



(<http://ipindia.nic.in/index.htm>)



(<http://ipindia.nic>)

## Patent Search

Invention Title	MACHINE LEARNING-BASED BiFeO <sub>3</sub> NANOPARTICLES FOR IMPROVED PHOTOCATALYTIC ENVIRONMENTAL APPLICATIONS	
Publication Number	28/2025	
Publication Date	11/07/2025	
Publication Type	INA	
Application Number	202531063003	
Application Filing Date	02/07/2025	
Priority Number		
Priority Country		
Priority Date		
Field Of Invention	CHEMICAL	
Classification (IPC)	B01J0035390000, C02F0001300000, C02F0101300000, G06N0020000000, C04B0035260000	
Inventor		
<b>Name</b>	<b>Address</b>	<b>Country</b>
Dr. Raj Kumar Gupta	Senior Assistant Professor, Department of Physics, Sardar Vallabhbhai Patel College, VKSU, Ara, Bhabhua, Kaimur, Bihar, India.	India
Dr. Arya Vidyadhari	Assistant Professor, Department of Pharmaceutics, Lord Buddha Koshi Pharmacy College, Bajinathpur, Saharsa, Bihar, India.	India
Dr Padmavathi Vustelamuri	Associate Professor of Chemistry, Head, Department of Humanities and Sciences, Neil Gogte Institute of Technology, Hyderabad, Medchal, Telangana, 500039, India.	India
Pathuri Ishita	4th Year B.Tech in Computer Science engineering Student, Manipal University, Jaipur, Rajasthan, India.	India
Dr. Manasi Vyankatesh Ghamande	Assistant Professor, DESH, Vishwakarma Institute of Technology, Pune, Haveli, Maharashtra, India.	India
Dr. Prasannakumar J K	Associate Professor and Head, Department of Chemistry, Bapuji Institute of Engineering and Technology, Davanagere, Karnataka, 577004, India.	India
Dr. S. Kannan	Assistant Professor, Department of Physics, V. S. B. Engineering College, Karur, Tamil Nadu, 639111, India.	India
Dr. Kavita Singh	Associate Professor, Department of Civil Engineering, Institute of Aeronautical Engineering, Dundigal, Hyderabad, Telangana, 500043, India.	India
Dr. Pritam Kumar Singh	Assistant Professor, Department of Physics, Degree College Tundi Binod Bihari Mahto Koyalanchal University, Tundi, Dhanbad, Jharkhand, India.	India
Dr Vishnu Kiran Manam	Senior Scientist, DGM - R&D, IB Group, Rajnandgaon, Indamara, Chhattisgarh, 491411, India.	India
Kumar Raj Chittaranjan singh	HOD, Department of Physics, Narayan Mahavidyalaya, Jai Prakash University, Chhapra, Gorea kothi, Siwan, Bihar, India.	India
Pappu Kumar	Research Scholar, Department of Physics, Sardar Vallabhbhai Patel College, VKSU, Ara, Bhabhua, Kaimur, Bihar, India.	India
Applicant		

Name	Address	Country
Dr. Raj Kumar Gupta	Senior Assistant Professor, Department of Physics, Sardar Vallabhbhai Patel College, VKSU, Ara, Bhabhua, Kaimur, Bihar, India.	India
Dr. Arya Vidyadhari	Assistant Professor, Department of Pharmaceutics, Lord Buddha Koshi Pharmacy College, Bajinathpur, Saharsa, Bihar, India.	India
Dr Padmavathi Vustelamuri	Associate Professor of Chemistry, Head, Department of Humanities and Sciences, Neil Gogte Institute of Technology, Hyderabad, Medchal, Telangana, 500039, India.	India
Pathuri Ishita	4th Year B.Tech in Computer Science engineering Student, Manipal University, Jaipur, Rajasthan, India.	India
Dr. Manasi Vyankatesh Ghamande	Assistant Professor, DESH, Vishwakarma Institute of Technology, Pune, Haveli, Maharashtra, India.	India
Dr. Prasannakumar J K	Associate Professor and Head, Department of Chemistry, Bapuji Institute of Engineering and Technology, Davanagere, Karnataka, 577004, India.	India
Dr. S. Kannan	Assistant Professor, Department of Physics, V. S. B. Engineering College, Karur, Tamil Nadu, 639111, India.	India
Dr. Kavita Singh	Associate Professor, Department of Civil Engineering, Institute of Aeronautical Engineering, Dundigal, Hyderabad, Telangana, 500043, India.	India
Dr. Pritam Kumar Singh	Assistant Professor, Department of Physics, Degree College Tundi Binod Bihari Mahto Koyalanchal University, Tundi, Dhanbad, Jharkhand, India.	India
Dr Vishnu Kiran Manam	Senior Scientist, DGM - R&D, IB Group, Rajnandgaon, Indamara, Chhattisgarh, 491411, India.	India
Kumar Raj Chittaranjan Singh	HOD, Department of Physics, Narayan Mahavidyalaya, Jai Prakash University, Chhapra, Goresa kothi, Siwan, Bihar, India.	India
Pappu Kumar	Research Scholar, Department of Physics, Sardar Vallabhbhai Patel College, VKSU, Ara, Bhabhua, Kaimur, Bihar, India.	India

#### Abstract:

MACHINE LEARNING-BASED BiFeO<sub>3</sub> NANOPARTICLES FOR IMPROVED PHOTOCATALYTIC ENVIRONMENTAL APPLICATIONS The method for the development of a nanoparticle bismuth ferrite (BiFeO<sub>3</sub>, BFO) have shown great promise as photocatalysts because of their multiferroic characteristics, low bandgap, and good chemical stability. This study investigates how to improve the photocatalytic effectiveness of BiFeO<sub>3</sub> nanoparticles for environmental applications by combining machine learning approaches with manufacturing and optimization. Photocatalytic performance indicators like degradation rate and pollutant specificity were associated with important synthesis factors: doping concentration, calcination temperature, and particle size using supervised learning models. The best arrangements for optimum photodegradation efficiency were found by feature selection and predictive modelling. The creation of high-performance BFO-based photocatalysts was sped up and experimental iterations decreased by the machine learning-guided method. The improved breakdown of organic contaminants in aquatic environments was validated by experiments. This multidisciplinary approach encourages sustainable and data-driven innovation in photocatalysis by showcasing how machine learning may be used to customize nanoparticles for focused environmental cleanup. FIG.1

#### Complete Specification

##### Description: Description of the Related Art

[0002] The environmental pollution has become a major hazard to ecosystems and human health in recent years, especially from organic pollutants, poisonous industrial effluents. Even if they can be somewhat successful, traditional restoration techniques frequently lack sustainability, scalability, and efficiency. Because of its potential to completely transform environmental remediation, photocatalysis—an sophisticated oxidation process that uses light-activated catalysts to breakdown pollutants—has drawn a lot of attention. Because of its distinct physicochemical characteristics, bismuth ferrite (BiFeO<sub>3</sub> or BFO) nanoparticles have attracted a lot of attention among the diverse variety of photocatalysts.

[0003] BiFeO<sub>3</sub> is a multiferroic perovskite oxide with strong polarization, great chemical stability, and outstanding ferroelectric characteristics. Its small bandgap (~eV) allows it to absorb visible light. Because of these qualities, BFO is a perfect fit for photocatalytic uses in the presence of sunlight. BiFeO<sub>3</sub>'s catalytic efficacy is hindered by a number of issues that hinder its practical application in environmental cleanup, including rapid charge carrier recombination, restricted surface area, and suboptimal crystal shape. In order to get beyond these obstacles, scientists have concentrated on modifying the surface, doping, and manufacturing of BiFeO<sub>3</sub> nanoparticles to customize their physicochemical characteristics. However, it takes a lot of time and resources to design materials using the conventional trial-and-error method. This is where the use of machine learning (ML) to the study of photocatalysis and nanomaterials becomes revolutionary.

[0004] A branch of artificial intelligence (AI) called machine learning provides data-driven predictive models that can recognize intricate correlations and patterns in structural characteristics, photocatalytic performance, and synthesis parameters. To forecast the ideal doping concentrations, morphologies, particle sizes, and synthesis circumstances that provide the greatest photocatalytic results, machine learning algorithms can be trained on experimental datasets. Specifically, material properties

[View Application Status](#)



**Department of Industrial  
Policy and Promotion**  
Government of India

Terms & conditions (<https://ipindia.gov.in/Home/Termsconditions>) Privacy Policy (<https://ipindia.gov.in/Home/Privacypolicy>)

Copyright (<https://ipindia.gov.in/Home/copyright>) Hyperlinking Policy (<https://ipindia.gov.in/Home/hyperlinkingpolicy>)

Accessibility (<https://ipindia.gov.in/Home/accessibility>) Contact Us (<https://ipindia.gov.in/Home/contactus>) Help (<https://ipindia.gov.in/Home/help>)

Content Owned, updated and maintained by Intellectual Property India, All Rights Reserved.

Page last updated on: 26/06/2019