Radha Gupta ..... Curriculum Vitae

PERSONAL DETAILS

PRESENT POSITION
Ph.D. (Submitted)

PRESENT ADDRESS
Department of Chemistry and Chemical Biology, Indian Institute of Technology (Indian School of Mines), Dhanbad, Jharkhand-826004, India

YEAR OF BIRTH
1989

GENDER
FEMALE

MARITAL STATUS
UNMARRIED

CONTACT
Phone:
+917368865056
+917581026010
Email:
radha.gupta1989@gmail.com
radha.2016dr0012@ac.iitism.ac.in
Research gate:
https://www.researchgate.net/profile/Radha-Gupta-7
Orcid id:
https://orcid.org/0000-0002-7022-569X

LANGUISHES KNOWN
English, Hindi (mother tongue)

CAREER OBJECTIVE

To be associated with an organization that gives me an opportunity for self-improvement while contributing to the symbolic growth of the organization with my technical, innovative and logical skills.

RESEARCH INTEREST

- Materials Chemistry, Mesoporous Materials, Metal ions adsorption, Dye degradation, Hybrid Materials.
- Heterogeneous catalysis.
- Mesoporous catalytic materials and Graphene-based catalysts.
- Fly ash based adsorbent.

EDUCATION

Ph.D. (Heterogeneous Catalysis and Heavy Metal Ions Adsorption)
Indian Institute of Technology (Indian School of Mines), Dhanbad, Jharkhand-826004, India.
Thesis Title: Synthesis of functionalized SBA-16 mesoporous materials: Applications in catalysis and removal of heavy metal ions from water

M.Sc. (Environmental Chemistry)
2009 - 2011
Jiwaji University, Gwalior, Madhya Pradesh, India, 474011.

B.Sc. (Industrial Chemistry)
2006 - 2009
Jiwaji University, Gwalior, Madhya, India, 474011.

ACHIVEMENTS AND AWARDS

- Qualified "**GATE-Chemistry**" in 2016.
- Received "**ISM-JRF Research Fellowship**" by IIT (ISM), Dhanbad, for Pursuing of Ph.D. (2016-2021).

EXPERIMENTAL AND SCIENTIFIC SKILLS

- Six years of research experience in material chemistry, heterogeneous catalysis and water remediation.
- Have ample expertise in mesoporous material synthesis.
- Expert and enthusiastic researcher with a demonstrated history of working in the field of heterogeneous catalysis and metal ions adsorption from aqueous solutions and dye degradation.
- Skilled in successfully synthesizing SBA-16, MCM-41, Graphene-oxide, Fly-ash based composite catalysts and adsorbents *via* sol-gel, deposition precipitation, impregnation, non-hydrothermal, physical grinding and template synthesis methods.

- Advance knowledge of materials and surface characterization techniques, such as PXRD, N_2-adsorption/desorption, FESEM, EDAX, ICP-MS, HRTEM, CO_2-TPD, solid-state ^{13}C NMR, FTIR, XPS, TGA, UV-Vis, pH meter and AAS.
- Practical experience of extraction methods, various chromatographic techniques, distillation, crystallization techniques.
- Expertise in the synthesis of solid silica-based mesoporous catalyst/adsorbent and their sequential functionalization through different synthesis routes.
- Expertise in analysis of data related to ^{1}H, ^{13}C, IR, UV-Vis and HRMS etc.
- Three month training experience in the field of "Analysis of pharmaceuticals products by analytical instruments" in **Rajat Pharma Chem LTD. Ankleshwar, Gujrat**.
- Excellent track record of productive research demonstrated by publications in leading scientific journals.
- Good project management skills, technical presentation and teaching skills.
- Strong knowledge of lab safety.
- Experienced in working independently as well as in coordinating and managing collaborative research projects.
- Articulate and confident in data interpretation, writing of research articles, proposals, reports etc.
- Expertise in Microsoft Office, Microsoft Excel, and various analytical software like Mnova, Origin, Chem draw, Adobe Photoshop etc.

INSTRUMENT HANDLED

- **FT-IR** (Perkin Elmer, Bruker ATR), **UV-Vis** (Shimadzu), **Column Chromatography**, **Gas Chromatography**, **pH meter, Dissolution tester, Karl Fischer titrator** and other small instruments are relevant to materials characterization and analysis.

SCIENTIFIC CONTRIBUTION

PEER-REVIEWED PUBLICATIONS

- Fabrication and application of low-cost thiol functionalized coal fly ash for selective adsorption of heavy toxic metal ions from water, S. Dash, H. Chaudhuri, **R. Gupta**, U. G. Nair and A. Sarkar*, ***Industrial & Engineering Chemistry Research***, **2017**, 56, 1461. (Impact factor **3.720**, cited **32** times) https://doi.org/10.1021/acs.iecr.6b03869.
- Room-temperature in-situ design and use of graphene oxide-SBA-16 composite for water remediation and reusable heterogeneous catalysis, H. Chaudhuri, S. Dash, **R. Gupta**, D. D. Pathak and A. Sarkar*, ***ChemistrySelect***, **2017**, 2, 1835. (Impact factor **2.109**, cited **13** times) https://doi.org/10.1002/slct.201601817.
- Efficient synthesis of branched polyamine based thermally stable heterogeneous catalyst for Knoevenagel condensation at room temperature, H. Chaudhuri*, **R. Gupta** and S. Dash, ***Catalysis Letters***, **2018**, 148, 1703. (Impact factor **3.186**, cited **7** times) https://doi.org/10.1007/s10562-018-2368-6
- Adsorption study of modified coal fly ash with sulfonic acid as a potential adsorbent for the removal of toxic reactive dyes from aqueous solution: Kinetics and thermodynamics, S.

Dash, H. Chaudhuri, **R. Gupta** and U. G. Nair*, ***Journal of Environmental Chemical Engineering***, **2018**, 6, 5897. (Impact factor **5.909**, cited **31** times) https://doi.org/10.1016/j.jece.2018.05.017

- Synthesis and characterization of guanine-functionalized mesoporous silica [SBA-16-G]: a metal-free and recyclable heterogeneous solid base catalyst for the synthesis of pyran-annulated heterocyclic compounds, **R. Gupta**, S. Layek, and D. D. Pathak*, ***Research on Chemical Intermediates***, **2019**, 45, 1619. (Impact factor **2.914**, cited **9** times) https://doi.org/10.1007/s11164-018-3693-5.
- Selective adsorption of toxic heavy metal ions using guanine-functionalized mesoporous silica [SBA-16-g] from aqueous solution, **R. Gupta**, S. K. Gupta and D. D. Pathak*, ***Microporous Mesoporous Materials***, **2019**, 288, 109577. (Impact factor **5.455**, cited **28** times) https://doi.org/10.1016/j.micromeso.2019.109577.
- Surface functionalization of mesoporous silica with maltodextrin for efficient adsorption of selective heavy metal ions from aqueous solution, **R. Gupta** and D. D. Pathak*, ***Colloids Surfaces A: Physicochemical Engineering Aspects***, **2021**, 631, 127695. (Impact factor **4.539**) https://doi.org/10.1016/j.colsurfa.2021.127695.
- Synthesis of 2-iminothiazolidin-4-ones using guanine functionalized SBA-16 as a solid base catalyst, **R. Gupta** and D. D. Pathak*, ***Tetrahedron Letters***, **2021**, 85, 153497. (Impact factor **2.415**) https://doi.org/10.1016/j.tetlet.2021.153497

INTERNATIONAL/NATIONAL CONFERENCE/WORKSHOP PROCEEDINGS

- **International Conference on Chemistry for Human Development (ICCHD-2018)**, was held on January 8-10, 2018 at HIT Kolkata, West Bengal, India.
- **National Symposium on Contemporary Facets in Organic Synthesis (CFOS-2017)**, was held on December 22-24, 2017 at IIT Roorkee, India.
- **Workshop on Intricacies of Adsorbents, Adsorption and Catalytic Degradation**, sponsored by MHRD-SPARC was held on September 23-27, 2017 at Maulana Azad National Institute of Technology, Bhopal, India.
- **One day International Webinar on the "Catalytic Materials"**, organized by The Catalysis Society of India was held on February 27, 2021 at IIT (ISM), Dhanbad, India.

LEADERSHIP/TEACHING EXPERIENCE

- **Five semester teaching assistantship** in chemistry experimental lab for undergraduate students (B. Tech. and B. Tech. Preparatory) at IIT (ISM), Dhanbad.
- **Two semester teaching assistantship** in chemistry experimental lab for postgraduate students (M.Sc.) at IIT (ISM) Dhanbad.
- **One semester teaching assistantship** in B. Tech. 1st Year Preparatory students.
- **One semester teaching assistantship** in B. Tech. 4^{rth} Year students.
- **Trained** four Ph.D. students.
- **Trained and guided** one M.Sc. student.

EXTRACURRICULUM ACTIVITIES

- Participated in various sports and community activities.

RESEARCH INTEREST

- Materials Chemistry, Mesoporous Materials, Metal ions adsorption, Dye degradation, Hybrid Materials.
- Heterogeneous catalysis.
- Mesoporous catalytic materials and Graphene Oxide-based catalysts.
- Fly ash based adsorbent.

REFERENCE

Dr. Devendra Deo Pathak (Ph.D. Supervisor), Professor (HAG), Department of Chemistry and Chemical Biology, Indian Institute of Technology (ISM) Dhanbad, India. E-mail: ddpathak@iitism.ac.in ORCID ID: 0000-0002-2097-4975.

DECLARATION

I do hereby declare that all the statements furnished are true and correct to the best of my knowledge and belief.

Place: IIT (ISM) Dhanbad
Date: 04/05/2022

Radha Gupta

Summary of Research Accomplishment

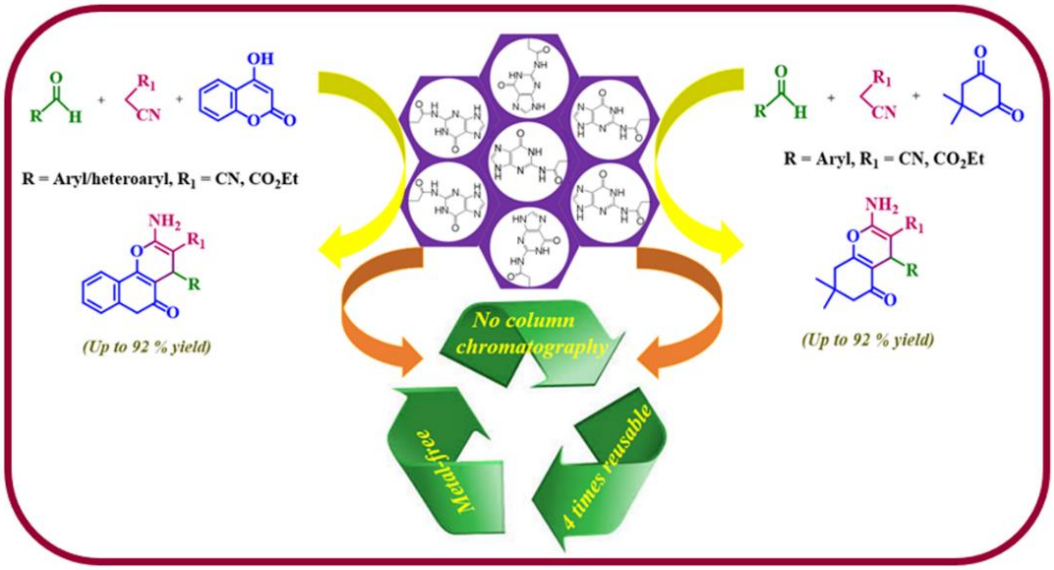
Radha Gupta
Ph.D. Submitted, Department of Chemistry and Chemical Biology, IIT (ISM), Dhanbad

Research Work Done in Ph.D. (Thesis title: *Synthesis of functionalized SBA-16 mesoporous materials: Applications in catalysis and removal heavy metal ions from water*)

Importance of Mesoporous Silica-based Materials Synthesis and Its Application in Catalysis and Water Remediation: Mesoporous materials have gained tremendous attention in scientific and technological research due to their capability of adsorbing and interacting with atoms, ions and molecules. The functionalities and prospective applications of the porous materials are largely dependent on their pore size distribution as well as pore surface properties. Under the motivation of achieving larger surface area and better framework properties, mesoporous silica materials have emerged as a novel category of porous materials with ultrahigh porosity, enormous surface area and novel functionalization. Mesoporous silica-based materials synthesis are of particular significance because of their indispensable involvement in several essential application functions of our life and society. These materials play a significant role in industries and find many applications such as catalysts, adsorbents, semiconductors, catalytic supports and photosensors. Due to potential features and miscellaneous applications, these materials are of prime importance to industries as well as researchers. In my doctoral research, I have explored various mesoporous silica-based materials synthesized and used in the heterogeneous catalysis and metal ions adsorption from aqueous solution and dye degradation.

A) Metal-free catalyst used for pyrans annulated and 2-iminothiazolidin-4-ones

1) Synthesis and characterization of guanine-functionalized mesoporous silica [SBA-16-G]: a metal-free and recyclable heterogeneous solid base catalyst for synthesis of pyran-annulated heterocyclic compounds (*Res. Chem. Intermed.*, 2019, 45, 1619).



The synthesis of a new solid base catalyst, i.e., guanine-functionalized mesoporous silica [SBA-16-G], is described. The synthesized catalyst has been fully characterized by FTIR, solid state ^{13}C NMR, TGA, XRD, BET, FESEM, EDAX, CHNS elemental analysis, CO_2-TPD, and TEM techniques. The surface area and the basicity of the synthesised [SBA-16-G] were found to be 524 m2/g and 3.230 mmol/g, respectively, based on BET and CO_2-TPD analysis. The

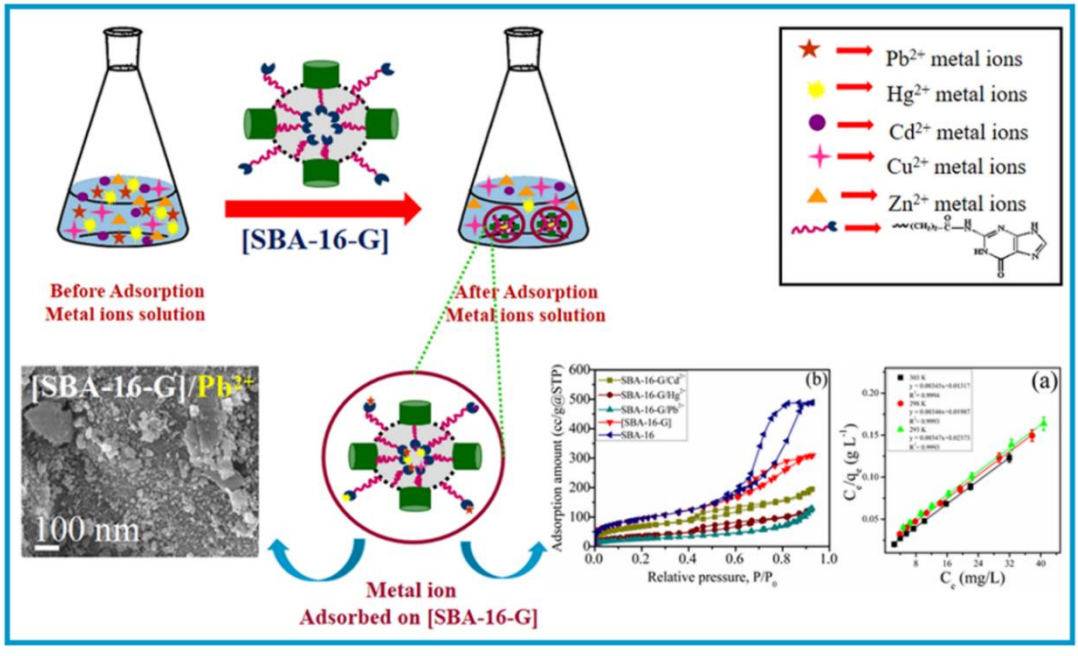
catalytic activity of the synthesized catalyst has been explored in the synthesis of a series of biologically and pharmaceutically active pyran-annulated heterocyclic compounds from a one-pot three-component reaction of an aromatic aldehyde, malononitrile/ethyl cyanoacetate, and a C-H activated acidic compound, in the presence of a catalytic amount (10 wt%) of [SBA-16-G]. The catalyst is metal-free, easy to synthesize and to isolate from the reaction mixture, and recycled up to four times without significant loss of catalytic activity.

2) Synthesis of 2-iminothiazolidin-4-ones using guanine functionalized SBA-16 as a solid base catalyst (*Tetrahedron Lett.*, 2021, 85, 153497).

The first example of a one-pot three-component tandem annulation approach is described for the synthesis of 2-iminothiazolidin-4-ones by the reaction of aromatic/aliphatic amines, aryl isothiocyanates, and ethyl bromoacetate, catalysed by guanine-functionalized SBA-16, [SBA-16-G], as an efficient and recyclable heterogeneous solid base catalyst. The methodology is simple and offers a broad-substrate scope under mild reaction conditions.

B) SBA-16 silica based mesoporous materials used for heavy metal ions adsorption

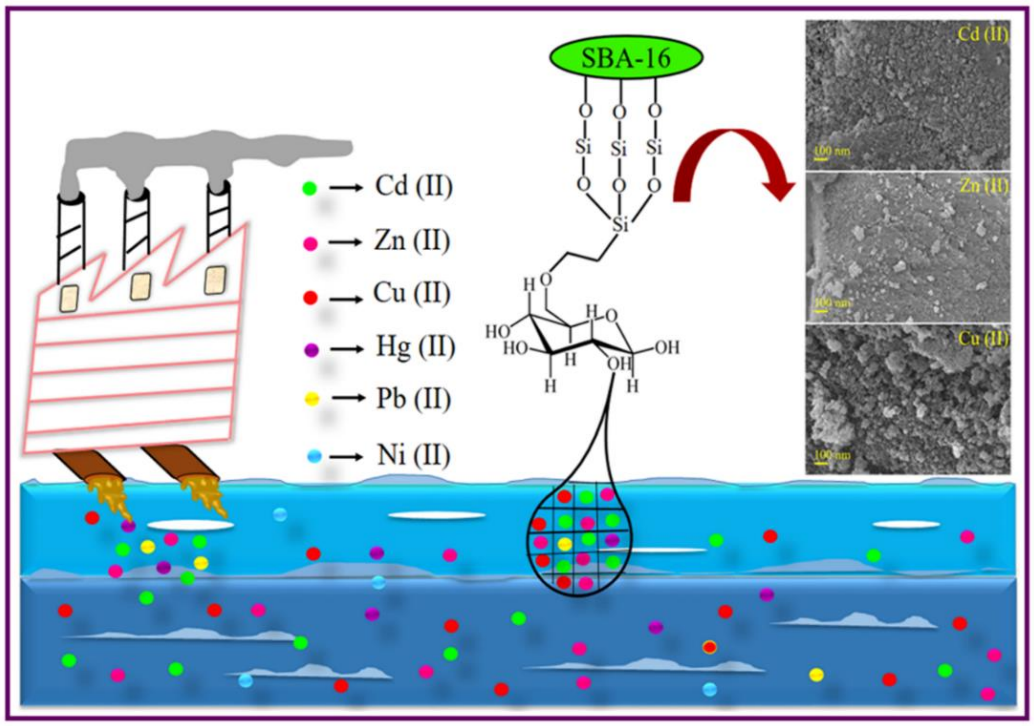
3) Selective adsorption of toxic heavy metal ions using guanine-functionalized mesoporous silica [SBA-16-g] from aqueous solution (*Microporous Mesoporous Mater.*, 2019, 288, 109577).



The removal of toxic metal ions e.g. Pb^{2+}, Hg^{2+} and Cd^{2+} from aqueous solution were explored using guanine-functionalized SBA-16 [SBA-16-G]. Nitrogen adsorption isotherm, HRXRD, FESEM, HRTEM, EDA-X analysis were performed to investigate the changes in the surface morphology and chemical characteristics of [SBA-16-G] before and after the adsorption of toxic metal ions. Owing to the presence of large number of

active functional groups of -NH, -C=O on the surface, this adsorbent demonstrated demonstrated proficient toxic metal ions removal capacities (maximum adsorption capacity, q_{max}: 289.9 mg g^{-1} for Pb^{2+} at 303 K, 259.9 mg g^{-1} for Hg^{2+} at 308 K and 228.8 mg g^{-1} for Cd^{2+} at 313 K, respectively) from aqueous medium. The isotherm study dictated that the adsorption data better comply to Langmuir isotherms with R_L value < 1 showing the favourable condition of adsorption. A careful analysis of data revealed that adsorption of these toxic metal ions followed pseudo-second-order kinetics. The plot of intra-particle diffusion model depicted two-stage process of adsorption i.e. mass transfer of metal ions to the boundary layer through dispersion followed by sorption into the pores due to intra-particle diffusion. The desorption study indicated that used adsorbent can easily be regenerated using acidic/basic solution and reused several times without causing any significant loss in their adsorption efficiency.

4) Surface functionalization of mesoporous silica with maltodextrin for efficient adsorption of selective heavy metal ions from aqueous solution (*Colloids Surf. A: Physicochem. Eng. Asp.*, 2021, 631, 127695).



A simple non-hydrothermal method for the synthesis of maltodextrin functionalized SBA-16 (SBA-16@MD) is reported for selective adsorption of heavy metal ions (HMIs) including Cd^{2+}, Zn^{2+}, and Cu^{2+} from aqueous solution. The as-synthesized SBA-16@MD is fully characterized by FESEM, EDX, HRTEM, PXRD, solid-state ^{13}C NMR spectrum, TGA, and BET surface area measurement. The HMIs adsorption was investigated for several parameters, for example, HMIs concentration, adsorbent dose, temperature, pH, contact time, and stirring speed. The SBA-16@MD shows high values of adsorption capacity for Cd^{2+} (575.53 mg/g), Zn^{2+} (564.67 mg/g), and Cu^{2+} (509.73 mg/g) respectively, at pH 6. The calculated adsorption data are best fitted with the Langmuir isotherm inferring homogeneous HMIs adsorption on the surface of SBA-16@MD. The kinetic data are consistent with the pseudo-second-order and intraparticle diffusion models. The calculated thermodynamic data reveals that the nature of adsorption is endothermic and spontaneous. The high values of adsorption capacity, SBA-16@MD for Cd^{2+}, Zn^{2+}, and Cu^{2+} can be explained based on electrostatic interactions and ion exchange taking place between the SBA-16@MD surface and HMIs.