Memorandum of Understanding

Between

Government Institute of Forensic Science,

Pahadshingpura, Nipatniranjan Nagar,
Caves Road, Aurangabad,
Maharashtra 431004

And

Parul University

Parul Institute of Applied Sciences,

Parul University Campus,
Vadodara, Gujarat, India, 391760

Director
Govt. Institute of Forensic Science
Aurangabad.

DATED 15th Feb 2021

Govt. Institute of Forensic Science ★ सत्यमेव जयते ★ Aurangabad

PARUL INSTITUTE OF APPLIED SCIENCES LIMDA, VADODARA.

Govt. Institute of Forensic Science ★ सत्यमेव जयते ★ Aurangabad-431004

PREAMBLE

Government Institute of Forensic Science, **Aurangabad (GIFSA)**, Nipatniranjan Nagar, Caves Road, Aurangabad, Maharashtra 431004, and ***Dept. of Forensic Science, Parul Institute of Applied Sciences*** **(PIAS)**, Parul University, Vadodara, Gujarat, India, 391760, recognize their strengths in research and education in one or more disciplines of science engineering, management and social sciences, and their mutual interest in engaging themselves in academic cooperation.

Therefore ***agree to establish a program for academic cooperation in the areas of mutual interest, and following terms and conditions outlined in this memorandum of understanding (MoU).***

OBJECTIVES

The goal is to foster collaboration, provide an opportunity for global experience, and facilitate the advancement of knowledge based on reciprocity, best effort, mutual benefit, and frequent interactions ***GIFSA and PIAS***, agree:

1. To exchange information on research and educational programs.
2. To exchange information on teaching, learning material and other literature relevant to their educational and research program.
3. There will be no restriction on the contents of the thesis and on publication of results of the thesis, subject to the condition that no Intellectual Property Rights can be secured for any part of the work which will be decided with mutual consent.
4. To jointly organize seminars, conferences, or workshops on topics of mutual interest and to invite each other's team members to participate therein.
5. To exchange, on a reciprocal basis, members of the team levels for limited periods for education and/or research.
6. Joint guidance of student projects/thesis
7. Guide from both the Institutes will be the corresponding authors in any publication resulting from the collaborative work. All the efforts put by the student/s as a part of this MoU will be accounted for by way of reporting the work in thesis and/or paper publication except the part for which IPR needs to be claimed

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GIFSA and PIAS, further agree that detailed terms and conditions that guide each activity identified above will be separately determined and agreed upon by the two institutions. These terms shall include a technical description of the proposed activity, arrangements, and person(s) responsible for its implementation, etc.

SHARING OF FACILITIES

The collaborative programs between ***GIFSA and PIAS*** shall be coordinated by a faculty coordinator from both the Institutes.

Both the ***GIFSA and PIAS*** shall make the provision to share research facilities. Both shall provide access to library facilities to students, faculty coordinators as per the prevailing rules & norms in the respective institutes.

A. Joint Research Activities

GIFSA and PIAS, agree to help identify and invite members from the other institution to participate in research or development programs. The terms and conditions for such participation will be worked out by mutual agreement between GIFSA and PIAS.

B. Exchange of Team members

GIFSA and PIAS, agree to encourage collaboration between team members from the two institutions to encourage members of their team to undertake short visits to or take up fixed-term visiting assignments at, each other's institution as per the existing norms education/ research purposes. Terms and conditions for each visit or an assignment, including those concerning name of the concerned member will be worked out between GIFSA and PIAS.

C. Student Exchange

GIFSA and PIAS, agree that student exchange will be only for the sole purpose of educational and research purposes includes internships, projects, dissertations, Ph.D. related work, assignments, conferences and workshops and will be guided by principles listed below. A home institution refers to the institution where a student is a full-time student or part-time attached to the same, and from where he/she is expected to gain some knowledge certificates. A host institution refers to an institution that receives a student for a brief period to undertake a predetermined program study or research/education programs.

D. Exchange of Scientific and Technical Information

GIFSA and PIAS, will exchange information on research and educational programs and teaching/learning material and other literature relevant to their educational and research

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Aurangabad.

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programs. Further, GIFSA and PIAS, agree to explore ways to share teaching/learning material, and other relevant literature, while respecting each other's intellectual property and other rights.

E. Joint Conferences, workshops and short-term courses

GIFSA and PIAS, agree to help identify and invite members from the other institution to participate in conferences, workshops and short-term courses. The terms and conditions for such participation will be worked out by mutual agreement between GIFSA and PIAS.

F. IPR

GIFSA and PIAS, agree to respect each other's rights to intellectual property. Further, the intellectual property rights that arise as a result of any collaborative research or activity under this MoU will be worked out on a case-by-case basis and will be consistent with the officially laid down IPR policies of the two institutions.

EFFECTIVE DATE AND DURATION OF MOU:

a) This MoU shall be effective from the date of its approval

b) The duration of the MoU shall be for **5 years** from the effective date.

c) During its tenancy, the MoU may be extended or terminated by prior notice of not less than 3 months by either party. However, termination of the MOU will not in any manner affect the interests of the students/faculty/scientists who have been admitted to pursue a program under the MoU.

d) Any clause or article of the MoU may be modified or amended by mutual agreement of GIFSA and PIAS.

MoU SPOC both parties:

a. ***Frist Party: Government Institute of Forensic Science*****, Aurangabad (GIFSA),** Nipatniranjan Nagar, Caves Road, Dr. Aurangabad, Maharashtra 431004

SPOC person: Dr. D. S. Bhagat (*devidas.bhagat@gov.in*)

Assistant Professor, Chemistry, Dept. of Forensic Chemistry, GIFSA.

b. Second Party: ***Parul Institute of Applied Sciences*** **(PIAS)**, Parul University, Vadodara, Gujarat, India, 391760

SPOC person: Dr. Shivani Pandya, (*shivani.pandya82075@paruluniversity.ac.in*)

Dept. of Forensic Science, ***Parul Institute of Applied Sciences***, Parul University, Vadodara.

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Aurangabad.

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ARBITRATION CLAUSE

Should there be a dispute relating to any aspect of academic cooperation, Director/Principal/Head/Coordinator, GIFSA and PIAS will jointly resolve the dispute in a spirit of independence, mutual respect, and shared responsibility

CONFIDENTIALITY

During the tenure of the MOU, both GIFSA and PIAS will maintain strict confidentiality and prevent disclosure of all the information and data exchanged under the scope of this MOU for any purpose other than under this MOU. Further both GIFSA and PIAS shall put in place adequate and reasonable measures to keep and store confidential information secure to prevent any unauthorized use.

Both the parties *GIFSA and PIAS, are acceptable to have entered into this agreement effective as on the date and year have first written above.*

Principal
Parul Institute of Applied Sciences,
Parul University, Vadodara, Gujarat.

Director
Govt. Institute of Forensic Science
Aurangabad

Director
Govt. Institute of Forensic Science
Aurangabad, Maharashtra.

Witness

Name: Dr. Shivani Pandya
Designation: HOD, Dept. of Forensic Sci.
Parul Institute of Applied Sciences

Witness

Name: Dr. D. S. Bhagat
Designation: Assist. Prof, Chemistry,
Department of Forensic Chemistry

Seal

Seal

Govt. Institute of Forensic Science
Aurangabad.

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DOI: 10.4467/12307483PFS.20.001.14781

OVERVIEW OF BIMETALLIC NANOMATERIALS USED FOR VISUALIZATION OF LATENT FINGERPRINTS ON VARIOUS SURFACES

Vilas A. CHAVAN[1], Devidas S. BHAGAT[2], Ajit K. GANGAWANE[3]

[1] *Center of Research for Development (CR4D) and Parul Institute of Applied Sciences, Parul University, Post Limda, Waghodia, Vadodara, Gujarat, India*
[2] *Department of Forensic Chemistry and Toxicology, Government Institute of Forensic Science, Aurangabad, MS India*
[3] *Parul Institute of Applied Sciences, Parul University, Post Limda, Waghodia, Vadodara, Gujarat, India*

Abstract

This review focuses on the current trends in the use of doped metallic nanomaterials in forensic science for the development and detection of latent fingerprints (LFPs) on various surfaces which provide better fingerprint image quality. The advantages and important results of studies conducted on latent fingerprints detection with various doped metallic nanomaterials are critically discussed. We also glimpse on fluorescent nanoparticles that have succeeded in producing high-quality fingerprint images which lead to the extraction of all three levels of fingerprint features. A few metallic nanomaterials used for latent fingerprints detection did not produce high-quality fingerprint images failing extraction of all three levels of fingerprint features. To overcome this forensic problem more research is needed to improve the latent fingerprint detection abilities of doped metallic nanomaterials.

Keywords

Fingerprint detection; Bimetallic nanoparticles; Forensic applications; Synthesis.

Received 1 December 2021; accepted 26 February 2022

1. Introduction

Forensic science deals with the recognition, identification, individualization and reconstruction of physical evidence collected from a crime scene to find out the truth on the alleged matter by applying theories, principles, laws and techniques of all the basic sciences in a crime scene investigation. The research, and identification of evidence at a crime scenes that provides direct links to criminals referred to forensic expertise (Andrade et al., 2016). Before a court judgment, evidence is critically examined for identifying perpetrators. It is also a better way to keep good records of evidence against the accused (Camargo Filho et al., 2015). Fingerprints, ear-prints and handwriting are all examples of prime evidence used to identification of individuals. As a result, forensic technology is one of the most important technologies utilized to apprehend criminals and ensure that justices are working efficiently (Mennell, 2007).

In crime scene investigation, numerous samples and subjects are collected for analysis, where forensic technology plays a crucial role in assisting a panel of judges and lawyers in producing evidence against criminals in a court of law (Doty, Muro, Bueno, Halamkova, Lednev, 2015). Existing forensic analysis techniques are losing their effectiveness which needs to include and develop new advanced tools and methods. Bloodstains, fabrics, fiber, glass, knife, fingerprint, hair, mobile phones, gunshot residues and paint are some of the most common types of evidence substrates encountered in forensic analysis. Basically,

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Review
Volume 13, Issue 5, 2023, 468
https://doi.org/10.33263/BRIAC135.468

Bimetallic Nanomaterials-Based Electroanalytical Methods for Detection of Pesticide Residues

Vilas A. Chavan [1,2,3], Devidas S. Bhagat [2,*], Ajit K. Gangawane [3], Himani P. Khawashi [4], Bapu R Thorat [5]

1 Department of Forensic Science, School of Paramedics and Allied Health Science, Centurion University of Technology and Management, Vizianagaram - 535 003, Andhra Pradesh, India; vilas.chavan47@gmail.com (V.A.C.);
2 Department of Forensic Chemistry and Toxicology, Government Institute of Forensic Science, Aurangabad - 431 004, Maharashtra, India; devidas.bhagat@gov.in (D.S.B.);
3 Parul Institute of Applied Sciences, Parul University, Post Limda, Waghodia, Vadodara - 391 760, Gujarat, India; ajit.gangawane@paruluniversity.ac.in (A.K.G.);
4 Department of Applied Chemistry, Karunya Institute of Technology and Sciences (Deemed to be University), Karunya Nagar, Coimbatore - 641 114, Tamil Nadu, India; hpkhawshi@gmail.com (H.P.K.);
5 Department of Chemistry, Government College of Arts and Science, Aurangabad - 431001 (MS), India; bthorat78@gmail.com (B.R.T.);
* Correspondence: devidas.bhagat@gov.in (D.S.B);

Scopus Author ID 57201065243

Received: 14.08.2022; Accepted: 19.10.2022; Published: 27.12.2022

Abstract: The application of bimetallic nanoparticles-based electroanalytical techniques in forensic science for pesticide detection residues in various exhibits are the emphasis of this review paper. Although many pesticide detection methods have been developed, nanomaterial-based electroanalytical methods have several benefits, including rapid analysis, cost-effective analysis, downsizing to increase performance, and field deployability. Bimetallic nanoparticles such as gold, platinum, palladium, nickel, and iron-based nanomaterials have been widely used as electrode modification agents for electrocatalytic activities and the synergistic impact of two different metals in a single probe. This review first outlined the applicability of electroanalytical techniques based on the bimetallic sensor for detecting pesticide residue. To assess existing applications and use of bimetallic nanoparticles for pesticide detection, selected studies with sensitivity, the limit of detection (LOD), and analytical application were examined. Finally, the existing difficulties and possible prospects in pesticide detection employing electroanalytical methods were explored.

Keywords: pesticide; bimetallic nanoparticles; electroanalytical; forensic applications.

1. Introduction

Forensic science deals with the recognition, identification, individualization, and reconstruction of physical evidence collected from the crime scene and finding the truth on the alleged matter by applying theories, principles, laws, and techniques of all the basic sciences in crime scene investigation [1]. Forensic technology is the study, inspection, and identification of clue materials at crime scenes that establish clear connections to offenders and facilitate their quick capture. Forensic evidence is crucial for identifying offenders through examinations at crime sites and related forensic exhibits before a court ruling. Additionally, it's a better way to maintain accurate records of the clue materials against the accused [2].

Biointerface Research in Applied Chemistry
Open-Access Journal (ISSN: 2069-5837)

Review
Volume 13, Issue 5, 2023, 466
https://doi.org/10.33263/BRIAC135.466

Recent Advances in the Detection of Lead Ions using Nanoparticle-Based Sensors

Himani P. Khawashi [1], Vilas A. Chavan [2], Devidas S. Bhagat [3,*], Satish U. Deshmukh [4]

1 Department of Applied Chemistry, Karunya Institute of Technology and Sciences (Deemed to be University), Karunya Nagar, Coimbatore - 641 114, Tamil Nadu, India; hpkhawshi@gmail.com (H.P.K.);
2 Department of Forensic Science, School of Paramedics and Allied Health Science, Centurion University of Technology and Management, Vizianagaram - 535 003, Andhra Pradesh, India; vilas.chavan47@gmail.com (V.A.C.);
3 Department of Forensic Chemistry and Toxicology, Government Institute of Forensic Science, Aurangabad - 431 004, Maharashtra, India; devidas.bhagat@gov.in (D.S.B.);
4 Department of Chemistry, Deogiri College, Aurangabad 431005, (M.S), India; satishud@gmail.com (S.U.D.);
* Correspondence: devidas.bhagat@gov.in (D.S.B.);

Scopus Author ID 57201065245

Received: 4.07.2022; Accepted: 15.08.2022; Published: 26.12.2022

Abstract: Even in trace amounts, lead is a pollutant that harms people and wildlife. We thoroughly examined more than a hundred articles on current developments in the detection of lead ions using nanoparticle-based sensors for this work. Lead ions' identification and reduction should be prioritized due to their dangerous nature to stop the severe pollution brought on by heavy metals. It is necessary to have on-site detecting technology to find heavy metal-polluted areas quickly. However, this advanced, commercially viable technology is hard to come by. Nano-based sensors improve spectral methods' sensitivity, selectivity, and detection limits, yet more attenuation is needed in hazardous pollution scenarios. It is concluded that, as research advances and methodological barriers are removed, nanotechnology offers a viable approach to lead detection in aquatic settings as well as forensic samples. These technologies will considerably support continuous environmental monitoring.

Keywords: nanoparticle; environmental; pollutant; toxicity; lead ions; poisoning; nano-sensor.

1. Introduction

Although fast industrialization has enormous benefits for humanity, it also has certain dangerous side effects, such as the release of wastewater containing heavy metals into the environment, which causes their widespread distribution in the atmosphere. Heavy metals are "Low-density chemical components that are highly toxic" and "metals with atomic weights between 63.5 and 200.6 g mol^{-1} and a specific gravity greater than 5 g cm^{-3}" [13]. Because heavy metals cannot degrade, they are problematic for both humans and the environment. It alters the metabolic life cycle by attaching to the sulphonyl group in proteins. Some heavy metals, such as Zn, Cu, Fe, Co, Mn, and others, are essential to life in small doses, and their toxicity results from exposure above the allowable limit [4-6].

Conventional analytical methods, for example, spectroscopic techniques, can analyze metal particles quantitatively. However, their implementation can be hindered by costly gear and complex techniques [7,8]. Given these drawbacks, current attention is focused on developing sensors for the on-site identification of metallic ions with great sensitivity, rapid response times, and selectivity. Techniques that are more thought to fit the condition include laser-induced breakdown spectroscopy (LIBS) [9], electrochemical [10], and optical [11]

PARUL UNIVERSITY

Ph.D./Notification-204/2022-23

NOTIFICATION

December 20, 2022

Subject: Allocation of PhD Co-Supervisor
Ref: Approval of the Provost

Sr No	Name of the PhD Scholar	Enrollment Number of PhD Scholar	Contact Details of PhD Scholar	Name of the PhD Supervisor	Details of the Alloted PhD Co-Supervisor	Contact Details of PhD Co- Supervisor	Type of Registration	Faculty	Remark
1	Parmar Vishvanathsinh G	200300412013	200300412013@paruluniversity.ac.in, vishvanath.parmar88@gmail.com / 7331102998 /	Dr. Mehul Gor	Dr. D. B Jani, Associate Professor, Government Engineering College, Dahod	dbjani@rediffmail.com / 9428044640	External – Part Time	Engneering and Technology	PhD scholar working under his/her supervision have been allotted new co-supervisor as per request received from PhD scholar, and recommendation from PhD supervisor, DRC experts and concerned Dean.
2	Chavan Vilas Anil	201100407002	201100407002@paruluniversity.ac.in vilash.chavan47@gmail.com / 9921421053, 7020088638	Dr. Shivani Pandya	Dr. Devidas Bhagat, Assistant Professor, Government Institute of Forensic Science, Aurangabad	devidas.bhagat@gov.in, dsbhagat999@gmail.com / 9595669292	External – Part Time	Applied Sciences	

Director
Govt. Institute of Forensic Science
Aurangabad.

Govt. Institute of Forensic Science Aurangabad

PASHA 21/12/2022
Dean
Doctoral Studies and Research
Parul University

DEAN
Doctoral Studies & Research
PARUL UNIVERSITY

To,
The PhD Scholars and PhD Supervisors
Copy to:
1. Dean and PhD Coordinator of concerned faculty
Copy submitted to:
1. The President
2. The Vice President
3. Dr. Geetika Madan Patel, Member, Governing Body and Medical Director
4. The Provost
5. The Pro Vice Chancellor
6. The Registrar
7. Student Section
8. Exam Section
9. MIS Section

PARUL UNIVERSITY

R/Notification-719/2021-22

Office of the Registrar
August 12, 2021

NOTIFICATION

Sub: Recognition as Co-Guide
Ref: (i) Application of the teacher
(ii) Approval of the Provost

Dr.Devidas Sudam Bhagat, Assistant Professor in the Dept.of Forensic Chemistry and Toxicology, Government Institute of Forensic Science, Aurangabad is recognized as Co-Guide for Ph.D Programme in the discipline of Forensic Science under Faculty of Applied Sciences in the University.

He shall adhere to the regulations governing Ph.D degree programmes in the university.

By Order

Registrar

To,
Dr.Devidas Sudam Bhagat, Assistant Professor in the Dept.of Forensic Chemistry and Toxicology, Government Institute of Forensic Science, Aurangabad

Copy to,

1) Dean, Doctoral Studies & Research
2) Dean, Faculty of Applied Sciences
3) Principal, PIAS
4) Deputy Registrar (Academic)

Submitted to,

1) The President
2) The Vice President
3) The Provost
4) The Pro Vice Chancellor

Govt. Institute of Forensic Science Aurangabad सत्यमेव जयते

Director
Govt. Institute of Forensic Science
Aurangabad.

Activity Report under MoU

Between

Government Institute of Forensic Science,

Pahadshingpura, Nipatniranjan Nagar, Caves Road,

Dr. Babasaheb Ambedkar Marathwada University Campus,

Aurangabad, Maharashtra 431004

And

Parul
University

Parul Institute of Applied Sciences,

Parul University Campus,

Vadodara, Gujarat, India, 391760

Govt. Institute of Forensic Science

Director
Govt. Institute of Forensic Science
Aurangabad.

Government Institute of Forensic Science, Nipatniranjan Nagar, Caves Road, Dr. Babasaheb Ambedkar Marathwada University Campus, Aurangabad, Maharashtra 431004 and ***Dept. of Forensic Science, Parul Institute of Applied Sciences***, Parul University, Vadodara, Gujarat, India, 391760, therefore ***agree to establish a program for academic cooperation in the areas of mutual interest, and following terms and conditions outlined in this memorandum of understanding (MoU).***

Following are the List of activities are held under these signed MoU

1. Dr. Devidas S. Bhagat recognised as Ph. D. co-guide in subject of forensic Science in Parul University under this MoU in academic 2021-222.

PARUL UNIVERSITY

R/Notification-719/2021-22

Office of the Registrar
August 12, 2021

NOTIFICATION

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Ref: (i) Application of the teacher
(ii) Approval of the Provost

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By Order

Registrar

To,
Dr.Devidas Sudam Bhagat, Assistant Professor in the Dept.of Forensic Chemistry and Toxicology, Government Institute of Forensic Science, Aurangabad

Copy to,

1) Dean, Doctoral Studies & Research
2) Dean, Faculty of Applied Sciences
3) Principal, PIAS
4) Deputy Registrar (Academic)

Submitted to,

1) The President
2) The Vice President
3) The Provost
4) The Pro Vice Chancellor

Govt. Institute of Forensic Science Aurangabad

Director
Govt. Institute of Forensic Science
Aurangabad.

2. Joint research: Dr. Devidas S. Bhagat Published three research paper detailed of the published paper as follows

1. Vilas A. Chavan, Devidas S. Bhagat, Ajit K. Gangawane, Over view of bimetallic nanomaterials used for visualization of latent fingerprints on various surfaces, *Problems of Forensic Sciences*, 2022, vol. 129, 75-91, DOI: 10.4467/12307483PFS.22.004.16305. (Scopus indexed Journal)

ISSN 1230-7483
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Problems of Forensic Sciences 2022, vol. 129, 75–91

DOI: 10.4467/12307483PFS.22.004.16305

OVERVIEW OF BIMETALLIC NANOMATERIALS USED FOR VISUALIZATION OF LATENT FINGERPRINTS ON VARIOUS SURFACES

Vilas A. CHAVAN[1], Devidas S. BHAGAT[2], Ajit K. GANGAWANE[3]

[1] *Center of Research for Development (CR4D) and Parul Institute of Applied Sciences, Parul University, Post Limda, Waghodia, Vadodara, Gujarat, India*
[2] *Department of Forensic Chemistry and Toxicology, Government Institute of Forensic Science, Aurangabad, MS India*
[3] *Parul Institute of Applied Sciences, Parul University, Post Limda, Waghodia, Vadodara, Gujarat, India*

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This review focuses on the current trends in the use of doped metallic nanomaterials in forensic science for the development and detection of latent fingerprints (LFPs) on various surfaces which provide better fingerprint image quality. The advantages and important results of studies conducted on latent fingerprints detection with various doped metallic nanomaterials are critically discussed. We also glimpse on fluorescent nanoparticles that have succeeded in producing high-quality fingerprint images which lead to the extraction of all three levels of fingerprint features. A few metallic nanomaterials used for latent fingerprints detection did not produce high-quality fingerprint images failing extraction of all three levels of fingerprint features. To overcome this forensic problem more research is needed to improve the latent fingerprint detection abilities of doped metallic nanomaterials.

Keywords

Fingerprint detection; Bimetallic nanoparticles; Forensic applications; Synthesis.

Received 1 December 2021; accepted 26 February 2022

1. Introduction

Forensic science deals with the recognition, identi- individuals. As a result, forensic technology is one of the most important technologies utilized to apprehend criminals and ensure that justices are working effi-

Govt. Institute of Forensic Science

Director
Govt. Institute of Forensic Science
Aurangabad.

2. *Devidas S. Bhagat*, Himani Khawashi , Vilas Chavan , Satish Deshmukh, "Recent Advances in the Detection of Lead Ions using Nanoparticle-Based Sensors"* ***Biointerface Research in Applied Chemistry, 2022****, Accepted. (Scopus indexed and Web of Science Indexed Journal)*

Manuscript ID	**briac-1825**
Manuscript Status	Paper accepted
Title	Recent Advances in the Detection of Lead Ions using Nanoparticle-Based Sensors
Journal	Biointerface Research in Applied Chemistry
Type	Review
License	n/a
Abstract	Even in trace amounts, lead is a pollutant that harms both people and wildlife. We thoroughly examined more than a hundred articles on current developments in the detection of lead ions using nanoparticle-based sensors for this work. To stop the severe pollution brought on by heavy metals, lead ions' identification and reduction should be prioritized due to their dangerous nature. Currently, it is necessary to have on-site detecting technology that can find heavy metal-polluted areas quickly. However, this kind of advanced, commercially viable technology is hard to come by. Nano-based sensors improve spectral methods' sensitivity, selectivity, and detection limits, yet more attenuation is needed in hazardous pollution scenarios. It is concluded that, as research advances and methodological barriers are removed, nanotechnology offers a viable approach to lead detection in aquatic settings as well as forensic samples. These technologies will considerably support continuous environmental monitoring.
Authors	Devidas S. Bhagat * , Himani Khawashi , Vilas Chavan , Satish Deshmukh
Author Emails	devidas.bhagat@gov.in, hpkhawshi@gmail.com, vilas.chavan47@gmail.com, satishud@gmail.com
Submission Date	04 July 2022
Date of last revision request	12 August 2022

Govt. Institute of Forensic Science Aurangabad

Director
Govt. Institute of Forensic Science
Aurangabad.

3. Devidas S Bhagat*, Vilas Chavan , Ajit Gangawane , Himani Khawashi , Bapu Thorat "Bimetallic Nanomaterials Based Electroanalytical Methods for Detection of Pesticide Residues", ***Biointerface Research in Applied Chemistry, 2022,*** *Accepted. (Scopus indexed and Web of Science Indexed Journal)*

Manuscript ID	**briac-2034**
Manuscript Status	Paper accepted
Title	Bimetallic Nanomaterials Based Electroanalytical Methods for Detection of Pesticide Residues
Journal	Biointerface Research in Applied Chemistry
Type	Review
License	n/a
Abstract	The application of bimetallic nanoparticles-based electroanalytical techniques in forensic science for pesticide detection residues in various exhibits is the emphasis in this review paper. Although many pesticide detection methods have been developed, nanomaterial-based electroanalytical methods have several benefits, including, rapid analysis, cost-effective analysis, downsizing to increase the performance of the developed methods, and field deployability. Bimetallic nanoparticles such as gold, platinum, palladium, nickel, and iron-based nanomaterials have been widely used as electrode modification agents due to their electrocatalytic activities and the synergistic impact of two different metals. This review first outlined the basic knowledge of pesticide residue detection using a bimetallic nanoparticles-based probe. To assess existing applications and use of bimetallic nanoparticles for pesticide detection, selected studies with sensitivity, the limit of detection (LOD), and analytical application were examined. Finally, the existing difficulties and possible developments in pesticide detection employing electroanalytical methods based on bimetallic nanoparticles were explored.
Authors	Devidas S Bhagat * , Vilas Chavan , Ajit Gangawane , Himani Khawashi , Bapu Thorat
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Submission Date	14 August 2022
Date of last revision request	12 October 2022

Govt. Institute of Forensic Science Aurangabad

Director
Govt. Institute of Forensic Science
Aurangabad.