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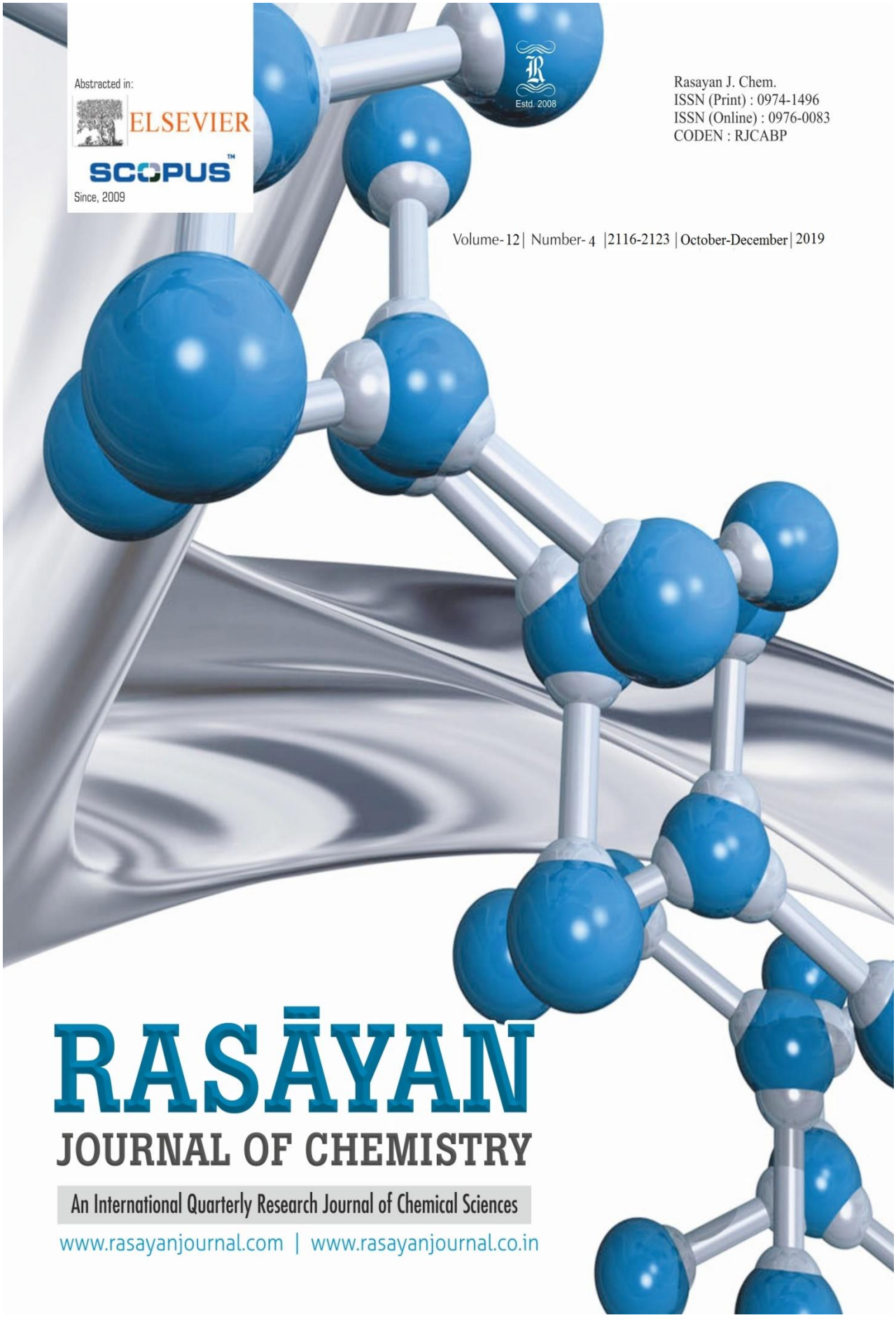

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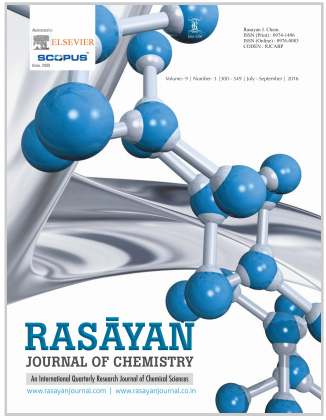


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## Volume 12, Number 4, 1676-2357, October-December 2019

PREPARATION AND CHARACTERIZATION OF CuInSe2 NANO-PARTICLES

*Purushotham Endla*

Rasayan J. Chem, 12 (4), 1676 - 1680 (2019)

**Keywords:** X-ray Diffraction, Particle Size, Lattice Strain, Debye-Waller Factor, Vacancy Formation Energy.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245132

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OXIDATION OF POLYETHYLENE GLYCOL-200 BY POTASSIUM PERIODATE IN ALKALINE MEDIUM: A KINETIC STUDY

*K. V. S. Koteswara Rao and R. Venkata Nadh*

Rasayan J. Chem, 12 (4), 1681- 1687 (2019)

**Keywords:** Kinetics, Oxidation, Polyethylene Glycol, Potassium Periodate, Alkaline Medium

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245433

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SPECTROSCOPIC, MECHANICAL AND DIELECTRIC STUDIES ON FILMS OF EPOXYRESIN IN DIETHYLENETRIAMINE

*M.V.L. Kumari, A. Kaviarasi, A.R. Prabakaran and A. Anandavadivel*

Rasayan J. Chem, 12 (4), 1688- 1692 (2019)

**Keywords:** FTIR, Tensile Strength, Flexural Strength, Toughness, Curing Agent, Epoxy Resin, Diethylenetriamine

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245384

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SIMULTANEOUS ASSAYS OF SULFAMETHOXAZOLE AND TRIMETHOPRIM IN SUSPENSION DOSAGE FORM By THREE ANALYTICAL METHODS OF UV SPECTROPHOTOMETRY

*Muchlisyam ,E.S.B Raesa, R. Dathita and S.P. Richa*

Rasayan J. Chem, 12 (4), 1693 - 1700 (2019)

**Keywords:** Three Methods, Spectrophotometry, Sulfamethoxazole, Trimethoprim, Validation.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245428

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## THERMO-CATALYTIC PROCESSING OF POLYMER WASTE OVER CATALYSTS ON THE BASIS OF NATURAL ZEOLITE FROM THE TAYZHUZGEN FIELD (KAZAKHSTAN) MODIFIED BY MOLYBDENUM

*Y. A. Aubakirov , L. R. Sassykova, Zh. Kh. Tashmukhambetova F. Zh. Akhmetova , S. Sendilvelan , K.O. Sharipov , Sh. N. Kubekova , A.A. Batyrbayeva , R.N. Azhigulova, R. G. Ryskaliyeva , A.K. Zhussu*

Rasayan J. Chem, 12 (4), 1701 - 1709 (2019)

**Keywords:** Polymer Wastes, Natural Tayzhuzgen Zeolite, Hydrogenation Thermocatalytic Recycling, Molybdenum, Kumkol Oil Field, Motor Fuels

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245435

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## SOLAR LIGHT ACTIVE CeO2/rGO HYBRID PHOTOCATALYST FOR DIRECT VIOLET 51 DEGRADATION

*A. Loganathan, A. Sivakumar , B. Murugesan, and P. Sivakumar*

Rasayan J. Chem, 12 (4), 1710- 1724 (2019)

**Keywords:** Carica papaya, CeO2/rGO Hybrid, Photocatalytic Degradation, Fractional Order, Direct Violet 51

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245351

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## SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL SCREENING OF SOME NOVEL 5-(BENZOFURAN-2-YL)-N'-(2- SUBSTITUTED-4-OXOTHIAZOLIDIN-3-YL)-1-PHENYL-1HPYRAZOLE-3-CARBOXAMIDE DERIVATIVES

*M. Idrees, S. Kola and N. J. Siddiqui*

Rasayan J. Chem, 12 (4), 1725- 1733 (2019)

**Keywords:** Benzylidene, Benzofuran-2-yl, Carbohydrazone, Carbohydrazide, Carboxamide

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245467

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## EFFECTS OF FIVE GREEN INHIBITORS OF CONTROLLING BARITE CRYSTAL GROWTH IN FLOW-INDUCED VIBRATION IN PIPE

*N. Karaman , W. Mangestiyono , S. Muryanto , J. Jamari and A. P. Bayuseno*

Rasayan J. Chem, 12 (4), 1734 - 1743 (2019)

**Keywords:** Mechanical Vibration, XRPD Analysis, SEM Analysis, Barite, Green Chemical Inhibitors

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245380

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## EFFECT ON PROPERTIES OF CONCRETE IN PARTIAL REPLACEMENT OF FINE AGGREGATE BY STEEL SLAG AND CEMENT BY METAKAOLIN

*R. Padmapriya, V.K. Bupesh Raja , V. Ganesh Kumar and J.Baalamurugan*

Rasayan J. Chem, 12 (4), 1744 - 1751 (2019)

**Keywords:** Steel Slag, Metakaolin, Concrete, Paver Block, Compressive Strength

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245211

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## GREEN SYNTHESIS OF COPPER NANOPARTICLES USING Uncaria gambir ROXB. LEAF EXTRACT AND ITS CHARACTERIZATION

*N. Elisma , A. Labanni , Emriadi , Y. Rilda , M. Asrofi and S. Arief*

Rasayan J. Chem, 12 (4), 1752- 1756 (2019)

**Keywords:** Green synthesis, copper nanoparticles, Uncaria gambir Roxb., bioreducing agent, chemical reduction.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245347

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## SYNTHESIS OF ALGAE BIODIESEL USING K2CO3/ZnO HETEROGENEOUS BASE CATALYST AND ITS CHARACTERISATION

*Jayashri Nair, Y.V.V.Satyanarayana Murthy , M.Ramesh and Gautam Edeira*

Rasayan J. Chem, 12 (4), 1757- 1765 (2019)

**Keywords:** Heterogeneous Catalyst, Algae Biodiesel, Transesterification, Characterization.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245273

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## EFFECT OF ELABORATION pH ON THE ELECTROACTIVITY OF CASSAVA STARCH SOLID BIOPOLYMER ELECTROLYTE FILMS

*Alvaro Arrieta Almario, Carlos García Mogollón and Enrique Combatt Caballero*

Rasayan J. Chem, 12 (4), 1766- 1773 (2019)

**Keywords:** Cassava, Solid Biopolymer Electrolyte, Electrochemistry, Starch, Electroactivity.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245302

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## MOLECULAR INTERACTIONS IN BINARY LIQUID MIXTURES CONTAINING BENZYL BENZOATE

*A.Nagarjuna, K.V.Yamini Kanth , G. Balaji Prakash and Debashis Das*

Rasayan J. Chem, 12 (4), 1774- 1782 (2019)

**Keywords:** Speed of Sound, Density, Molar Volume, Free Length, R-K polynomial.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245469

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## GROWTH AND CHARACTERIZATION OF COBALT AND SULPHAMIC ACID DOPED AMMONIUM DIHYDROGEN ORTHOPHOSPHATE: A POTENTIAL NONLINEAR OPTICAL MATERIAL

*K.Kumar , K. Selvaraju , P. Baskaran and N. Senthilvelan*

Rasayan J. Chem, 12 (4), 1783- 1791 (2019)

**Keywords:** Solution Growth Technique, X-Ray Diffraction, NLO Material, FT-IR.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1232035

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## ALGINATE-MODIFIED SAPONITE AND STUDY FOR UREASLOW RELEASED FERTILIZER APPLICATION

*Wildan Faishol , Dwiarso Rubiyanto , Laemthong Chuenchom and Is Fatimah*

Rasayan J. Chem, 12 (4), 1792- 1802 (2019)

**Keywords:** Adsorption, Clay, Urea, Polymer-Clay Composite.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245386

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## COMPARATIVE STUDIES OF ETHYLENE VINYL ACETATE FILMS WITH VARIOUS SILICATE NANOCOMPOSITES

*A. Kaviarasi, M.V.L. Kumari, A.R. Prabakaran and A. Anandavadivel*

Rasayan J. Chem, 12 (4), 1803- 1809 (2019)

**Keywords:** EVA, MMT (Montmorillonite), Sodium Silicate, FTIR, Thermogravimetry, Thermal stability

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245362

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## SYNTHESIS AND ANTIBACTERIAL ACTIVITY OF 3-(2-(5- AMINO-1H-PYRAZOL-4-YL) THIAZOL-4-YL)-2H-CHROMEN2-ONE AND ITS DERIVATIVES

*M. Shivanand , P.Vijaya Kumar and V. Ravikumar*

Rasayan J. Chem, 12 (4), 1810- 1815 (2019)

**Keywords:** Coumarin, Thiazole, Pyrazole, Thiazolyl-pyrazoles, Cyclisation reaction.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245375

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## ION-ASSOCIATION AND ION-SOLVATION BEHAVIOR OF METHY, PHENYL AND BENZYL TRIMETHYL AMMONIUM CHLORIDE IN DMSO-WATER MIXTURES AT 298K

*V. Radhika, J. Sunil Kumar , N. Srinivas and P. Manikymba*

Rasayan J. Chem, 12 (4), 1816 - 1821 (2019)

**Keywords:** Association Constant, Contact Ion Pair, Limiting Molar Conductance, Free Energy.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245130

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## ISOLATION OF QUERCITRIN FROM Dendrophthoe pentandra (L.) Miq LEAVES AND IT'S ANTIOXIDANT AND ANTIBACTERIAL ACTIVITIES

*Rini Hardiyanti , Lamek Marpaung, I. Ketut Adnyana and Partomuan Simanjuntak*

Rasayan J. Chem, 12 (4), 1822- 1827 (2019)

**Keywords:** Dendrophthoepentandra (L.) Miq, Flavonoid, Quercitrin, Antioxidant, Antibacterial

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1235353

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## EVALUATION OF GROUNDWATER QUALITY IN PREMONSOON AND POST-MONSOON SEASONS OF A YEAR USING WATER QUALITY INDEX (WQI)

*V. Dhilleswara Rao, M.V. Subba Rao and M.P.S.Murali Krishna*

Rasayan J. Chem, 12 (4), 1828- 1838 (2019)

**Keywords:** Water Quality Index, Groundwater, Physicochemical parameters, correlation, Gara Mandal.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245394

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## THE CHEMICAL PROPERTIES COMPARATIVE OF YEAST HYDROLYSATE ENZYMATIC (YHE) FROM YEAST THAT FERMENTED IN RICE FLOUR VARIATION

*R. Agustini , I. G. M. Sanjaya and A. Widodo*

Rasayan J. Chem, 12 (4), 1839- 1849 (2019)

**Keywords:** Chemical Composition, Rice, Yeast, Yeast Hydrolysate Enzymatic, Extranx Yeast.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245314

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## MICROWAVE ASSISTED SYNTHESIS OF N-(1-ISOPROPYL-2- OXOINDOLIN-5-YL) SUBSTITUTED AMIDE DERIVATIVES AND THEIR ANTIMICROBIAL ACTIVITY

*P. Shankaraiah, V. Sunitha , A. Kishore Kumar and R. Madhu*

Rasayan J. Chem, 12 (4), 1850- 1856 (2019)

**Keywords:** Benzimidazole, Heterocyclic, HATU, EDC.HCl.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245445

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## PREPARATION OF HYDROGEL NANOCOMPOSITE CONTAINING GOLD NANOPARTICLES WITH UNIQUE SWELLING/DESWELLING PROPERTIES

*E.R.Wikantyasning, M.Mutmainnah, Z.Cholisoh , I.Hairunisa, M.F.A. Bakar and M. Da'i*

Rasayan J. Chem, 12 (4), 1857- 1863 (2019)

**Keywords:** Nanoparticles, Sensor, Responsive Hydrogel

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245209

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## A NOVEL POROUS ACTIVATED CARBON COMPOUND PREPARED FOR ADSORPTION OF COBALT (CO (II)) FROM AQUEOUS SOLUTION FOR ENVIRONMENTAL POLLUTION MITIGATION

*Pramod Kamble, Rupali H. Landge , Abhijit N. Lande and Vinayak P. Dhulap*

Rasayan J. Chem, 12 (4), 1864- 1871 (2019)

**Keywords:** Cobalt (Co (II)), Porous activated carbon, Bio-adsorbent, Plant material

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245324

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## AN EXPERIMENTAL STUDY ON SURFACE MODIFIER ASSISTED EXFOLIATION OF MOLYBDENUM DISULPHIDE IN A MIXED SOLVENT

*Kalyani Sreekumar, B. Bindhu, K. Veluaraja and Reena V. L.*

Rasayan J. Chem, 12 (4), 1872- 1880 (2019)

**Keywords:** MoS2, Exfoliation, Li-AHA, Photoluminescence, Antimicrobial

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245332

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## CYCLIC VOLTAMMETRIC AND AFM STUDY OF CORROSION INHIBITION AND ADSORPTION BEHAVIOR OF SODIUM DODECYL SULPHATE-ZN2+ ON CARBON STEEL IN AQUEOUS MEDIUM

*V. R. Nazeera Banu, V. Ramesh Babu, C. Kayalvizhi and K. Saravanan*

Rasayan J. Chem, 12 (4), 1881- 1888 (2019)

**Keywords:** SDS, Corrosion Inhibition, Synergistic Effect, Carbon Steel.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245339

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## THE FEASIBILITY OF SAGO BARK (Metroxylon sagu) IN Cu(II) REMOVAL: BATCH AND FIXED BED COLUMN EVALUATION

*S. Fauzia, H. Aziz , D. Dahlan and R. Zein*

Rasayan J. Chem, 12 (4), 1889- 1900 (2019)

**Keywords:** Adsorption, Batch, Column, Cu(II), Sago Bark

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245444

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## PHYTOCHEMICAL SCREENING AND ANTIOXIDANT ACTIVITY OF EXTRACTS OF Xanthium strumarium, Chrysanthemum AND THEIR MIXTURE

*M. O. Malpani , P. R. Rajput , K. V. Chinchole, S. S. Kapse and K. S. Ambarkar*

Rasayan J. Chem, 12 (4), 1901- 1908 (2019)

**Keywords:** Asteraceae species, Phytochemical Screening, DPPH Assay, Antioxidant Activity

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245447

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## THERMODYNAMIC AND ACOUSTIC STUDIES ON VARIOUS BINARY LIQUID MIXTURES

*T. Kalimulla, D. Das , M. Gowrisankar, K. Govinda Rao and Shaik. Babu*

Rasayan J. Chem, 12 (4), 1909- 1918 (2019)

**Keywords:** Speed of Sound, Viscosity, Density, R-K polynomial, Partial and Excess Partial Molar Volumes.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245481

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## TOSMIC REAGENT: AN EXCELLENT PRECURSOR IN THE SYNTHESIS OF BIOLOGICALLY ACTIVE HETEROCYCLES

*Damilola V. Aderohunmu, Taiwo T. Odutola, Olayinka O. Ajani and Ezekiel F. Adebiyi*

Rasayan J. Chem, 12 (4), 1919- 1926 (2019)

**Keywords:** Heterocyclic Motifs, Isocyanides, Bioactive Molecule, Cyclization, Total Synthesis.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245315

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## ANTAGONISTIC MECHANISM OF α-MANGOSTIN DERIVATIVES AGAINST HUMAN ESTROGEN RECEPTOR A OF BREAST CANCER USING MOLECULAR DYNAMICS SIMULATION

*M. Muchtaridi , S. Megantara, D. Dermawan and M. Yusuf*

Rasayan J. Chem, 12 (4), 1927- 1934 (2019)

**Keywords:** α-Mangostin, Breast Cancer, hERα, Molecular Docking, Molecular Dynamics

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245391

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## PREPARATION OF CHITOSAN PCL/PLA NANOCOMPOSITE BLENDED WITH BENTONITE FROM ACEH, INDONESIA

*Ridwan, B. Wirjosentono, Tamrin and T. Rihayat*

Rasayan J. Chem, 12 (4), 1935- 1941 (2019)

**Keywords:** Polycaprolactone, Poly Lactic Acid, Bentonite, Nanocomposite, Biodegradability.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245282

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## GREEN SYNTHESIS OF NiFe2O4 SPINEL FERRITES MAGNETIC IN THE PRESENCE OF Hibiscus rosa-sinensis LEAVES EXTRACT: MORPHOLOGY, STRUCTURE AND ACTIVITY

*Rahmayeni, J. Putri, Y. Stiadi, Zilfa and Zulhadjri*

Rasayan J. Chem, 12 (4), 1942- 1949 (2019)

**Keywords:** NiFe2O4, Hydrothermal, Hibiscus rosa-sinensis, Magnetic, Photocatalytic.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245304

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## CHARACTERIZATION OF TUNGSTEN/TITANIUM CARBIDE COATINGS DEPOSITED BY CATHODIC ARC DEPOSITION FOR HYDROGEN EVOLUTION

*J. Bautista-Ruiz, J.C. Caicedo and A. Chaparro*

Rasayan J. Chem, 12 (4), 1950- 1955 (2019)

**Keywords:** Hydrogen, Coating, Voltammetry, Roughness.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245390

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## UTILIZATION OF UNWANTED TERRESTRIAL WEEDS FOR REMOVAL OF DYES

*A. Singh , S. Kumar , V. Panghal , S. S. Arya and S. Kumar*

Rasayan J. Chem, 12 (4), 1956- 1963 (2019)

**Keywords:** Adsorption, Wastewater, Congo Red, Methylene Blue, Crystal Violet, Adsorbent.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245401

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## SYNTHESIS OF HYDROXYAPATITE FROM AVOCADO FRUIT PEEL AND ITS APPLICATION FOR HEXAVALENT CHROMIUM REMOVAL FROM AQUEOUS SOLUTIONS - ADSORPTION ISOTHERMS AND KINETICS STUDY

*Suman Pawar, Thomas Theodore and Poornima G. Hiremath*

Rasayan J. Chem, 12 (4), 1964- 1972 (2019)

**Keywords:** Hydroxyapatite, Avocado Peel, Isotherms, Adsorption Kinetics.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245425

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## EFFECTS OF THERMAL ENERGY, MECHANICAL ENERGY, AND SOLVENT ON CIPROFLOXACIN HYDROCHLORIDE MONOHYDRATE PHYSICOCHEMICAL PROPERTIES

*Indah Widyastuti, Ahmad Ainurofiq and Sundani Nurono Soewandhi*

Rasayan J. Chem, 12 (4), 1973- 1984 (2019)

**Keywords:** Ciprofloxacin HCl Monohydrate, Thermal Energy, Mechanical Energy, Solvent, Physicochemical property

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245426

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## EPINEPHRINE SENSOR DEVELOPED ON MWCNT MODIFIED REDOX BEHAVING METAL COMPOSITE ELECTRODE

*G. Sivasankari, S. Boobalan , P. Mekala and S. Gowri*

Rasayan J. Chem, 12 (4), 1985- 1991 (2019)

**Keywords:** MWCNT/Cys/NiHCF, Epinephrine, Composite electrode, Sensor, Cysteamine

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245430

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## PHYTOCHEMICAL SCREENING AND ANTIHYPERGLYCEMIC ACTIVITY OF ETHANOLIC EXTRACT OF Coriandrum sativum L. LEAF

*S.M. Sinaga, G. Haro , S. Sudarmi and Iksen*

Rasayan J. Chem, 12 (4), 1992- 1996 (2019)

**Keywords:** Coriander, Alloxan, Antihyperglicemic, Extract, Ethanolic

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245451

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## CHEMO SELECTIVE, ROOM TEMPERATURE AND SOLVENT FREE SYNTHESIS OF THIO-ESTERS USING EFFECTIVE SYNERGISTIC CATALYTIC SYSTEM

*Hari R. Pawar , Narendra R. Kamble and Vinod T. Kamble*

Rasayan J. Chem, 12 (4), 1997- 2004 (2019)

**Keywords:** Niobium Pentachloride, Silver Salt, Thiols, Acyl Chlorides.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245381

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## SYNTHESIS, CHARACTERISATION AND ANTIMICROBIAL ACTIVITY OF NEW NICOTINAMIDE-THIAZOLE DERIVATIVES

*H. Venkatasubramanian, Sarojkumar Sha , S. Hemalatha and D. Easwaramoorthy*

Rasayan J. Chem, 12 (4), 2005- 2010 (2019)

**Keywords:** Nicotinamide, Thiazole, Antimicrobial Activity, Amide Bond

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245321

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## INTERACTIONS OF CEFTIOFUR SODIUM WITH H2- RECEPTOR ANTAGONIST

*Runjhun Tandon , Nitin Tandon, Raakhi Gupta and Neelima Gupta*

Rasayan J. Chem, 12 (4), 2011- 2022 (2019)

**Keywords:** Cephalosporins, Ranitidine, Absorbance, H2-Receptor Antagonists, Bioavailability

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245363

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## ZINC-OXIDE NANOPARTICLES AS FACILE CATALYST FOR RAPID SYNTHESIS OF 5-METHYL-4-(2-(3-METHYL-4- NITROISOXAZOL-5-YL)-1-ARYLETHYL)-1H-PYRAZOL3-OLS IN AQUEOUS MEDIUM

*P. Usharani and N. Madhavi*

Rasayan J. Chem, 12 (4), 2023- 2029 (2019)

**Keywords:** Heterogeneous Catalysis, Zinc-oxide Nanoparticles, Multi-component Reaction, 3-Methyl-4-nitro-5-alkenylisoxazoles, Pyrazole.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245468

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## MOLECULAR DOCKING STUDIES OF PHYTOCOMPOUNDS WITH TRANSCRIPTIONAL FACTORS IN HEPATOCELLULAR CARCINOMA

*Sushma S. Murthy and T. Bala Narsaiah*

Rasayan J. Chem, 12 (4), 2030- 2038 (2019)

**Keywords:** Hepatocellular Carcinoma, Phytocompounds, Transcriptional Factors, Molecular Docking, AutoDockVina

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245475

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## THE APPARENT AND PARTIAL MOLAR VOLUMES OF SODIUM CARBOXYMETHYLCELLULOSE IN ACETONITRILE-WATER MIXED SOLVENT MEDIA

*P. Nandi and C. Das*

Rasayan J. Chem, 12 (4), 2039- 2046 (2019)

**Keywords:** Sodium Carboxymethylcellulose, Mixed Solvent Media, Partial Molar Volume, Counterion Binding, Ion-Solvent Interactions

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245388

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## SYNTHESIS AND RESEARCH OF POLYMER HYDROGELS ON THE BASIS OF HYDROLYSED POLYACRYLONITRILE AND EPICHLORHYDRIN

*R. Zh. Omirova, A. A. Bolysbek , Sh. D. Shirinov and A.T. Dzhalilov*

Rasayan J. Chem, 12 (4), 2047- 2051 (2019)

**Keywords:** HYPAN (hydrolyzed polyacrylonitrile), Polymers, Temperature, Epichlorohydrin, Hydrophilic

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245331

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## Bi(OTf)3 PROMOTED MICROWAVE SYNTHESIS OF 2-ARYL, 5-SUBSTITUTED 1,3,4-OXADIAZOLES AND EVALUATION OF THEIR ANTICANCER ACTIVITY

*Baby Ramana Mutchu , Siva Nagi Reddy Mule , Krishna Murthy Mannam and Hari Babu Bollikolla*

Rasayan J. Chem, 12 (4), 2052- 2057 (2019)

**Keywords:** 2-Aryl,5-disubstituted-1,3,4-oxadiazoles, 1,3,4-Oxadiazoles, Bismuth Triflate, Aryl Carboxylic Acid Hydrazide, Aryl Carboxylic Acid Chlorides.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245237

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## GREEN CHEMISTRY FOR THE PREPARATION OF BIO-BASED OIL FROM CATFISH FAT USING A CAVITATION SYSTEM

*Hong Tran Thi, Tien Nguyen Minh , Do Quy-Diem , Trung Nguyen Kim, Thoa Dao Thi Kim and Tan Phan Minh*

Rasayan J. Chem, 12 (4), 2058- 2064 (2019)

**Keywords:** Catfish Fat, Cavitation, Bio-based Oil, Bio-lubricant

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245289

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## OVERVIEW OF PHYTOCHEMICAL COMPOUNDS AND PHARMACOLOGY ACTIVITIES OF CRATOXYLUM GENUS

*D. Juanda, I. Fidrianny , K. Ruslan , and M. Insanu*

Rasayan J. Chem, 12 (4), 2065- 2073 (2019)

**Keywords:** Cratoxylum, Guttiferae, Xanthone, Traditional Uses, Pharmacological Activities, Phytochemical Compounds

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245303

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*N. M. Saptarini, D. Rahayu and S.A.F. Kusuma*

Rasayan J. Chem, 12 (4), 2074- 2081 (2019)

**Keywords:** Casein, First-Order Thermal Inactivation, Precipitation, Specific Character

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245319

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*I. Irfan, M. Irfan , M. Abid and A. Azam*

Rasayan J. Chem, 12 (4), 2082- 2096 (2019)

**Keywords:** Pyrazoline, Metal complexes, E. histolytica, Docking and ADMET studies.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245320

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*S. H. Shigalugov, Yu. I. Tyurin and D. V. Dubrov*

Rasayan J. Chem, 12 (4), 2097- 2102 (2019)

**Keywords:** Crystalline Phosphorus, Nitrous Oxide, Luminescence Kinetics, Luminescence Spectrum, Yttrium Oxide

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245413

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*S. Dharmadhikari, D. Ghime and V. Kumar*

Rasayan J. Chem, 12 (4), 2103- 2110 (2019)

**Keywords:** Microbial Fuel Cells, Proton Exchange Membrane, Ion Exchange Capacity, Chemical Oxygen Demand

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245422

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Rasayan J. Chem, 12 (4), 2111- 2115 (2019)

**Keywords:** Organic matters, Pre-Chlorination, Coagulation, Adsorption, Chloroform

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245472

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*Nanik Siti Aminah , Andika Pramudya Wardana, Alfinda Novi Kristanti, Brilliana Via Safitri and Mafalda Rosa*

Rasayan J. Chem, 12 (4), 2116- 2123 (2019)

**Keywords:** Acid-base, Green Chemistry, Impatiens balsamina L., Natural Indicator, Titration

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245498

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*V. Chitra and D. Roopsingh*

Rasayan J. Chem, 12 (4), 2124- 2131 (2019)

**Keywords:** Poly(ester amides), 2,5-Pyridinedicarboxylic Acid, Direct Polycondensation, Characterization; LC Properties, Wound Scratch Assay.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245431

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*M. Yusuf ,D. Roza , Nurfajriani , H. Gunawan and N. Dari*

Rasayan J. Chem, 12 (4), 2132- 2140 (2019)

**Keywords:** Bis(β-diketonato)zirconium(IV) Chloride, Ring Opening Polymerization, ε-Caprolactone, Poly(εcaprolactone), Plausible Mechanism.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245463

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*V. Sathiyanarayanan , H. Venkatasubramanian and D. Easwaramoorthy*

Rasayan J. Chem, 12 (4), 2141- 2148 (2019)

**Keywords:** Irbesartan, HPLC, Reversed-phase, Stationary Phase, Active Content.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245419

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*P. Rajamani and N. Sundaraganesan*

Rasayan J. Chem, 12 (4), 2149- 2165 (2019)

**Keywords:** BPTP, UV-Vis, NMR, HOMO-LUMO, MEP.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245436

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*S. Sivaprakash and S.K. Krishna*

Rasayan J. Chem, 12 (4), 2166- 2175 (2019)

**Keywords:** Activated Carbon, Adsorbent, Composite, Dye, Capacity.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245181

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Rasayan J. Chem, 12 (4), 2176- 2182 (2019)

**Keywords:** Waste water treatment, Biosorption, Isotherm Studies, Dye Pollution, Industrial pollution

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245478

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*Bhaskar Chakraborty*

Rasayan J. Chem, 12 (4), 2183- 2209 (2019)

**Keywords:** Green Chemistry, 1,3-Dipolar cycloadditions, Heterocycles, Mechanochemistry, Aqueous Phase Synthesis, Ionic Liquids, Microwave induced Reactions

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Rasayan J. Chem, 12 (4), 2210- 2217 (2019)

**Keywords:** Bismuth Oxide, Solution Combustion, Fuel-oxidant, Photocatalyst, Photocatalysis

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245323

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Rasayan J. Chem, 12 (4), 2218- 2226 (2019)

**Keywords:** Alccofine, Coconut Shell concrete, Optimization, Properties, Inverted Metallurgic Microscope.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245231

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Rasayan J. Chem, 12 (4), 2227- 2234 (2019)

**Keywords:** Oleoresin, Tapping pine, Vinegar, Organic Stimulant, Quarre

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245199

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*Parul Kumar, Sushma Jain and Bhupender Kumar*

Rasayan J. Chem, 12 (4), 2235- 2240 (2019)

**Keywords:** Ground Water, Heavy Metal Pollution Index, Metal Index, Hazard Index, Sirsa, Haryana.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245259

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Rasayan J. Chem, 12 (4), 2241- 2251 (2019)

**Keywords:** Adsorption Kinetics, Chitosan, Nonlinear Method, Tartrazine

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245309

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Rasayan J. Chem, 12 (4), 2252- 2259 (2019)

**Keywords:** Green Synthesis, Ocimum sanctum, X-ray Diffraction, TEM, SEM, Antibiofilm Activity

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245341

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Rasayan J. Chem, 12 (4), 2260- 2266 (2019)

**Keywords:** 1, 2, 3- Triazole, Chalcone, Pyrazoline, FTIR, 1H NMR, 13C NMR, Mass Spectra and Antimicrobial Activity.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245383

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**Keywords:** Chromone, Antioxidant, DPPH, Schiff Base, Radical Scavenging.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245489

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Rasayan J. Chem, 12 (4), 2273- 2283 (2019)

**Keywords:** Anti-xanthine Oxidase, Flavone, Dillenia indica L., Molecular Docking.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245412

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*O. Fadriyanti, I. D. Nasution , D. Handayani and W. Siswomiharjo*

Rasayan J. Chem, 12 (4), 2284- 2289 (2019)

**Keywords:** GC-MS, Biological Activities, Aspergillus sp, Rhizophora mucronata.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245415

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Rasayan J. Chem, 12 (4), 2290- 2295 (2019)

**Keywords:** Grey Water, Purification, Fibrous Material, Agave Sisalana, Areca Nut Husk.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245453

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**Keywords:** Hydroquinone, Arbutin, Voltammetry, Ferrocene, Cosmetics, Whitening Agent

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**Keywords:** CO2 Emission, Chlorella sp, Photobioreactors, Kinetic Models

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245439

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**Keywords:** Congo red, Spathodea Campanulata, Textile wastewater, Biosorption

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**Keywords:** Schiff Base Metals Complexes, Spectroscopic Investigation, TGA, Antimicrobial, Antimycobacterial Activity

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245459

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Rasayan J. Chem, 12 (4), 2338- 2347 (2019)

**Keywords:** Escitalopram, L-methyl folate, RP-HPLC and Orthophosphoric Acid buffer.

**DOI:** http://dx.doi.org/10.31788/RJC.2019.1245438

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Rasayan J. Chem, 12 (4), 2348- 2357 (2019)

**Keywords:** Diabetes Mellitus Type 2, Fermentation, Yeast Hydrolysate Enzymatic, Chromium, Rice Flours

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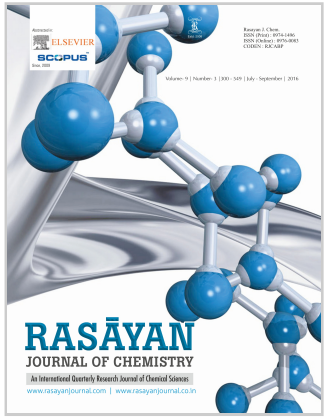


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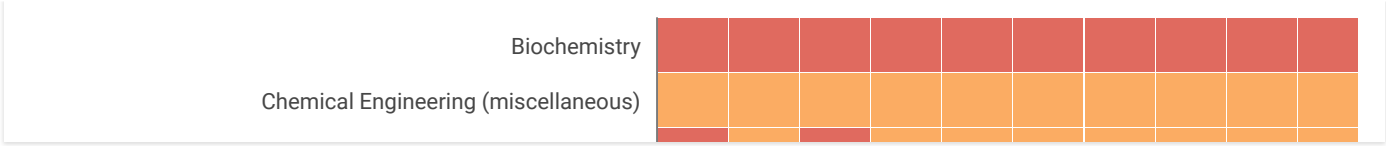


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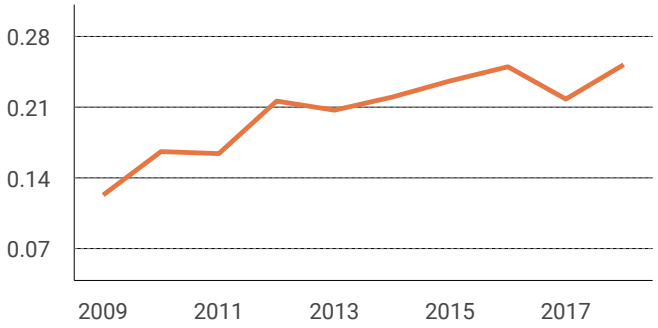


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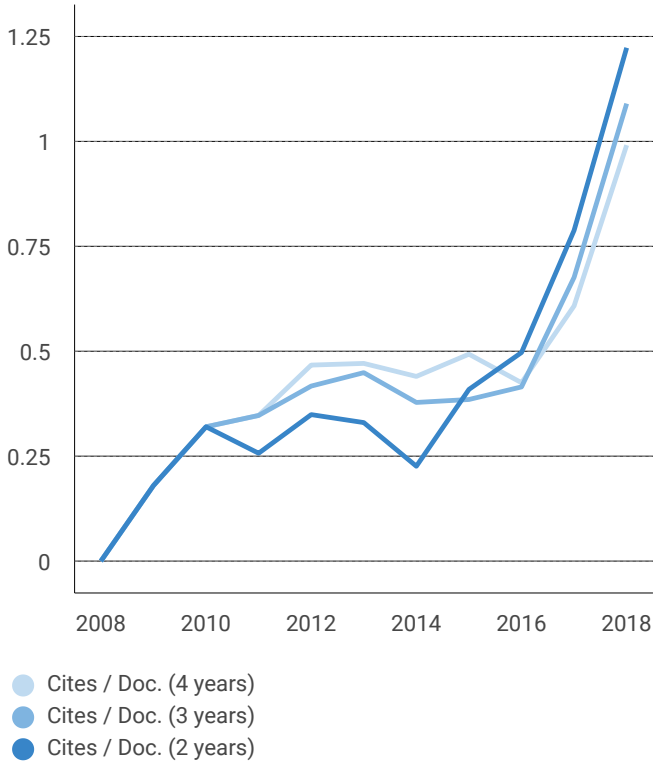


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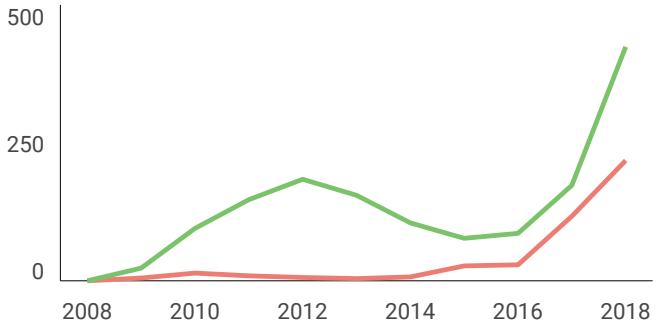


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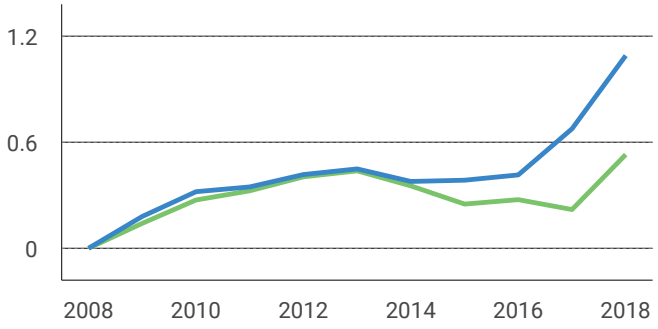


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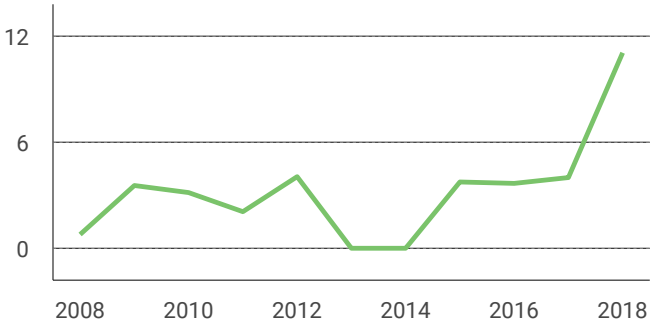


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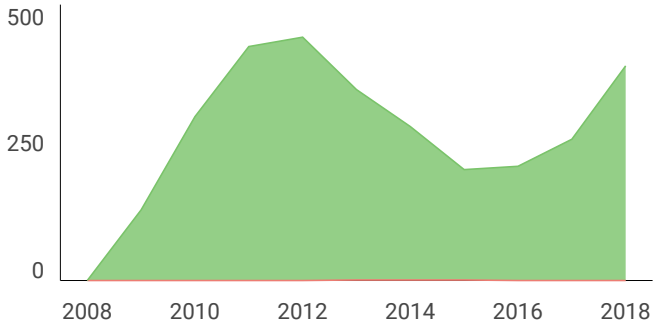


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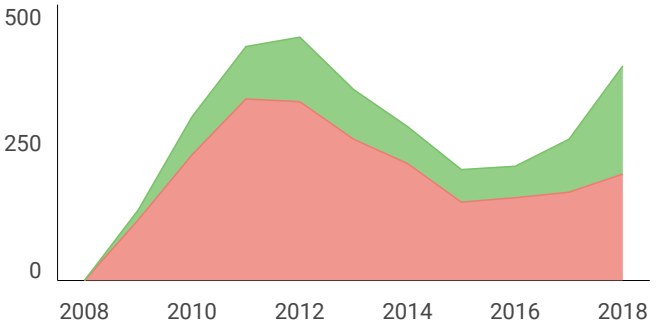


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# APPLICATION OF FLOWER COLOR VARIATIONS TO *Impatiens balsamina* L. AS AN ENVIRONMENTALLY FRIENDLY ACID-BASE INDICATOR

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**ABSTRACT**

An acid-base titration is one of the quantitative analysis methods involving a high-polluting, harmful, hazardous, and relatively expensive synthetic indicator. The development of the concept of green chemistry encourages research to invent natural indicators that are more environmentally friendly. *Impatiens balsamina* L. flower has a variety of colors and contains anthocyanin pigments. Rose pink, red, violet, orangish red, and pink *Impatiens balsamina* L. flower were extracted with acidified ethanol solvent. All five *I. balsamina* L. flower extracts indicate discoloration on pH range 10-12. Violet flower extract has an error percentage of strong acid-strong base titration which was 50.48 ± 2.18%, while in strong acid-weak base titration was 19.27 ± 1.15%. Meanwhile, it cannot be applied in weak acids-strong base titration. Thus, *I. balsamina* L. flowers can be used as an alternative to environment-friendly natural acid-base indicators.

**Keywords:** Acid-base, Green Chemistry, *Impatiens balsamina* L., Natural Indicator, Titration



## INTRODUCTION

The beginning of green chemistry was dominated by the green organic synthesis in various branches of the chemical industry.[1]This green chemistry activity has been applied to the role of analytical chemists in making laboratory practices more environmentally friendly.[2] Green analytical chemistry (GAC) emerged in 2000, where the main principle was to replace toxic reagents, reduce the number of reagents used and the waste produced dramatically, thereby reducing or avoiding the side effects of the analytical process. It is carried out to increase the awareness of environmental problems caused by analytical processes and industries in the chemical field.[3]

Titration is the most common laboratory method carried out by quantitative chemical analysis used to determine the concentration of analytes.[4] Some scientists frequently conducted titration using high-polluting, harmful, hazardous, and relatively expensive synthetic indicators[4]. Both dye and synthetic indicators have become a cause of concern because of the damages to the environment and living systems. Therefore, efforts to replace hazardous synthetic indicators with the natural one obtained from plant sources have been made.[5] Therefore, various studies on the indicators from natural products are being carried out widely by many scientists around the world because they are less dangerous, low cost, easily available, and environmentally friendly.[6] Research on acid-base indicators of natural products includes flower estates such as *Nerium oleander* and *Catharanthus roseus*[7], *Antirrhium majus* and *Dianthus plumarius*[8], *Quisqualis indica*, *Pentas lanceolate*, *Malabathricum melastoma*, *Impatiens acaulis* [9], *Thunbergia erecta*[10], and *Syzygium cumini.*[11]

Anthocyanin compounds are water-soluble pigments and are naturally found in various types of plants. The color of red to blue flowers comes from anthocyanins, a class of flavonoids. Flower color is one of the most important characteristics of floricultural crop.[12] Color is given by anthocyanin due to its long and conjugated double bond arrangement, so it can absorb light in the visible light range.


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*I. balsamina* is a flowering plant that is widely grown and belongs to the family of *Balsaminaceae* originating from India. Balsam is commonly known as garden balsam, rose balsam and Gulmehdiin Hindi.[13] This plant is a qualitative short-day plant, free-flowering, semi-hard and compact, can withstand heavy rain and live in high humidity. Balsamina is a popular species in northern India.[14] This plant can also be grown in Indonesia and has been reported to grow in Pontianak, West Kalimantan.[15] *I. balsamina* L. plants are assumed to have anthocyanin since it has a variety of flower color, from red to purple. Thus, it is necessary to conduct research on the color variations of *I. balsamina* L. flowers as a substitute for synthetic indicators that are more environmentally friendly, low cost, less dangerous and easily available.

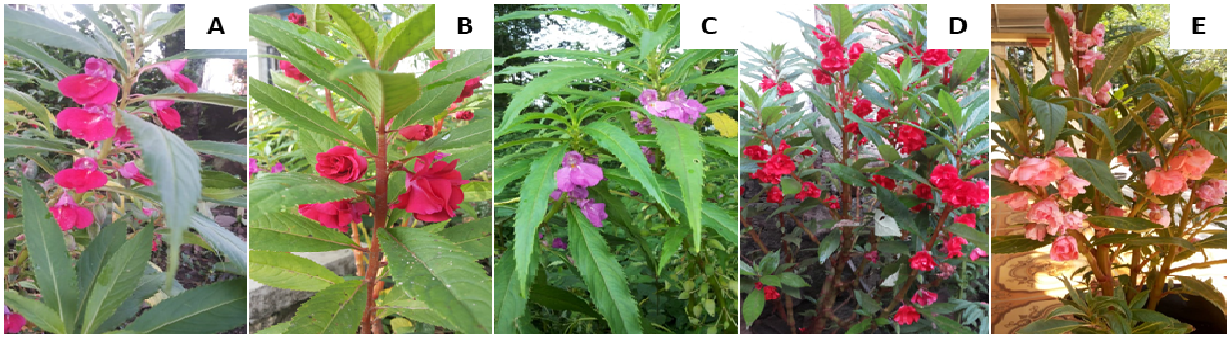


Fig.-1: *Impatiens balsamina* L. flower (A) Rose Pink, (B) Red, (C) Violet, (D) Orangish Red, dan (E) Pink

## EXPERIMENTAL

### Material

The materials used in this research were five *Impatiens balsamina* L. flowers with various colors, namely rose pink, red, violet, orangish red, and pink. The chemicals used were HCl, NaOH, $CH_3COOH$, $NH_4OH$, ethanol 96%, phenolphthalein (pp), methyl red, and distilled water.

### Apparatus

The tools used in this research were a UV-Vis spectrometer, Beaker glass, Erlenmeyer flask, pipette, pH meter, rotary vacuum evaporator, Buchner funnel, burette, mortar and pestle.

### Extraction of *I. Balsamina* L Flower.

Samples in the form of fresh flowers from the five *I. balsamina* L. flowers macerated with 96% ethanol acidified with 1% HCl for 30 minutes. The maceration results of each flower were then filtered and the extract obtained was then concentrated with a rotary vacuum evaporator at 35°C until thick extracts were obtained[10].

### Determination of pH Range of Indicator Obtained From *I. Balsamina* L. Flower Extract

The 3 drops of each indicator of *I. balsamina* L. flower extract was dropped onto 5 mL solution of pH 1 to 14. The color change was observed and the absorption bands were determined by UV-Vis spectrophotometer at wavelengths of 200-600 nm. The pH range was determined from color changes and absorption bands from the solutions which have been given an indicator of *Impatiens balsamina* L. flower extract.

### Determination of Error Percentage of Indicator Obtained From *I. Balsamina* L. Flower Extract

Error percentage of the five indicators obtained from *I. balsamina* L. flower extract with variations in flower colors was determined by the acid-base titration method and compared to standard indicators. Titrations used were strong acid-strong base, strong acid-weak base, weak acid-strong base, and weak acid-weak base titration with standard phenolphthalein and methyl red indicators.

$$\%Error = \left|\frac{Experimental\ value - Theoritical\ value}{Theoritical\ value}\right| x100$$

## RESULTS AND DISCUSSION

### Absorption Bands of *I. balsamina* L. Flower Extract

The absorption bands of the *I. balsamina* L. flower extracts were shown in Fig.-2. Based on the UV-Vis spectra above, it indicated that the absorption bands of extract A were at 505.5, 324.5 and 248.5 nm, extract B were at 517.5 nm, 320 nm and 266.5 nm, extract C were at 533.5 nm, 345 nm and 263.5 nm, extract D were at 503 nm, 317 nm and 249 nm, while extract E was at 519.5 nm, 339.5 nm and 249 nm. It shows that the five colors of *I. balsamina* L. flower are assumed to contain anthocyanin compounds. The anthocyanin compound has the characteristics of two absorption regions at wavelengths that are UV (260-280 nm) and visible (490-550 nm).[16] The color of anthocyanin is caused by a long conjugated double bond arrangement; thus, it can absorb light in the visible light range. The color caused by anthocyanin depends on the acidity (pH) of the environment. Therefore, this pigment can be used as a pH indicator. However, it is not possible to distinguish the various types of anthocyanins based solely on the UV-Vis spectrum.

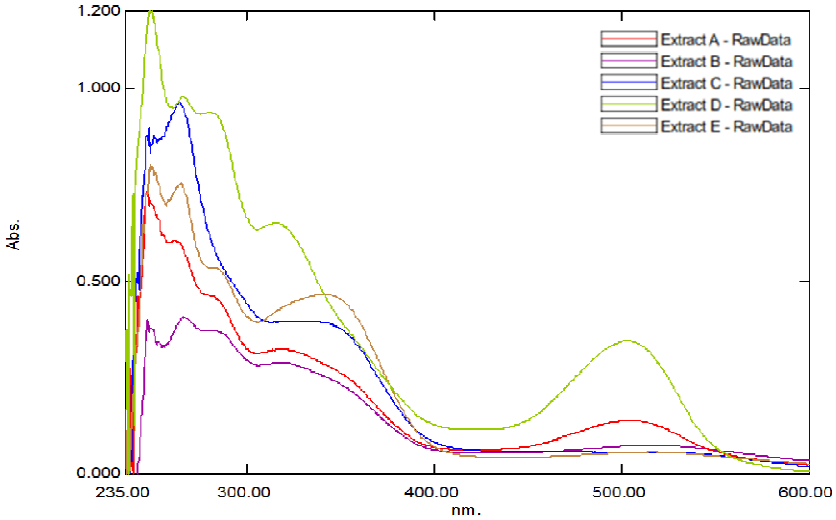



Fig.-2: UV-Vis Spectra of *I. balsamina* L. Flower Extract By Various Flower Colours, (A) Rose pink, (B) Red, (C) Violet, (D) Orangish pink, and (E) Pink

### Determination of pH Range On Indicator Obtained From *I. Balsamina* L. Flower Extract

The pH range of the five indicators obtained from *Impatiens balsamina* L. flower extract was determined based on its color changes and absorption bands in acid-base solutions (pH 1-14). The change in the indicator color of the 5 flowers in the pH solution was shown in Fig.-3.

There are four forms of anthocyanin structure in equilibrium which cause color changes in anthocyanin-containing flower extracts. All five indicators can be inferred that it changes from red to orange color at acidic pH (1-2), it is because anthocyanin forms a flavylium cation. The increase in pH change causes the color of the extract to fade almost to colorless due to the formation of a pseudo base carbinol from anthocyanin caused by the flavylium cation hydration which subsequently undergoes tautomeric formation of chalcone pseudo base. At alkaline pH, anthocyanin forms a bluish-colored quinonoidal base. Color changes at pH 1-14 from the five *Impatiens balsamina* L. flower extracts were supported by changes in the UV-Vis absorption band. It is one of the supporting data in determining the pH range of each flower extract. The UV-Vis spectra of the five *I. balsamina* L. flower extracts with respect to pH changes were shown in Fig.-5.

The absorption band shift of extract A (Fig.-5. A1 and A2), extract B (Fig.-5. B1 and B2), and extract E (Fig.-5. E1 and E2) at pH 1-10 were not significant, while at pH 11-12 absorption bands I and II were significantly shifted. The absorption band of Extract C (Fig.-5. C1 and C2) was relatively constant at pH 1-9, while at pH 10-11 the bands I and II shift were significant. On extract D (Fig.-5. D1 and D2), the absorption bands I and II at pH 1-10 were relatively stable, but at pH 11-12, a significant absorption band shift occurred. Extract D also undergoes a shift in absorption bands at pH 12-13

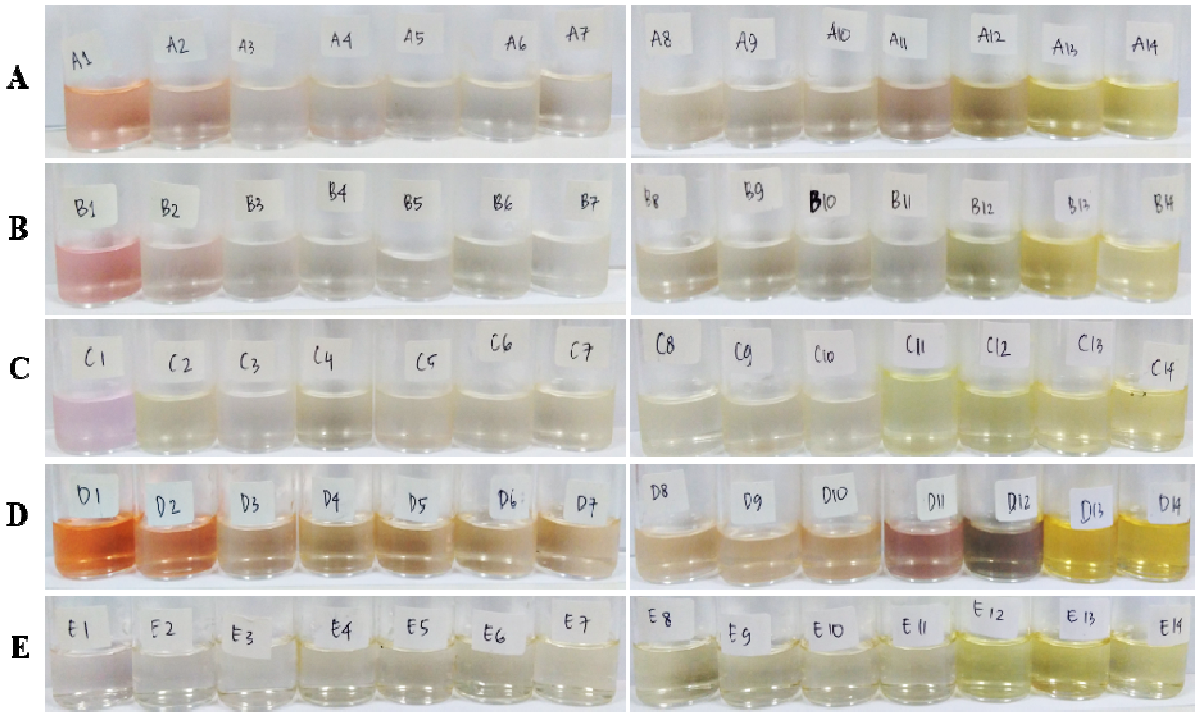



Fig.-3: The Color Changes Of Indicator Obtained From *Impatiens balsamina* L. Flower Extract, (A) Rose Pink, (B) Red, (C) Violet, (D) Orangish Red, dan (E) Pink

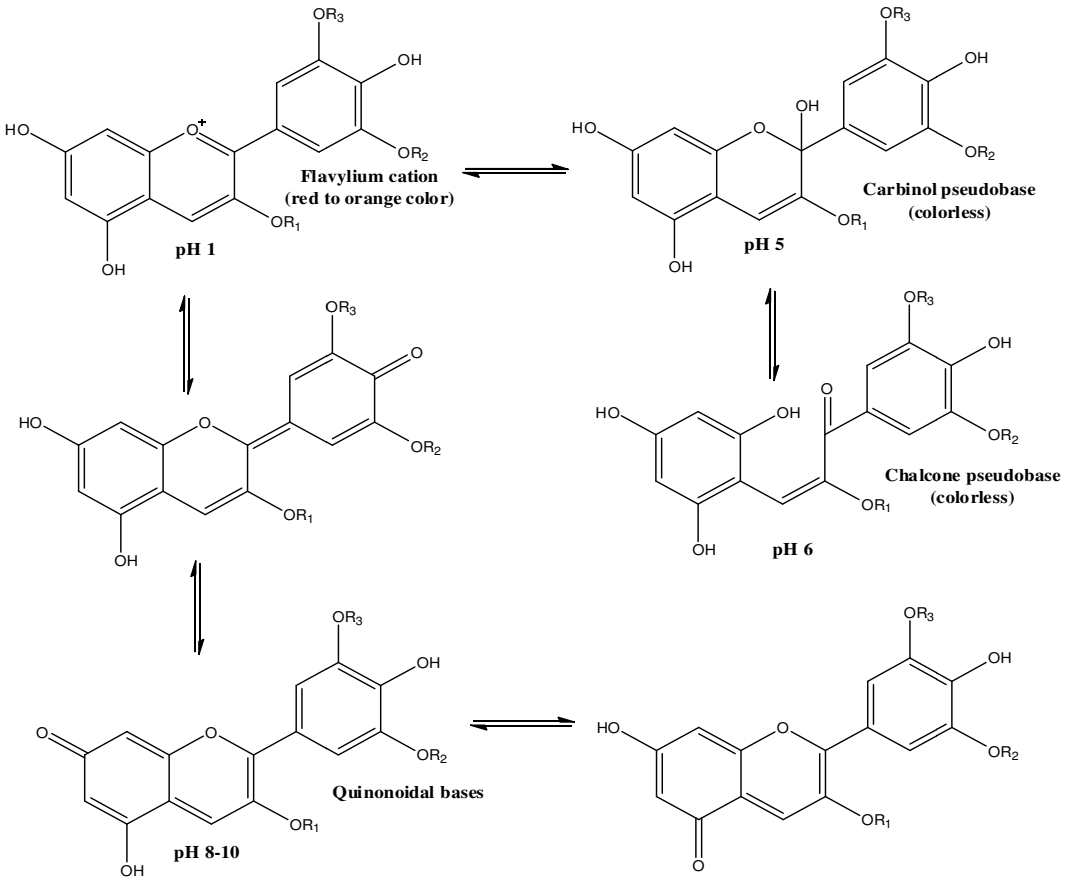
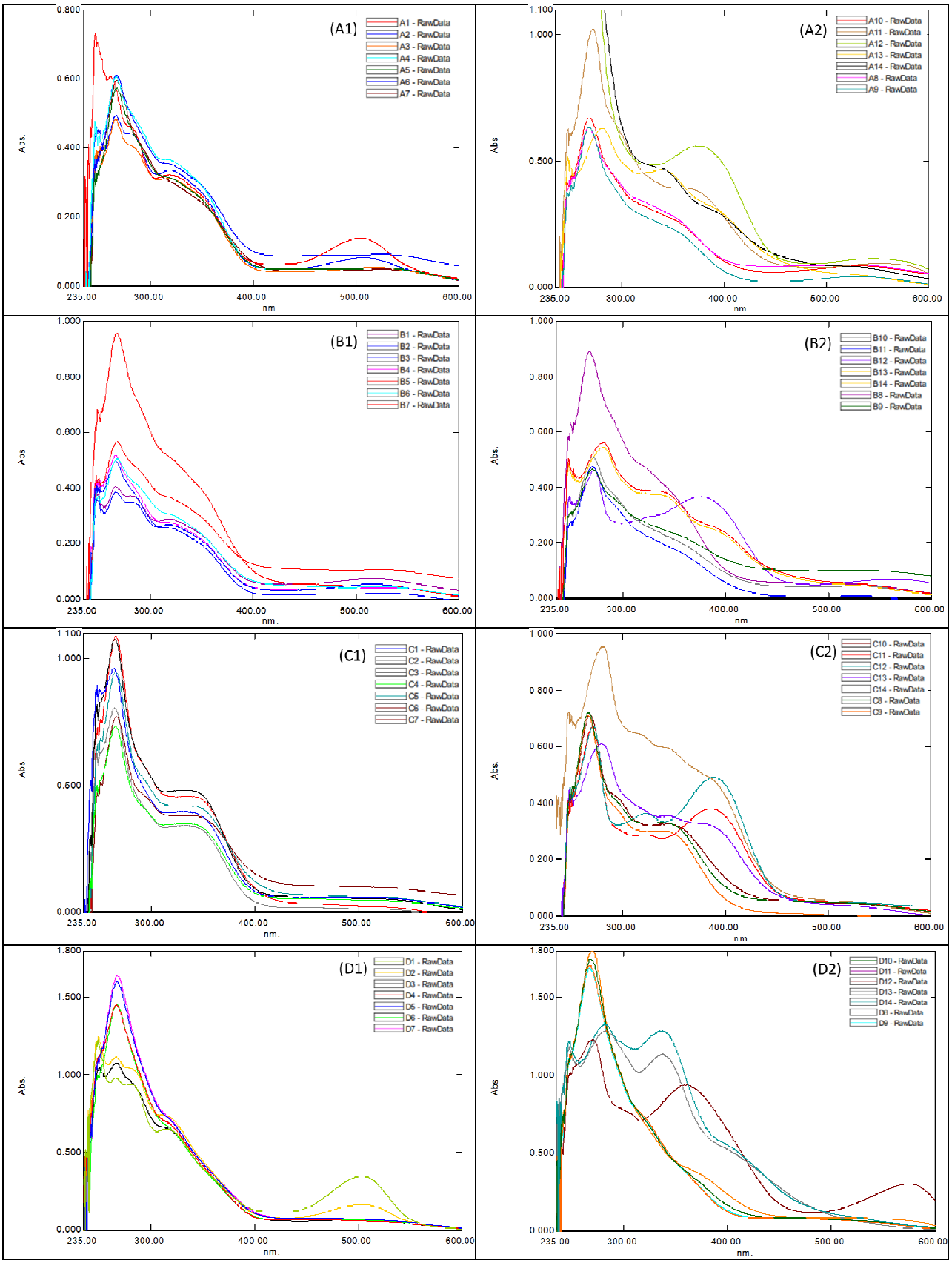



Fig.-4: Effect of pH on The Form of Anthocyanin Compounds (Modified)[17]


(A1)
A1 - RawData
A2 - RawData
A3 - RawData
A4 - RawData
A5 - RawData
A6 - RawData
A7 - RawData
(A2)
A10 - RawData
A11 - RawData
A12 - RawData
A13 - RawData
A14 - RawData
A8 - RawData
A9 - RawData
(B1)
B1 - RawData
B2 - RawData
B3 - RawData
B4 - RawData
B5 - RawData
B6 - RawData
B7 - RawData
(B2)
B10 - RawData
B11 - RawData
B12 - RawData
B13 - RawData
B14 - RawData
B8 - RawData
B9 - RawData
(C1)
C1 - RawData
C2 - RawData
C3 - RawData
C4 - RawData
C5 - RawData
C6 - RawData
C7 - RawData
(C2)
C10 - RawData
C11 - RawData
C12 - RawData
C13 - RawData
C14 - RawData
C8 - RawData
C9 - RawData
(D1)
D1 - RawData
D2 - RawData
D3 - RawData
D4 - RawData
D5 - RawData
D6 - RawData
D7 - RawData
(D2)
D10 - RawData
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D14 - RawData
D8 - RawData
D9 - RawData
Abs.
nm.

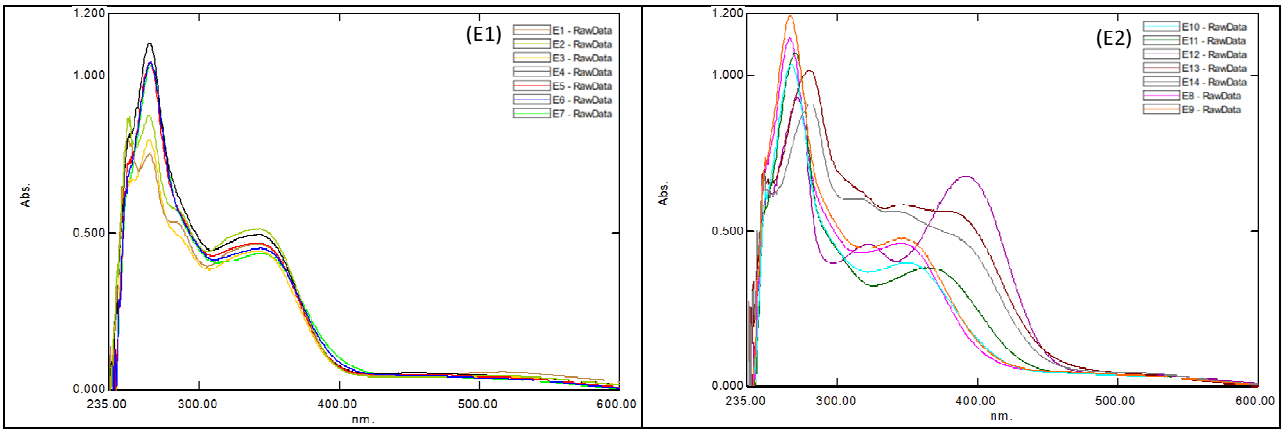


Fig.-5. UV-Vis Spectra Of *Impatiens Balsamina* L. Flower Extract On pH Value 1-14. (A1) Flower Extract A On pH Value 1-7, (A2) Flower Extract A On pH Value 8-14, (B1) Flower Extract B On pH Value 1-7, (B2) Flower Extract B On pH Value 8-14, (C1) Flower Extract C On pH Value 1-7, (C2) Flower Extract C On pH Value 8-14, (D1) Flower Extract D On pH Value 1-7, (D2) Flower Extract D On pH Value 8-14, (E1) Flower Extract E On pH Value 1-7, (E2) Flower Extract E On pH Value 8-14.

Based on the color changes and absorption band shifts of *I. balsamina* L. flower extract, the pH range of the flower extract indicator can be determined as shown in Table-1.

Table-1: Color Change and Absorption Band of the *I. Balsamina* L. Flower Extracts Indicators

| No. | Flower extract | Color change | Bands ($\lambda_{max}$ nm) | | |
|---|---|---|---|---|---|
| | | | I | II | III |
| 1 | A | | | | |
| | pH 11 | Orange | 369.5 | 271 | - |
| | pH 12 | Reddish yellow | 375 | 245 | - |
| 2 | B | | | | |
| | pH 11 | Colorless | - | 352.5 | 271 |
| | pH 12 | Bluish yellow | 562.5 | 376 | 271 |
| 3 | C | | | | |
| | pH 10 | Colorless | 352 | 268.5 | - |
| | pH 11 | Yellow | 386 | 271 | - |
| 4 | D | | | | |
| | pH 11 | Purplish red | - | 367.5 | 269.5 |
| | pH 12 | Violet | 574.5 | 360.5 | 270 |
| | pH 13 | Yellow | 338 | 283 | 248 |
| 5 | E | | | | |
| | pH 11 | Colorless | 339.5 | 249.5 | |
| | pH 12 | Yellow | 391.5 | 271.5 | |

**Error Percentage of Indicator Obtained From *I. Balsamina* L Flower Extract**

Acid-base titration is used to determine the error percentage of the five *Impatiens balsamina* L. flower extracts. The error percentage of each flower was shown in Table-2.

Table-2: Error Percentage of the Five *Impatiens Balsamina* L. Flower Extract Indicators

| No. | Type of titration | Indicator | End point pH | | | % Error ± SD |
|---|---|---|---|---|---|---|
| | | | I | II | III | |
| 1 | Strong acid-Strong base | Phenolphthalein | 8.7 | 8.5 | 8.9 | 24.29±2.86 |
| | | A | 11.3 | 11.5 | 11.2 | 61.90±2.18 |
| | | B | 11.4 | 11.2 | 11.5 | 62.38±2.18 |

| No. | Type of titration | Indicator | End point pH | | | % Error ± SD |
|---|---|---|---|---|---|---|
| | | | I | II | III | |
| | | C | 10.7 | 10.5 | 10.4 | 50.48±2.18 |
| | | D | 11.1 | 11.1 | 11.2 | 59.05±0.82 |
| | | E | 11.9 | 12 | 12.3 | 72.38±2.97 |
| 2 | Strong acid-Weak base | Phenolphthalein | 8.8 | 8.9 | 8.8 | 1.30±0.66 |
| | | A | 11.5 | 11.4 | 11.4 | 31.12±0.66 |
| | | B | 11.1 | 11.3 | 11.2 | 28.44±1.15 |
| | | C | 10.4 | 10.3 | 10.5 | 19.27±1.15 |
| | | D | 11.2 | 11.1 | 11.2 | 28.06±0.66 |
| | | E | 12.3 | 12.4 | 12.2 | 41.06±1.15 |
| 3 | Weak acid-Strong base | Methyl Red | 5.4 | 5.3 | 5.6 | 2.90±2.89 |
| | | A | 11.2 | 11.3 | 11.3 | 100 |
| | | B | 11.3 | 11.4 | 11.2 | 100 |
| | | C | 10.2 | 10.1 | 10.1 | 100 |
| | | D | 11.1 | 11.2 | 11.2 | 100 |
| | | E | 11.8 | 11.9 | 12 | 100 |

The error percentage of the five indicators in several titrations shows that at strong base-strong acid titration are all above 50%, indicating that the pH range of the flower extract indicator is not suitable for strong base-strong acid titration because the equivalence point at this titration is at pH 7 while the pH range of the indicators around pH 10-12. Meanwhile, on the strong acid-weak base titration, the error percentage given by each flower extract indicator is relatively smaller. Extract C has the best error percentage, which is 19.27% ± 1.15. The titration of the weak acid-strong base from all extract indicators has an error rate of 100%, showing that the indicator cannot be employed in weak acid-weak base titration. The titration of the weak acid-strong base has an equivalent point at around pH 5.28 while the five *I. balsamina* L. flower extract indicators have pH range of 10-12 (bases) which poses this indicator not to be used in weak acid-strong base titration applications.

## CONCLUSION

*I. balsamina* L. flowers with various color variations can be used as an alternative acid-base indicator that is environmentally friendly. The pH range of the indicator was at pH 10-12. The best error percentage of *I. balsamina* L. flower extract was violet-colored flowers, on strong acid-weak base titration with the error percentage 50.48 ± 2.18%. In the strong acid-weak base, the error percentage was 19.27 ± 1.15%. Meanwhile, weak acids-strong base titration cannot be employed.

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