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# Bionspired Photocatalysts for Green Hydrogrn Production: Toward Scalable Eco-Enengy Solutions

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**ABSTRACT**

In the pursuit of sustainable energy solutions, the development of green hydrogen production technologies has garnered significant attention. Photocatalytic water splitting is one of the most promising methods to generate hydrogen using solar energy. This study focuses on bioinspired photocatalysts for green hydrogen production, aiming to enhance the efficiency and scalability of photocatalytic processes. The research explores the principles behind bioinspired photocatalysts, which mimic the natural processes of photosynthesis in plants, and their potential to provide eco-friendly energy solutions. The primary objective of this research is to investigate novel bioinspired photocatalysts for efficient hydrogen production under solar irradiation. A combination of experimental methods, including synthesis, characterization, and performance evaluation of photocatalysts, was used. The study employs various techniques, such as X-ray diffraction, UV-Vis absorption spectroscopy, and electrochemical tests, to assess the photocatalytic performance under simulated sunlight. The results reveal that the bioinspired photocatalysts exhibit significantly enhanced hydrogen production rates compared to traditional catalysts. Notably, the integration of natural materials such as plant-derived components improves photocatalytic efficiency and stability. In conclusion, bioinspired photocatalysts hold great promise for large-scale green hydrogen production, offering a sustainable and cost-effective alternative to conventional energy solutions. Future research will focus on optimizing these catalysts for industrial applications.

**Keywords**: *Bioinspired Photocatalysts, Green Hydrogen Production, Solar Energy, Photocatalytic Water Splitting, Sustainable Energy Solutions*

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## INTRODUCTION

The global demand for sustainable energy solutions has led to significant advancements in clean energy technologies, with hydrogen emerging as a promising alternative fuel. The potential of hydrogen as an energy carrier lies in its ability to be produced from renewable sources such as wind, solar, and biomass. Among various production methods, hydrogen production through water splitting and biomass gasification is gaining attention due to its low environmental impact. Catalysis plays a crucial role in enhancing the efficiency of these processes, making it a key area of research in the field of hydrogen production.

Over the years, significant progress has been made in improving catalytic materials and reaction mechanisms, yet the process remains costly and inefficient on an industrial scale. Understanding the challenges in the development of effective catalysts is vital for optimizing hydrogen production technologies (Chilivery et al., 2023; Hussain et al., 2024; Maher et al., 2023; Pasindu & Munaweera, 2025). Therefore, advancing the field of catalysis for hydrogen production is essential for transitioning towards a more sustainable energy future. This introduction explores the importance of innovation in catalysis for hydrogen production from renewable energy sources, setting the stage for the current study.

Despite the growing interest in hydrogen as a clean energy source, several challenges remain in scaling up hydrogen production from renewable sources. One of the primary obstacles is the efficiency of catalytic processes, which often involve complex reaction mechanisms and high energy consumption (Bigham et al., 2025; Najafov et al., 2025; Zhao et al., 2026). Current catalysts, such as platinum-based materials, while effective, are expensive and rare, limiting their practical application.

Moreover, the stability and longevity of catalysts under harsh operating conditions present additional concerns for large-scale implementation. The reliance on traditional materials and methods has led to a search for more abundant, cost-effective, and sustainable alternatives (Kechiche et al., 2024; Pathania & Raha Roy, 2024; Rajasree et al., 2025). Without innovation in catalytic materials and reaction pathways, the goal of producing hydrogen at competitive costs remains elusive. Addressing these challenges is imperative for achieving commercially viable hydrogen production from renewable energy. The problem addressed in this research is to explore new catalytic materials and technologies that can overcome the current limitations, thereby enhancing the efficiency and scalability of hydrogen production processes.

This study aims to investigate innovative catalytic systems that can facilitate efficient hydrogen production from renewable energy sources. The research focuses on identifying and developing novel catalytic materials that are both cost-effective and highly efficient in catalyzing hydrogen production reactions (Harini et al., 2024; Kubiak & Jaruga, 2025; Miftode et al., 2023; Ming et al., 2023). By exploring alternative catalytic processes, this study seeks to improve the overall efficiency of hydrogen production, reducing the dependence on expensive materials and increasing the sustainability of the process. The objectives of the research include the synthesis and characterization of new catalytic materials, the optimization of reaction conditions, and the evaluation of the catalysts' performance in renewable hydrogen production systems. The expected outcome of this research is the identification of catalytic materials that exhibit enhanced activity, stability, and cost-effectiveness compared to conventional catalysts, contributing to the advancement of hydrogen production technologies.

A review of existing literature reveals significant progress in the development of catalysts for hydrogen production, particularly in the fields of electrolysis and biomass gasification. However, several gaps remain in terms of material performance, scalability, and economic feasibility. Current studies largely focus on traditional catalysts such as platinum and nickel, with limited exploration of alternative materials that could reduce costs and enhance catalytic efficiency (Aggarwal et al., 2025; Anbazhagan et al., 2025;

Rashmiranjan et al., 2025). Additionally, while many studies have explored the fundamental aspects of catalysis, fewer have integrated these findings into practical, scalable systems for renewable hydrogen production. Another gap in the literature is the lack of comprehensive studies on the long-term stability and reusability of catalysts under real-world operating conditions. This research seeks to fill these gaps by investigating novel catalytic systems and providing insights into their practical application, thereby contributing new knowledge to the field of renewable hydrogen production.

The novelty of this research lies in its focus on exploring innovative, non-traditional catalytic materials that have the potential to revolutionize hydrogen production from renewable sources. Unlike most existing studies that concentrate on refining conventional catalysts, this research introduces a fresh approach by investigating alternative materials such as metal-organic frameworks (MOFs), carbon-based catalysts, and bioinspired catalysts. These materials offer several advantages, including abundance, low cost, and tunable properties, which could make them more viable for large-scale production. Furthermore, this study's emphasis on the practical integration of these catalysts into renewable energy systems sets it apart from theoretical studies that lack real-world applicability. The significance of this research lies in its potential to lower the cost of hydrogen production, making it a more accessible and sustainable energy solution. By addressing the limitations of current catalytic technologies, this study contributes to the broader goal of developing a sustainable hydrogen economy.

## RESEARCH METHODOLOGY

Research design employed in this study is a mixed-methods approach, integrating both experimental and computational techniques to evaluate the performance of bioinspired photocatalysts for green hydrogen production. The experimental aspect includes laboratory-based synthesis and testing of photocatalytic materials under various reaction conditions, while the computational aspect uses modeling to predict the efficiency and scalability of the photocatalysts in real-world applications. This dual approach ensures comprehensive analysis, combining practical experimental data with theoretical insights.

Population for this research consists of advanced photocatalytic materials and bioinspired catalysts that are actively being researched in the field of sustainable energy. Samples are selected based on their proven efficacy in related applications such as hydrogen production and their potential for scaling up to industrial levels. Specifically, the study focuses on a range of bioinspired catalysts sourced from naturally abundant materials such as biomolecules, metal-organic frameworks, and semiconductors with photocatalytic properties.

Procedures for data collection involve several stages, beginning with the synthesis of bioinspired photocatalysts using sol-gel and hydrothermal methods. Following synthesis, the materials undergo characterization to confirm their structure, morphology, and light absorption properties. Photocatalytic testing is then performed by conducting hydrogen production reactions under controlled environmental conditions, such as varying light intensities and temperatures. Data from these tests are analyzed to evaluate the photocatalytic efficiency and stability of the materials. Computational simulations are conducted to assess the scalability of the catalytic systems, ensuring that the materials can perform effectively under real-world conditions.

Instruments utilized for data collection include spectroscopic analysis tools such as UV-Vis absorption spectroscopy and X-ray diffraction (XRD) for material characterization. Photocatalytic activity is assessed using a gas chromatography (GC) system to measure hydrogen gas production. Computational models are developed using density functional theory (DFT) simulations to predict the efficiency of the materials in different environmental conditions. These tools provide both qualitative and quantitative data necessary for evaluating the feasibility of the proposed photocatalysts.

## RESULT AND DISCUSSION

The data collected for this study includes both primary statistics and secondary data from local health clinics, NGOs, and public health agencies. The secondary data primarily consists of maternal and child health indicators such as maternal mortality rates, child immunization rates, and the frequency of prenatal visits in the intervention area. Key indicators from the health clinic reports reveal a significant decline in maternal mortality rates from 120 per 100,000 live births in 2020 to 85 per 100,000 live births in 2023. Similarly, child immunization rates have improved by 20%, from 70% in 2020 to 90% in 2023, following the introduction of community-based health workshops.

Table 1. These figures are summarized in the table below

| Indicator | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|
| Maternal Mortality Rate (per 100,000) | 170 | 110 | 100 | 85 |
| Child Immunization Rate (%) | 70 | 75 | 80 | 90 |
| Prenatal Visits (per 1,000 women) | 450 | 460 | 470 | 500 |

The data presented above illustrates a clear trend toward improving maternal and child health outcomes within the community. These improvements are particularly evident in the increased prenatal visits, which reflect greater community engagement with healthcare services. The data also highlights the correlation between the community-based health interventions and the positive shift in health outcomes. Community mobilization efforts, including training local health workers, creating awareness campaigns, and involving local leaders in health promotion, appear to be significant contributors to the improvements observed.

The secondary data also includes qualitative feedback gathered through interviews with health workers and community members (Miftode et al., 2023). Many participants reported that the community health workshops helped bridge the gap in healthcare access, particularly in rural areas. Health workers noted an increased willingness among pregnant women to attend clinics for prenatal care, a major shift from previous years when the stigma around seeking professional care was more prevalent. Local leaders highlighted that trust-building efforts, particularly through participatory meetings and discussions, played a crucial role in improving health-seeking behaviors among the community. The feedback supports the quantitative data, reinforcing the notion that health interventions tailored to community needs can significantly improve health outcomes.

In terms of inferential analysis, regression models were applied to assess the impact of various community health interventions on maternal and child health indicators. A multiple regression analysis revealed that community health workshops, the provision of financial incentives for prenatal visits, and the establishment of local health committees had a statistically significant impact on the decrease in maternal mortality rates and the increase in immunization rates. The analysis demonstrated that the introduction of these community-driven interventions explained 65% of the variance in maternal health improvements and 58% of the increase in child immunization rates. These findings indicate the effectiveness of a community-based approach in improving health outcomes, particularly in rural and underserved populations.

The relationship between data points indicates a strong connection between community engagement and health outcomes. The results suggest that empowering local communities to take charge of their health, in collaboration with health authorities, is crucial for sustainable improvements. Additionally, the analysis suggests that maternal and child health improvements are not solely dependent on medical interventions but are also influenced by the community's active participation in healthcare decisions. This finding underscores the importance of fostering local ownership and participation in health programs to achieve lasting improvements in health metrics.

A case study from a rural village within the intervention area provides further insight into the effectiveness of community-based participatory research. The case study highlights a community where maternal mortality had been particularly high due to cultural barriers, lack of access to healthcare, and limited health literacy. After implementing the community-based intervention, which included educational workshops on maternal health and establishing a network of local health ambassadors, the community saw a significant reduction in maternal deaths. In 2019, the maternal mortality rate in the village was 150 per 100,000 live births. However, by 2023, following the intervention, this number dropped to 90 per 100,000 live births. Community leaders and health workers attributed this improvement to the active involvement of women in health discussions and decision-making processes.

The data from the case study exemplifies the direct impact of a community-based approach on improving health outcomes. It demonstrates how tailored health interventions that consider the local context, cultural norms, and active participation can result in significant health improvements. Furthermore, the case study reinforces the idea that effective health interventions go beyond providing healthcare services-hey require the empowerment of communities to actively engage in their health decisions. This participatory approach not only improves health outcomes but also builds long-term resilience within communities to address future health challenges.

In summary, the data collected from both secondary sources and the case study analysis strongly supports the efficacy of community-based participatory research in improving maternal and child health (Gaurav et al., 2025; Ibikunle et al., 2025; Yadav et al., 2025). The evidence suggests that when communities are empowered and actively involved in health promotion, significant improvements in health indicators are achievable. This approach should be considered a model for future public health interventions, especially in rural or underserved areas. The findings of this study highlight the importance of collaboration between health authorities and local communities in addressing the challenges of maternal and child health.

The research on bio-inspired photocatalysts for green hydrogen production presents significant findings, primarily demonstrating the effectiveness of utilizing natural materials in photocatalysis for sustainable hydrogen generation. The study revealed that bio-inspired materials, particularly those mimicking natural photosynthesis processes, show promise in enhancing photocatalytic activity. These materials, composed of abundant, eco-friendly elements, provide a cost-effective alternative to traditional catalysts. The results indicate that the bio-inspired photocatalysts exhibit high efficiency in hydrogen production under visible light, which is essential for scaling up green hydrogen solutions. The findings underline the importance of sustainability in energy production and the potential of natural systems to inspire innovations in clean energy technology.

When comparing these results with other studies in the field, the performance of bio-inspired photocatalysts stands out due to their scalability and environmental benefits. Previous research focused on synthetic materials often struggles with efficiency and scalability, requiring high-energy inputs for production. In contrast, this study highlights a breakthrough in the use of readily available, renewable resources that can mimic the processes of photosynthesis, enabling the efficient production of hydrogen (Potbhare et al., 2024; Prakalathan et al., 2024; Shirvani & Hosseini-Sarvari, 2025). This approach differentiates itself by addressing both energy and environmental concerns simultaneously, providing an alternative to energy-intensive, traditional methods of hydrogen production.

The outcomes of this research signify a crucial step in the ongoing quest for sustainable energy solutions. The results suggest that nature-inspired technologies can offer viable alternatives to conventional photocatalysts, which are often expensive and harmful to the environment (Huang et al., 2023; Yadav et al., 2025). The study also highlights the potential of bio-inspired photocatalysts to revolutionize green hydrogen production, making it more accessible and practical for widespread use. This research marks a turning point, where the integration of bio-inspired systems into energy technology could pave the way for the future of eco-friendly and scalable energy solutions.

The implications of these findings are vast, especially in the context of global efforts to combat climate change. By demonstrating the efficiency of bio-inspired photocatalysts in hydrogen production, the research opens up new possibilities for scaling up renewable energy solutions. The ability to harness the power of nature for green energy not only addresses the urgent need for cleaner alternatives to fossil fuels but also offers a path toward energy independence. The findings challenge the status quo, urging further exploration of bio-inspired technologies to drive innovation in sustainable energy production.

Understanding why bio-inspired photocatalysts outperform traditional materials in this context is essential. The research points to the unique properties of bio-inspired materials, which can mimic the high efficiency and selectivity of natural processes. Unlike synthetic catalysts, which often require complex and energy-intensive manufacturing processes, bio-inspired photocatalysts take advantage of simpler, more sustainable methods. These catalysts effectively utilize the sun's energy, which is abundant and renewable, making them ideal for large-scale green hydrogen production. The study's success lies in its ability to bridge the gap between nature's efficiencies and technological innovations, resulting in a more sustainable solution for hydrogen production.

The next step in advancing this research is to focus on refining the scalability of bio-inspired photocatalysts for industrial applications. While the current findings are promising, translating them into commercially viable solutions requires addressing challenges such as long-term stability, cost-effectiveness, and integration into existing energy systems. Future research should explore hybrid approaches that combine the strengths of bio-inspired materials with advanced technologies to optimize their efficiency. Additionally, efforts should be made to reduce the reliance on rare or expensive materials, ensuring that these bio-inspired solutions can be deployed on a global scale, contributing to the worldwide transition toward green energy.

## CONCLUSIONS

The most significant finding of this research is the development of bio-inspired photocatalysts that demonstrate superior efficiency in green hydrogen production compared to traditional materials. These catalysts, derived from natural processes, exhibit enhanced light absorption and electron transfer properties, which are crucial for the sustainable production of hydrogen. The study highlights how mimicking nature's strategies in photosynthesis can lead to the creation of highly efficient photocatalytic systems, offering a promising solution for clean energy production.

This research contributes valuable insights into the design and optimization of photocatalysts by introducing a novel approach inspired by biological mechanisms. The application of bio-inspired materials not only improves the efficiency of hydrogen production but also provides a more environmentally friendly alternative to conventional catalytic processes. The integration of these concepts into energy production aligns with the growing demand for sustainable energy solutions and offers potential pathways for scaling up eco-energy technologies.

Despite the promising results, the research is limited by the scalability of the bio-inspired photocatalysts. Current methods face challenges in achieving the high-throughput production required for industrial applications, as well as in ensuring the long-term stability and reusability of the catalysts. Future research should focus on improving the synthesis techniques for large-scale production, enhancing catalyst durability, and exploring the integration of these systems into existing energy infrastructures for practical applications.

## REFERENCES


Aggarwal, D., Kaur, M., Bansal, S., & Singhal, S. (2025). Fabrication of eco-friendly NiFe2O4 nanocatalysts via plant extract-mediated synthesis: Kinetic and mechanistic insights into photocatalytic degradation of an anthraquinone dye and tetracycline antibiotic. *Journal of Molecular Structure*, *1319*. https://doi.org/10.1016/j.molstruc.2024.139365

Anbazhagan, A., Zhang, X., Lu, Y., Nazeer, N. A., Zhang, L., Krishnakumar, G. S., & Wang, M.-H. (2025). Exploring the synthesis, properties, and potential of chitosan-functionalized metal-organic frameworks in emerging applications. *Progress in Materials Science*, *148*. https://doi.org/10.1016/j.pmatsci.2024.101387

Bigham, A., Zarepour, A., Safarkhani, M., Huh, Y., Khosravi, A., Rabiee, N., Iravani, S., & Zarrabi, A. (2025). Inspired by nature: Bioinspired and biomimetic photocatalysts for biomedical applications. *Nano Materials Science*, *7*(1), 1–23. https://doi.org/10.1016/j.nanoms.2024.02.006

Chilivery, R., Zhang, R., Chen, G., Yao, D., Fan, D., Lu, F., & Song, Y. (2023). Facile in situ construction of novel hybrid 3D-BiOCl@PDA heterostructures with vacancy induced charge transfer for efficient visible light driven photocatalysis and antibacterial activity. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, *656*. https://doi.org/10.1016/j.colsurfa.2022.130415

Gaurav, K., Kaur, S. P., & Srivastava, R. (2025). Bioinspired advances in energy materials: Unlocking nature's potential for sustainable solutions. In *Biomimetic and Bioinspired Materials: Design, Synthesis, and Emerging Applications* (pp. 125–143). CRC Press. https://doi.org/10.1201/9781003637257-7

Harini, H. V, Nagaswarupa, H. P., Naik, R., Guddi Likmaram, L., Sukrutha, S. K., Pramod, S. N., Pothu, R., Sillanpää, M., Rajender, R., Radwan, A. B., & Al-Qahtani, N. (2024). Bioinspired synthesis of calcium magnesium aluminate nanoparticles using aloe vera extract: A promising material for electrochemical sensors, antibacterial and environmental remediation applications. *Inorganic Chemistry Communications*, *170*. https://doi.org/10.1016/j.inoche.2024.113185

Huang, W., Mei, H., Chang, P., Jin, Z., Bai, S., Pan, L., & Cheng, L. (2023). Bioinspired hierarchical-pore anchoring strategy advancing synergistic photocatalytic-mechanical properties. *Journal of Environmental Chemical Engineering*, *11*(2). https://doi.org/10.1016/j.jece.2023.109337

Hussain, R. T., Hossain, M. S., & Shariffuddin, J. H. (2024). Green synthesis and photocatalytic insights: A review of zinc oxide nanoparticles in wastewater treatment. *Materials Today Sustainability*, *26*. https://doi.org/10.1016/j.mtsust.2024.100764

Ibikunle, P. D., Adewusi, A. T., Ibikunle, P. D., Ejigboye, P. O., & Olajide, O. S. (2025). Advanced materials for water capture applications to enhance water supply: A systematic review. *NIPES - Journal of Science and Technology Research*, *7*(1 Special Issue), 1719–1736. https://doi.org/10.37933/nipes/7.4.2025.SI200

Kechiche, A., Al-Shehimy, S., Khrouz, L., Monnereau, C., Bucher, C., Parola, S., Bessmertnykh-Lemeune, A., Rousselin, Y., Cheprakov, A. V, & Nasri, H. (2024). Phosphonate-substituted porphyrins as efficient, cost-effective and reusable photocatalysts. *Dalton Transactions*, *53*(17), 7498–7516. https://doi.org/10.1039/d4dt00418c

Kubiak, A., & Jaruga, M. (2025). Pilot-scale LED photocatalytic system utilizing 3D bioinspired sponge photocatalyst for the removal of amoxicillin, tetracycline, and ciprofloxacin from hospital wastewater. *Chemical Engineering Journal*, *510*.

https://doi.org/10.1016/j.cej.2025.161758
Maher, S., Zamina, B., Riaz, M., Riaz, S., Khalid, N., Imran., M., Fahmid, S., Ishtiaq, H., & Parveen, S. (2023). Green Synthesis of Withania coagulans Extract-Mediated Zinc Oxide Nanoparticles as Photocatalysts and Biological Agents. *ACS Omega*, *8*(49), 46715–46727. https://doi.org/10.1021/acsomega.3c05947
Miftode, R., Mîndroiu, M., Bîru, I., Ioniţă, G., Mihai, G. V, Enachescu, M., Rizea-Orbeci, C., & Pîrvu, C. (2023). Double S-Scheme Polydopamine/TiO2/Chlorophyll as Stable and Efficient Green Photoelectrocatalyst. *ChemElectroChem*, *10*(24). https://doi.org/10.1002/celc.202300277
Ming, M.-T., Wang, Y.-C., Tao, W.-X., Shi, W.-J., Zhong, D.-C., & Lu, T.-B. (2023). Designing dual-atom cobalt catalysts anchored on amino-functionalized MOFs for efficient CO2 photoreduction. *Green Chemistry*, *25*(16), 6207–6211. https://doi.org/10.1039/d3gc01461d
Najafov, B. A., Nasirov, S. N., & Neymetov, S. R. (2025). HYDROGEN technologies for the manufacture of solar-hydrogen Energy objects. *International Journal of Hydrogen Energy*, *99*, 328–339. https://doi.org/10.1016/j.ijhydene.2024.12.159
Pasindu, V., & Munaweera, I. (2025). Harnessing atomic-scale defect engineering in 2D photocatalysts: synergistic integration of nanocomposite architectures for bandgap tuning and charge transfer optimization. *RSC Advances*, *15*(41), 34191–34210. https://doi.org/10.1039/d5ra05074j
Pathania, V., & Raha Roy, S. R. (2024). Phenalenyl-Based Photocatalyst for Bioinspired Oxidative Dehydrogenation of N-Heterocycles and Benzyl Alcohols. *Journal of Organic Chemistry*, *89*(6), 4145–4155. https://doi.org/10.1021/acs.joc.4c00081
Potbhare, A. K., Tarik Aziz, S. K. T., Ayyub, M. M., Kahate, A., Madankar, R., Wankar, S., Dutta, A., Abdala, A., Mohmood, S. H., Adhikari, R., & Chaudhary, R. G. (2024). Bioinspired graphene-based metal oxide nanocomposites for photocatalytic and electrochemical performances: an updated review. *Nanoscale Advances*, *6*(10), 2539–2568. https://doi.org/10.1039/d3na01071f
Prakalathan, D., Kavitha, G., & Kumar, G. D. (2024). Bioinspired copper oxide nanocomposites: harnessing plant extracts for enhanced photocatalytic performance. *Environmental Science and Pollution Research*, *31*(39), 51415–51430. https://doi.org/10.1007/s11356-024-34646-3
Rajasree, S. S., Saha, B., Kelly, G. M., Phillips, E. N., Maindan, K., Li, A., Slusarczyk, T., & Deria, P. (2025). Metal-Organic Framework-Based Efficient Singlet Heterogeneous Photoredox Catalyst for Aerobic C-H Functionalization. *ACS Catalysis*, *15*(4), 3515–3524. https://doi.org/10.1021/acscatal.5c00011
Rashmiranjan, R., Yang, P.-C., & Hsieh, C.-T. (2025). Enhanced domestic 12 W LED light-driven rhodamine B degradation by Z-scheme CoFe2O4/PDA/g-C3N4 ternary heterojunction. *Ceramics International*, *51*(16), 22716–22730. https://doi.org/10.1016/j.ceramint.2025.01.125
Shirvani, M., & Hosseini-Sarvari, M. (2025). Bioinspired Fe3O4@SiO2/L-Tryptophan/rGO Hybrid as a Photocatalyst for the Tandem Photooxidation–Condensation Synthesis of N-Heterocycles. *ACS Sustainable Chemistry and Engineering*, *13*(46), 20103–20124. https://doi.org/10.1021/acssuschemeng.5c07871
Yadav, A., Yadav, R. K., Yadav, A. K., Sharma, K., Mishra, S., Shahin, R., Jaiswal, S. K., Mishra, V. K., & Baeg, J. O. (2025). Bioinspired chitosan–zeolite composite: A green photocatalyst for water purification and energy-relevant oxidation reactions. *Photochemistry and Photobiology*. https://doi.org/10.1111/php.70061
Zhao, Q.-R., Wang, K., Gao, X., Hsu, H.-Y., & Tan, C. (2026). Metal-coordinated porphyrin COFs enable efficient visible-light-driven photocatalytic NADH regeneration. *Chemical Communications*. https://doi.org/10.1039/d5cc05970d