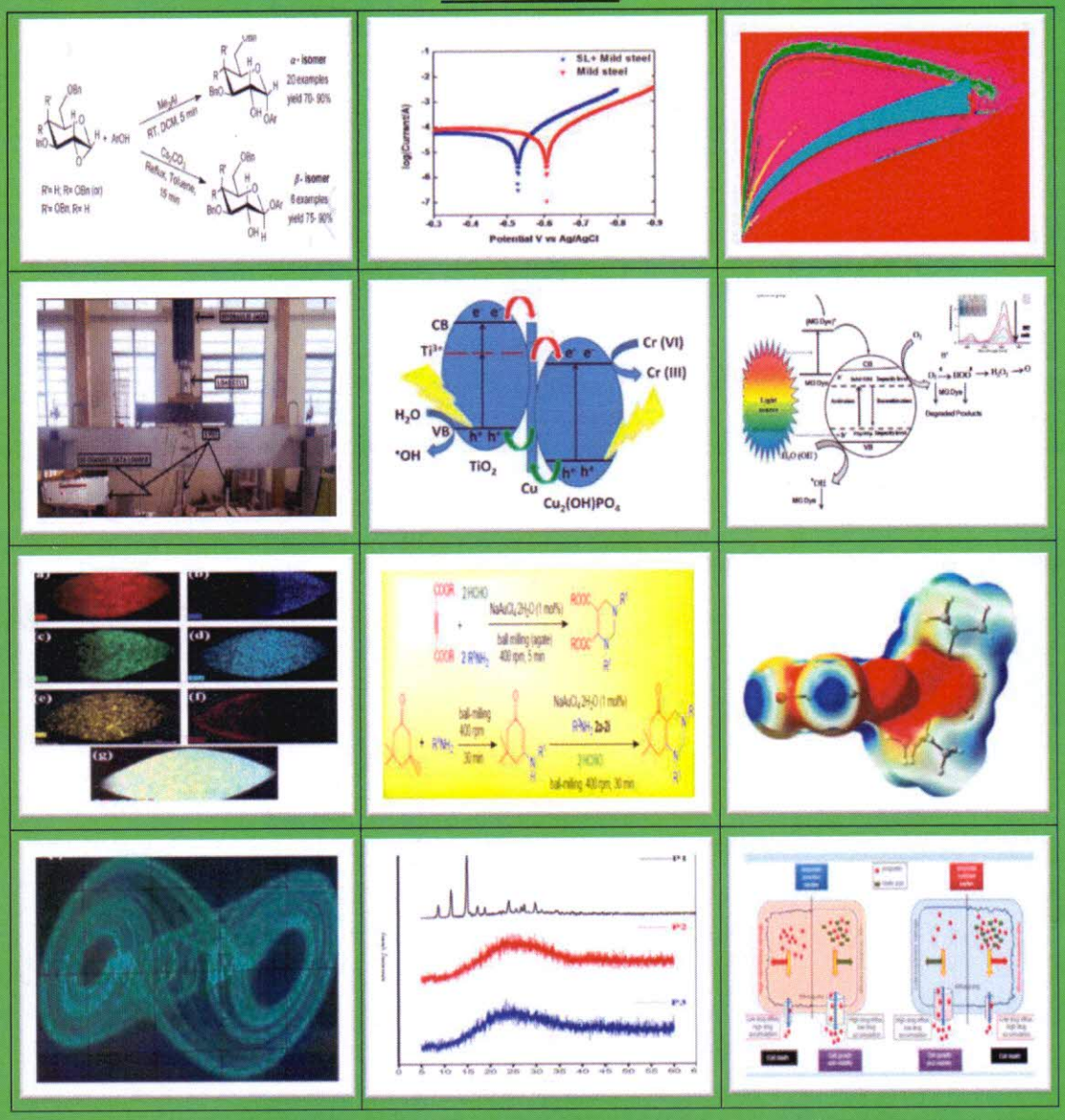
# Crescent

Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

## REPORT ON OUTCOME OF EXTRAMURAL R & D PROJECTS

## 2010 – 2015




## ESPAC –OFFICE OF CENTER FOR ENERGY, SPONSORED PROJECTS AND CONSULTANCY

**(GOVERNMENT OF INDIA FUNDED PROJECTS)**

सत्यमेव जयते

**Submitted to**

**GOVERNMENT OF INDIA**

**DEPARTMENT OF SCIENCE & TECHNOLOGY, NEW DELHI**

**JULY – 2019**

Technical report no: CRESCENT/ESPAC/EM-DST/ 91020722

# REPORT ON OUTCOME OF EXTRAMURAL R & D PROJECTS 2010-2015 (DST, CSIR, DRDO)

## ESPAC
## OFFICE OF CENTER FOR ENERGY, SPONSORED PROJECTS AND CONSULTANCY

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सत्यमेव जयते

**Submitted to**
**GOVERNMENT OF INDIA,**
**DEPARTMENT OF SCIENCE & TECHNOLOGY, NEW DELHI**
**JULY – 2019**

B.S. Abdur Rahman Crescent Institute of Science & Technology
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# Brief Details of EXTRAMURAL R & D PROJECTS OUTCOME - 2010-15

| Sl. No | Name of PI | Project Tile | Cost of the Project (Rs. in Lakhs) |
|---|---|---|---|
| 1 | Dr. S. Bhagavathy | Palladium catalyzed Buchwald Hartwig coupling of 2-C hydroxymethyl- D- glycols and aryl halides : Synthesis of functionalized C – Aryl Glycosides | 42.60 |
| 2 | Dr. D.Easwaramoorthy | Design of Zeozymes as biomimetic catalyst for the treatment of organic pollutants | 13.60 |
| 3 | Dr. J. William John Bosco | A novel access to indolizidine and quinolozidine alkaloids through stereo selective N-tethered intramolecular cyclopropanation of pyridine | 44.00 |
| 4 | Dr. J. William John Bosco | Diasteroselective intramolecular cyclopropanation of enol ethers derived from aminoacids: a novel access to aza-c-glycosides | 13.70 |
| 5 | Dr. J. Revathy. | Seismic retrofitting of prestressed concrete beams externally bonded with fibre reinforced polymer composites | 17.04 |
| 6 | Ms. R. Saai Harini | Bismuth titanate quantum dots for photo voltaic application | 15.68 |
| 7 | Dr. J. Thirumalai. | Preparation of rare-earth doped molyodate nanostructures using soft chemical route for opto electronic applications | 23.20 |
| 8 | Dr. K. Karthikeyan | Applications of Gold Catalysis for the Synthesis of Bioactive Heterocyclic and Natural Product Mimic | 14.00 |
| 9 | Dr. Revathi Purushothaman | Development of COF/Polymide composites with low dielectric constant for microelectronic applications | 23.50 |
| 10 | Dr. I. Raja mohamed | Investigation of chaotic and strange nonchaotic phenomena in coupled nonlinear circuits and systems | 32.46 |
| 11 | Dr. R. Vasanthakumari | Development of absorbing polymer product for efficient removal of oil spills in sea water | 20.04 |
| 12 | Dr. Soumen Bera | GPx1 gene polymorphisms and mitochondrial ROS signaling in cancer risk | 24.70 |
| 13 | Dr. Vajjiravel Murugesan | Synthesis of novel low band gap poymer materials for solar cell applications | 23.78 |
| 14 | Dr. Noor Aman Ahrar Mundari | Development of Graphene Sr TIO 3 based hybrid photocatalytic system for the production of solar fuels | 24.98 |
| 15 | Dr. Shazia Jamal | To study the effect of Diclofenac and Osmolytes on protein stability in Renal Dysfunction | 13.60 |
| 16 | Dr. Md Khurshid Alam Khan | Identifying the molecular basis of peroxidase activity of peroxiredosin 6 – an approach for designing antioxidant peptides and inhibitors | 14.30 |
| **Total** | | | **361.18** |

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Paper

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*Arkivoc* **2018**, part iii, 90-101

# Gold catalyzed synthesis of tetrahydropyrimidines and octahydroquinazolines under ball milling conditions and evaluation of anticonvulsant potency

**M. Vadivelu,[a] A. A. Raheem,[b] S. Sugirdha,[a] G. Bhaskar,[c] K. Karthikeyan,*[a] and C. Praveen*[b]** [a]*Department of Chemistry, B. S. Abdur Rahman Crescent University, Chennai-600 048, Tamil Nadu, India* [b]*Functional Materials Division, Central Electrochemical Research Institute (CSIR Laboratory), Karaikudi-630003, Tamil Nadu, India*

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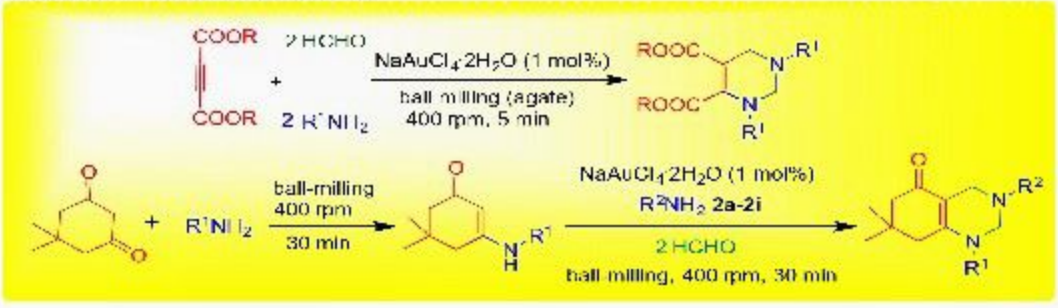
**Dedicated with respect to Dr. P. T. Perumal for his 35 years of contribution to synthetic organic chemistry**

**Received** 10-23-2017 **Accepted** 12-16-2017 **Published on line** 12-21-2017

## Abstract

A fast, mechanochemical and solvent-free synthesis of substituted tetrahydropyrimidines and octahydroquinazolines under Au(III)-catalysis has been developed. The practical feasibility, eco-friendliness and operational simplicity of this chemistry is exemplified by ball milling three components such as formaldehyde, amines and 2-butynedioates/dimedone in a shaker mill for as little as five minutes, thus avoiding the requirement of undesirable solvents and long reaction times. Moreover, this protocol furnishes the target compounds in high yields without any side products and in some cases offers products with excellent regioselectivity. Out of the 26 compounds screened for anticonvulsant potency, 11 compounds exhibited comparable activity against a standard drug.




**Keywords:** Mechanochemistry, gold catalysis, multicomponent reaction, tetrahydropyrimidines, octahydroquinazolines, anticonvulsant

Research Article

*For reprint orders, please contact: reprints@futuremedicine.com*

Future MICROBIOLOGY

# Revealing the dual role of gallic acid in modulating ampicillin sensitivity of *Pseudomonas aeruginosa* biofilms

Rekha Yamini Kosuru[1], Md Aashique[1], Aisha Fathima[1], Amrita Roy**,[1] & Soumen Bera*,[1]

[1]School of Life Sciences, BS Abdur Rahman University, Vandalur, Chennai, Tamil Nadu 600048, India

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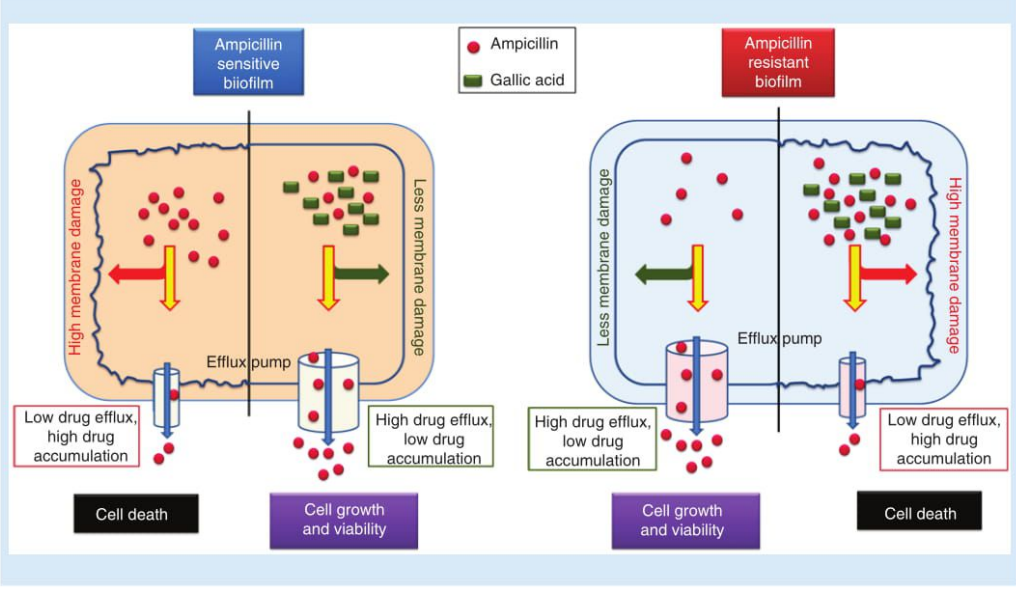
** Author for correspondence: dr_amritaroy@yahoo.com

**Aim:** To understand the effects of gallic acid (GA) on ampicillin (Amp) sensitive or resistant strain of *Pseudomonas* sp. and also in modulating the corresponding biofilms. **Methodology:** The cell viability was determined by broth dilution, dry weight and CFU assays. Biofilm formation was measured by crystal violet assay while oxygen consumption rate was measured to verify the metabolic status of the cells. The membrane damage and drug efflux/accumulation were studied by fluorimetric assays. **Results:** GA transformed the Amp resistant cells, both planktonic and biofilms, into highly sensitive one by inducing membrane damage and enhancing accumulation of drug, whereas the Amp sensitive cells gained resistance against Amp. **Conclusion:** Use of GA as an antimicrobial compound should be analyzed more critically depending on the drug dosages, drug sensitivity as well as types of bacterial strains being studied.

**Graphical abstract:**




First draft submitted: 4 July 2017; Accepted for publication: 13 October 2017; Published online: 15 February 2018

**Keywords:** ampicillin • bacterial biofilm • drug efflux and drug accumulation • drug resistance • gallic acid • membrane potential • oxygen consumption assay

The discovery of penicillin in 1928 and commercialization of this antibiotic have revolutionized the battle against infectious diseases. Latter, various groups of antibiotics have been identified, isolated and implemented in curing microbial diseases; however, recent emergence of drug resistant bacteria, especially *Pseudomonas*, *Salmonella*,

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DOI: 10.1002/jcb.27610



RESEARCH ARTICLE

WILEY Journal of Cellular Biochemistry

# Subcellular compartmentalization of glutathione peroxidase 1 allelic isoforms differentially impact parameters of energy metabolism

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[2]Department of Biotechnology, Indian Academy Degree College, Bengaluru, Karnataka, India

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**Abstract**

Specific genetic variations in the gene for the selenium-containing antioxidant protein glutathione peroxidase 1 (GPX1) are associated with the risk of a variety of common diseases, including cancer, diabetes, and cardiovascular disorders. Two common variations have been focused upon, one resulting in leucine or proline at codon 198 and another resulting in 5, 6, or 7 alanine repeats were previously shown to affect the distribution of GPX1 between the cytoplasm and mitochondria. Human MCF7 cells engineered to exclusively express GPX1 with five alanine repeats at amino terminus and proline at codon 198 (A5P) and seven alanine repeats at amino terminus and leucine at codon 198 (A7L), as well as derivatives targeted to the mitochondria by the addition of a mitochondrial localization sequence (mA5P and mA7L) were used to assess the consequences of the expression of these proteins on the cellular redox state and bioenergetics. Ectopic expression of A5P and A7L reduced the levels of reactive oxygen species, and the mitochondrially targeted derivatives exhibited better activity in these assays. Bioenergetics and mitochondrial integrity were assessed by measuring mitochondrial membrane potential, oxygen consumption, adenosine triphosphate (ATP) levels, and the levels of lactate dehydrogenase. The results of these assays indicated distinctively, and sometimes opposing, patterns with regard to differences between the consequences of the expression of A5P, A7L, mA5P, and mA7L. These data provide new information on the consequences of differences in the primary structure and cellular location of GPX1 proteins and contribute to the understanding of how these effects might contribute to human disease.

**KEYWORDS**

glutathione peroxidase (GPX), gene polymorphisms, mitochondria, oxidative stress, respiration

## 1 | INTRODUCTION

Glutathione peroxidases (GPXs) are antioxidant enzymes that detoxify hydrogen peroxide ($H_2O_2$) or lipid hydroperoxides using reducing equivalents obtained from glutathione.[1] One member of this family is GPX1, a selenocysteine-containing enzyme expressed in most tissues and cell types, being present in both the cytoplasm and mitochondria.[2] Lower levels of GPX1 have generally been associated with increased cancer risk although this association is not absolute [reviewed in reference[1]]. We have previously reported on a positive correlation

Md Aashique and Soumen Bera contributed equally to this study.

  

# Development of Novel $TiO_2$-$Cu_2(OH)PO_4$ Heterojunction as Nanophotocatalyst for Improved Cr (VI) Reduction

Deviga Magadevan[1], Egambaram Dhivya[1], Noor Danish Ahrar Mundari[2], Trilochan Mishra[3], Noor Aman[1]*

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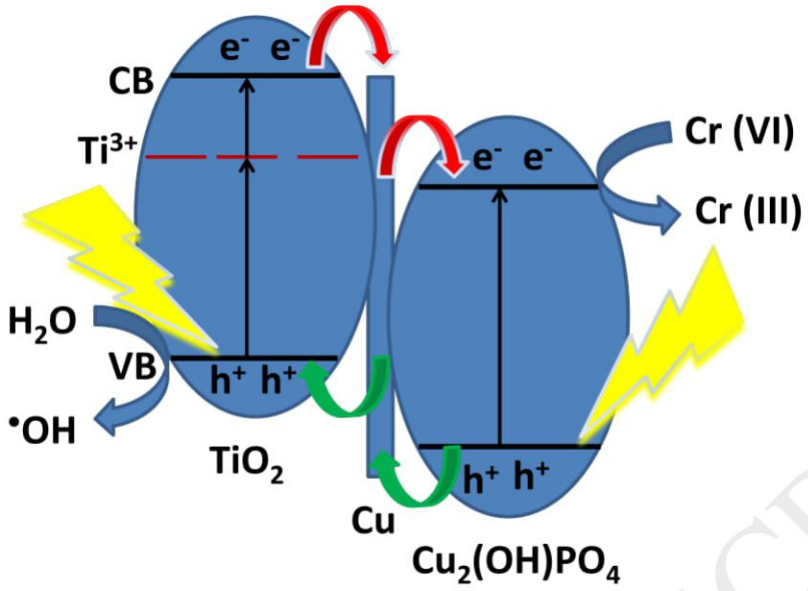
Graphical abstract




$TiO_2$-$Cu_2(OH)PO_4$ heterojunction nanophotocatalyst exhibits exceptional activity towards the reduction of Cr (VI) under visible light. Improved photocatalytic activity is attributed to the high surface area, improved visible-NIR light absorption and formation of proper heterojunction.

Highlights

- $TiO_2$-$Cu_2(OH)PO_4$ nanomaterials synthesized by hydrothermal method.
- Heterojunction exhibits light absorption from UV to visible-NIR region.
- Cr is reduced within 90 minutes of visible light irradiation.

**Abstract**

$TiO_2$-$Cu_2(OH)PO_4$ heterojunction nanomaterials with 2-10% of $Cu_2(OH)PO_4$ were synthesized by hydrothermal method. The physiochemical properties of synthesized nanomaterials were studied using XRD, FESEM, HRTEM, $N_2$

# Synchronization of Two Chaotic Oscillators Through Threshold Coupling


**A. Chithra and I. Raja Mohamed**

**Abstract** In this paper, the dynamic modeling of two identical oscillators which are coupled through threshold controller is proposed. Until now, most of the synchronization of chaotic systems found in literature is based on common coupling methods (unidirectional and bidirectional) that attracted the attention of researchers. To strengthen this, the idea illustrated here is to show the effectiveness of a new kind of coupling called threshold controller coupling. Using this, complete and anticipatory synchronization could be achieved. The system used is of second-order non-autonomous type. The coupled system is investigated using MATLAB–Simulink technique. The result shows that based on coupling strength, coupled system is switched among the basic synchronization, viz. lead and complete.

**Keywords** Modeling · Synchronization · Threshold controller
Chaotic · MATLAB–Simulink

## 1 Introduction

Chaos theory has one of the greatest achievement and application in secure communication over two decades. Chaotic system can produce infinite number of chaotic signals which are non-periodic and is characterized by high sensitive to parameter value and initial condition. Due to this property and broadband nature of chaotic signal, which makes particular interest in the concept of synchronization for the application of secure communication to mask the embedded message or signal becomes possible.

Synchronized chaos is a phenomenon that occurs when two or more chaotic systems adjust to common behavior due to coupling. The idea of chaos synchro-

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S. K. Muttoo (ed.), *System and Architecture*, Advances in Intelligent Systems and Computing 732, https://doi.org/10.1007/978-981-10-8533-8_24

Journal of Computational Electronics (2018) 17:1297–1302
https://doi.org/10.1007/s10825-018-1185-x

# Strange nonchaotic dynamics of parametrically enhanced MLC circuit

R. Rizwana[1] · I. Raja Mohamed[1]

Published online: 26 May 2018


**Abstract**
We report experimental and numerical studies of a strange nonchaotic attractor (SNA) using a parametrically perturbed Murali–Lakshmanan–Chua (MLC) circuit. One of the energy storage elements in the circuit, i.e., the capacitor, is perturbed parametrically with a sinusoidal excitation. Under this condition, the circuit exhibits both chaotic and strange nonchaotic behavior for suitably adjusted capacitor values. This constitutes the novelty of this work. The other point to note in this circuit is that one of the two alternating-current (AC) stimulations (which are usually connected in series to observe SNA) is obtained by varying the capacitance with a perturbation consisting of a periodic stimulating force. The experimental results are confirmed by numerical study, in particular calculations of the correlation coefficient, path of translation variables, modified mean square displacement, singular continuous spectrum, power spectrum, and autocorrelation coefficient, to confirm the existence of an SNA in the dynamics of the modified MLC circuit.

**Keywords** Strange nonchaotic attractor · Parametric perturbation · Voltage-controlled variable capacitor

## 1 Introduction

The notions of "chaos" and "strange nonchaos" have motivated researchers and scientists working in the area of nonlinear dynamics to investigate the inherent nonlinear properties of such systems and their applications, theoretically as well as experimentally. Many such practical nonlinear circuits and systems can be used as model systems to investigate nonlinear behaviors that occur in daily life. Similar to the nonlinear nature of chaos, the characteristics of SNA reveal a fractal path in the complex plane with geometric structure. Chaos is characterized by a positive maximal Lyapunov exponent, manifesting exponential divergence of nearby trajectories in phase space, whereas SNA is characterized by negative Lyapunov exponents due to exponential convergence of trajectories, related to the behavior of periodic dynamics. Hence, SNA is assumed to correspond to a quasiperiodic state [1–3] due to its appearance during the transition from periodic to aperiodic dynamics. In particular, for the quasiperiodically forced systems theoretically described by Grebogi et al. [4], when two incommensurate frequencies exist, SNA behavior can be generated. Hence, irrational frequencies correspond to generation of SNA. SNAs have been realized using many quasiperiodically perturbed practical systems [5,6], maps [1–3,7], and electronic circuits [8–10].

Many nonlinear systems involving perturbation have attracted considerable interest. The perturbation effect in nonlinear systems has been considered either due to its influences on or to help control the dynamics [11–13]. Different kinds of perturbation such as additive, parametric, and periodic have been found to initiate many interesting phenomena in nonlinear systems [14,15].

The aim of this paper is to present the occurrence of strange nonchaotic dynamics in a parametrically perturbed MLC circuit and explore its characteristics.

The rest of this manuscript is organized as follows: Section 2 presents the design of the system and explains how it achieves parametric perturbation. The existence of SNA is demonstrated by the experimental and numerical results in Sect. 3. The discussion is concluded in Sect. 4.

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Research Article

# Influence of ultrasound on multi-site phase transfer catalyzed polymerization of *N*-vinyl carbazole in two phase system

Elumalai Marimuthu[1] · Vajjiravel Murugesan[1]



**Abstract**

Carbazole—containing motifs are of most desired materials because of its wide range of applications due to π- extended systems, molecular and optical properties was easily tunable via diverse structural modifications. Herein, we reported an efficient and facile polymerization of *N*-vinyl carbazole (NVK) using multi-site phase transfer catalyst with and without ultrasound condition. The rate of polymerization (Rp) was effectively improved with ultrasound in short time on compare with silent condition. Role of different parameters such as variation of frequency, monomer, initiator, catalyst and temperature, solvents, aqueous and pH on the rate of polymerization of NVK was explored under silent and ultrasound condition (45 kHz/550 W). Activation energy of polymerization was supported for an enhancement of rate under ultrasound condition. From the experimental results, an appropriate kinetic model and role of various parameters in polymerization reaction was discussed. The obtained poly (*N*-vinyl carbazole) was confirmed and characterized by FT-IR, $^1$H NMR, TGA and XRD techniques.

**Keywords** Ultrasound · Multi-site phase transfer catalyst · Kinetics of polymerization · Rate of polymerization · *N*-vinyl carbazole

## 1 Introduction

Carbazoles are classical class of nitrogen- based heterocyclic, possessing of two benzene rings in central pyrrole motif. Carbazole based polymeric materials have attracted much interest in scientific and industrial arena [1–3] and it was considered one of the best desired materials for versatile applications [4, 5] due to facile π—extended systems, easily tunable structures and their natural features of hole-transporting, high charge-carrier mobility and electroluminescent properties [1, 6]. The capability of hole-transporting properties of carbazole was useful in organic electronics applications [7]. Among various carbazole based polymers, a great attention was placed for poly (*N*-vinyl carbazole) (PNVK) because of easy synthesis and good solubility in common organic solvents [8]. PNVK was a class of promising photoconductive materials used in photocopiers, laser printers, printing plates, and electrophotographic microfilming [9].

Polymerization of *N*-vinyl carbazole (NVK) was investigated extensively using different methods, for instance, free radical [10], cationic polymerization [11], anionic polymerization [12], nitroxide-mediated polymerization (NMP) [13–15], atom transfer radical polymerization (ATRP) [16–20], reversible addition-fragmentation chain transfer (RAFT) polymerization [21–26], charge transfer [27], electrochemical [28] and solid state polymerization [29, 30], single electron transfer-living radical polymerization (SET-LRP) [31], organo-hetero atom mediated living radical polymerization [32], and organometallic-mediated radical

**Electronic supplementary material** The online version of this article (https://doi.org/10.1007/s42452-019-0661-7) contains supplementary material, which is available to authorized users.

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ORIGINAL PAPER

# Comparative investigation on radical polymerization of methyl and ethyl methacrylate under multi-site phase-transfer catalytic conditions

Vajjiravel Murugesan[1] · Elumalai Marimuthu[1]

Received: 6 October 2017 / Accepted: 4 January 2018 / Published online: 25 January 2018


**Abstract**
Methyl and ethyl methacrylate was polymerized in heterogeneous system with the help of newly synthesized multi-site phase-transfer catalyst and using water-soluble initiator at 60 ± 1 °C under unstirred inert atmospheric condition. Polymer yield was increased with increasing molar concentrations of monomer, initiator, catalyst and temperature. Polymerization follows first-order kinetics with respect to monomer and half-order with respect to catalyst and initiator, respectively. PTC has myriads of applications in the synthesis of various organic and polymeric materials because of its fast reaction and high yield in short period of time. Without addition of PTC, polymerization did not occur; this indicates that catalyst plays the pivotal role on initiation of polymerization. It extracts the reactive radical anion from aqueous phase and transfers to the organic phase where acrylates were polymerized. Polymerization reactivity of methyl and ethyl methacrylate under PTC conditions was studied by various parameters. The activation energy (Ea) and other thermodynamic parameters were calculated. The Ea value supports the reactivity of acrylates. The results obtained from this investigation were used for inferring the radical mechanism of phase-transfer-catalyzed polymerization. The obtained polymers were analyzed by spectral and thermal analyses.

**Keywords** Kinetics · Multi-site phase-transfer catalyst · Rate of polymerization · Two-phase system · Methyl and ethyl methacrylate

## Introduction

Acrylates containing polymers have potential applications in industries like textile, surface coating, automotive, aerospace, biomedical to optics and microelectronics, etc. because of their surface-free energy properties and water/oil repellence, etc. [1, 2]. Synthesis of acrylates polymers with controlled molecular weight distributions and low polydispersity index (PDI) is one of the key parameters to realize any kind of applications and synthesis of such acrylates polymers has attracted remarkable attention between polymer chemists and industrial community. Among the various polymerization techniques, free radical polymerization is one of the simplest and well-known best techniques for synthesizing poly (alkyl acrylates/alkyl methacrylates) with different composition, structures, and functionalities and with low dispersity, as this polymerization can be carried out at room and or moderately high temperature with less-stringent reaction condition compared to anionic polymerization [3–9].

The discovery and establishment of nitroxide-mediated stable free radical polymerization (NMP) [3, 7], radical addition fragmentation chain transfer polymerization (RAFT) [5, 8], atom transfer radical polymerization (ATRP) [4, 6] and degenerative chain transfer polymerization [10, 11] contributed an incredible advancement in the area of controlled living radical polymerization of alkyl acrylates/alkyl methacrylates for the past few decades. Consequently, in the verge of these polymerization techniques, phase-transfer-catalyzed polymerization is one of the recognized and established techniques for the polymerization of alkyl methacrylates in heterogeneous condition using water-soluble initiator. PTC is the most important innovative technique for promoting reactions between lipophilic and hydrophilic reactants. In

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