

2026



DEPARTMENT OF CHEMISTRY
Chaudhary Charan Singh University
Meerut - 250004



DR. MUKTI VERMA

NOVELTY



CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

Product Code: Mixed ligand complexes of transition metals as fungicides and process of preparation thereof

PATENT NO:
PATENT APPLICATION NO: 202311009296 A
PATENT PUBLISHED: 17.February,2023
PATENT GRANTED:
APPLICANT: C.C.S.University, Meerut
INVENTORS: Dr. Mukti Verma, Dr. Moni Verma

TECHNICAL SPECIFICATION

- 1-The invention relates to mixed ligand complexes of transition metals useful as fungicides.
- 2- The complexes comprise a transition metal ion, a primary chelating ligand, and a secondary co-ligand.
- 3- Transition metals are selected from Cu, Ni, Co, Zn, Mn, Fe, and Cr.
- 4-The ligands form stable coordination complexes enhancing fungicidal activity.
- 5-The complexes are prepared by reacting metal salts with ligands in alcoholic or aqueous medium.
- 6- The reaction is carried out at 40–80 °C under controlled pH conditions.
- 7- The resulting complexes show enhanced antifungal activity at low concentrations.
- 8-The complexes are effective against phytopathogenic fungi.
- 9- The invention provides a simple, cost-effective, and scalable preparation process.
- 10-The complexes are suitable for agricultural fungicidal formulations

NEED OF INVENTION

- Development of resistance
- High toxicity and environmental persistence
- Limited spectrum of activity
- Poor stability and solubility
- Rising regulatory restrictions



ABOUT THE PATENT

The patent relates to novel mixed ligand complexes of transition metals developed for use as fungicidal agents. The invention addresses limitations of conventional fungicides such as resistance, toxicity, and limited efficacy. The patented complexes comprise a transition metal ion coordinated with two different ligands, providing enhanced stability and biological activity. The patent also covers a simple and reproducible process of preparation of the said complexes. The invention demonstrates broad-spectrum antifungal activity at lower effective concentrations. The patented technology offers an eco-friendly, cost-effective, and scalable alternative for agricultural applications.

PATENT CERTIFICATE

(12) PATENT APPLICATION PUBLICATION

(21) Application No.202311009296 A

(19) INDIA

(22) Date of filing of Application :13/02/2023

(43) Publication Date : 17/02/2023

(54) Title of the invention : MIXED LIGAND COMPLEXES OF TRANSITION METALS AS FUNGICIDES AND PROCESS OF PREPARATION THEREOF

(51) International classification :B01J0031240000, H01L0051000000, C12Q001000000, B01J0031180000, B01J0037030000

(71)Name of Applicant :
1)Chaudhary Charan Singh University, Meerut
Address of Applicant :Meerut – 250004, Uttar Pradesh, India
Meerut -----

(86) International Application No :NA
Filing Date :NA

Name of Applicant : NA
Address of Applicant : NA

(87) International Publication No :NA

(72)Name of Inventor :
1)Mukti Verma

(61) Patent of Addition to Application Number :NA
Filing Date :NA

Address of Applicant :Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP) -250004 Meerut -----

(62) Divisional to Application Number :NA
Filing Date :NA

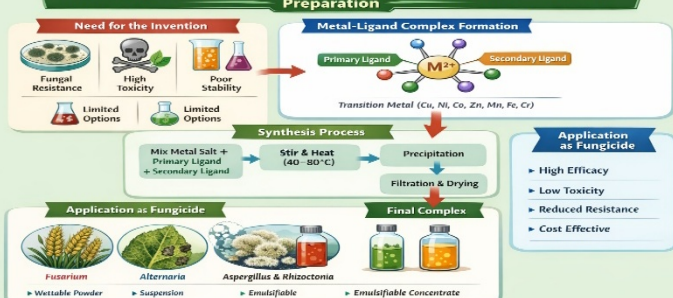
2)Moni Verma
Address of Applicant :Department of Chemistry, N.A.S. (PG) College, Meerut (UP) -250001 Meerut -----

(57) Abstract :

The present invention provides for a mixed ligand complexes as antifungicides and a process for preparation thereof. Further, the present invention relates to mixed ligand complexes of transition metals as fungicides. In particular the invention provides for a mixed ligand complexes of transition metals with thiosemicarbazone as primary ligand and naphthoic acid as co-ligand. Furthermore, the present disclosure relates to a mixed ligand complexes of transition metals as antifungicides in agriculturally acceptable salt or isomeric form. Moreover, the present disclosure relates to a process of preparation of said mixed ligand complexes of transition metals.

No. of Pages : 23 No. of Claims : 15

Mixed Ligand Transition Metal Complexes as Fungicides & Process of Preparation



CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

**Product Code: Oxazole based transition metals complexes
as fungicides and process of preparation thereof**

PATENT NO:

PATENT APPLICATION NO: 202311011562 A

PATENT PUBLISHED: 17.March,2023

PATENT GRANTED:

APPLICANT: C.C.S. University, Meerut

INVENTORS: Dr.Mukti Verma, Dr. Moni Verma

NEED OF INVENTION

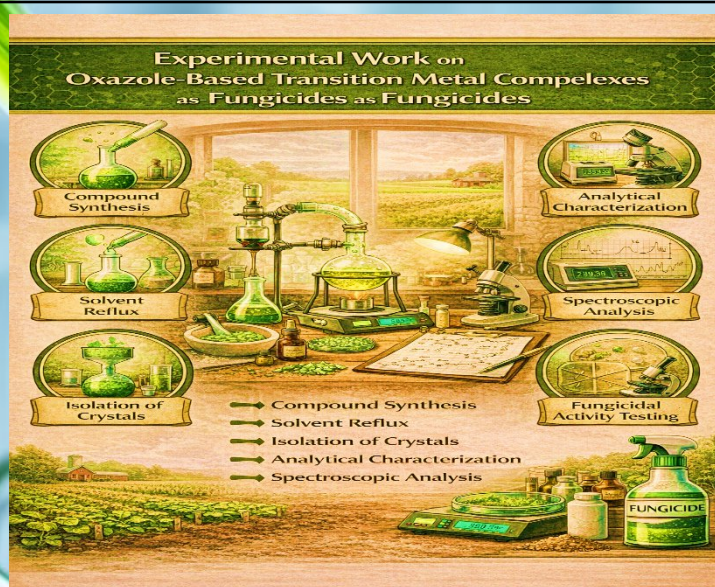
- Increasing resistance of fungi to conventional fungicides
- Environmental and toxicity concerns of existing agrochemicals
- Need for more effective and low-dose antifungal agents
- Development of novel oxazole-metal complexes with enhanced bioactivity

TECHNICAL SPECIFICATION

- Oxazole-based heterocyclic ligand acts as chelating agent
- Transition metals selected from Cu(II), Ni(II), Co(II), Zn(II), Fe(III), Mn(II)
- Metal-to-ligand molar ratio of 1:1 or 1:2
- Alcoholic solvents such as ethanol or methanol employed
- Reaction carried out under stirring and reflux conditions
- pH maintained in the range of 6–8
- Solid complexes isolated by filtration and drying
- Complexes exhibit enhanced fungicidal activity over free ligands
- Effective against common phytopathogenic fungi

ABOUT THE PATENT

- Novel oxazole-based transition metal fungicides
- Improved antifungal activity via metal complexation reproducible preparation process
- Simple and Effective at low concentrations
- Suitable for agricultural and post-harvest use

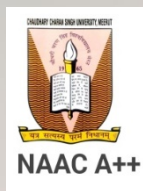


PATENT CERTIFICATE

(12) PATENT APPLICATION PUBLICATION	(21) Application No.202311011562 A
(19) INDIA	
(22) Date of Filing of Application :20/02/2023	(43) Publication Date : 17/03/2023
(54) Title of the invention : OXAZOLE BASED TRANSITION METAL COMPLEXES AS FUNGICIDES AND PROCESS OF PREPARATION THEREOF	
(51) International classification :C07D 633/00, C08F 100/00, H01M 04/1310, H01M 04/1315, H01M 04/3050	(71)Name of Applicant : 1)Chaudhary Charan Singh University, Meerut Address of Applicant :Meerut -250004, Uttar Pradesh, India Meerut -----
(56) International Application No :NA Filing Date :NA	Name of Applicant : NA Address of Applicant : NA
(57) International Publication No :NA	(72)Name of Inventor : 1)Moni Verma Address of Applicant :Department of Chemistry, N.A.S. (PG) College, Meerut (UP) -250001 Meerut -----
(61) Patent of Addition to Application Number :NA Filing Date :NA	2)Mukti Verma Address of Applicant :Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP) -250004 Meerut -----
(62) Divisional to Application Number :NA Filing Date :NA	

(57) Abstract:
The present invention provides for an oxazole based complexes as fungicides and a process for preparation thereof. Further, the present invention relates to oxazole based complexes of transition metals as fungicides. In particular the invention provides for an oxazole based complexes of transition metals with 2-amino-4-(p-methoxy phenyl) oxazole. Furthermore, the present disclosure relates to an oxazole based complexes of transition metals as fungicides in agriculturally acceptable salt or isomeric form. Moreover, the present disclosure relates to a process of preparation of said oxazole based complexes of transition metals, agriculturally acceptable salt or isomers thereof.

No. of Pages : 28 No. of Claims : 8



CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

Product Code: **Analogues of mixed ligand complexes of transition metals
as fungicides and process of preparation thereof**

PATENT NO:

PATENT APPLICATION NO: 202311076115A

PATENT PUBLISHED: 01 December 2023

PATENT GRANTED:

APPLICANT: C.C.S. University, Meerut

INVENTORS: Dr. Mukti Verma, Dr. Moni Verma

NEED OF THE INVENTION

- Reduced efficacy due to resistance development
- High toxicity & environmental persistence
- Need for novel chemical entities
- Enhanced biological potency
- Fine-tuning of activity & selectivity
- Cost-effective synthesis process
- Broad-spectrum action at low doses
- Eco-friendly & stable metal-based fungicides

TECHNICAL SPECIFICATION

- Transition metals selected from **Cu, Ni, Co, Zn, Mn, Fe**
- Mixed ligand system** comprising primary and secondary ligands
- Ligands coordinated through **N/O donor atoms**
- Formation of **stable mono- or polynuclear complexes**
- Synthesized by **solution phase reaction** under controlled conditions
- Stoichiometric metal-to-ligand ratio** maintained
- Complexes isolated by **filtration and drying**
- Products exhibit **enhanced antifungal activity**
- Effective at **low concentration**
- Suitable for **agricultural fungicidal applications**

Analogues of Mixed Ligand Complexes of Transition Metals as Fungicides and Process of Preparation Thereof



ABOUT THE PATENT

- Relates to **analogues of mixed ligand transition metal complexes**
- Focuses on **novel metal-ligand combinations**
- Provides an **efficient process of preparation**
- Exhibits **enhanced fungicidal activity**
- Effective against **plant pathogenic fungi**
- Requires **low dosage for high efficacy**
- Shows **improved stability and shelf life**
- Environmentally **safer than conventional fungicides**
- Applicable in **agriculture and crop protection**
- Scalable for **industrial production**

PATENT CERTIFICATE

(12) PATENT APPLICATION PUBLICATION

(21) Application No. 202311076115 A

(19) INDIA

(22) Date of filing of Application: 08/11/2023

(43) Publication Date: 01/12/2023

(54) Title of the invention: ANALOGUES OF MIXED LIGAND COMPLEXES OF TRANSITION METALS AS FUNGICIDES AND PROCESS OF PREPARATION THEREOF

(51) International classification: :H01L0051000000, B01J0031240000, C08F0004659000, C08F0210160000, C07C0253100000

(86) International Application No: :NA
Filing Date: :NA

(87) International Publication No: :NA

(61) Patent of Addition to Application Number: :NA
Filing Date: :NA

(62) Divisional to Application Number: :NA
Filing Date: :NA

(71) Name of Applicant: 1) Chaudhary Charan Singh University, Meerut
Address of Applicant: Meerut - 250004, Uttar Pradesh, India
Meerut -----

Name of Applicant: NA
Address of Applicant: NA

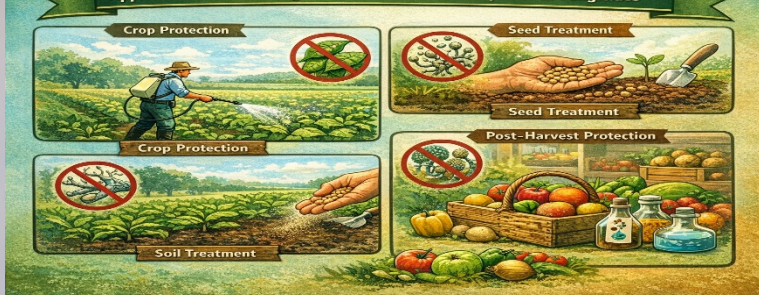
(72) Name of Inventor: 1) Mukti Verma
Address of Applicant: Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP) - 250004 Meerut -----
2) Moni Verma
Address of Applicant: Department of Chemistry, N.A.S. (PG) College, Meerut (UP) - 250001 Meerut -----

(57) Abstract:

The present invention provides for analogues of mixed ligand complexes as antifungicides and a process for preparation thereof. Further, the present invention relates to analogues of mixed ligand complexes of transition metals as fungicides. In particular the invention provides for analogues of mixed ligand complexes of transition metals with thiosemicarbazone as primary ligand and naphthoic acid as co-ligand. Furthermore, the present disclosure relates to analogues of mixed ligand complexes of transition metals as antifungicides in agriculturally acceptable salt or isomeric form. Moreover, the present disclosure relates to a process of preparation of said analogues of mixed ligand complexes of transition metals.

No. of Pages: 22 No. of Claims: 10

Applications of Mixed Ligand Transition Metal Complexes as Fungicides





CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

Product Code:Thiazole based transition metals complexes as fungicides
and process of preparation thereof

PATENT NO:

PATENT APPLICATION NO: 202311076116A

PATENT PUBLISHED: 01.December2023

PATENT GRANTED:

APPLICANT: C.C.S. University, Meerut

INVENTORS: : Dr.Mukti Verma, Dr. Moni Verma

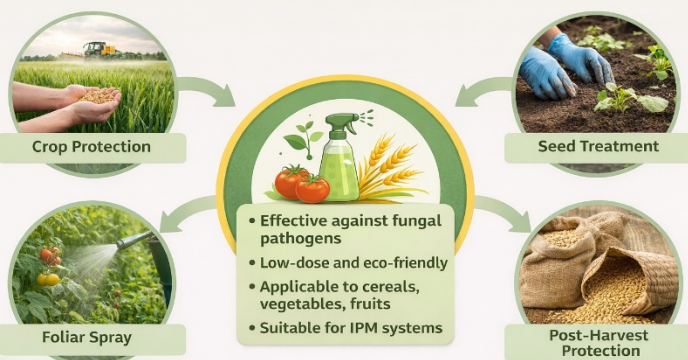
TECHNICAL SPECIFICATION

- Thiazole derivatives used as coordinating ligands
- Transition metals: Cu(II), Ni(II), Co(II), Zn(II), Mn(II)
- Simple solution-phase synthesis under controlled pH & temperature
- Complexes isolated, purified, and structurally characterized
- Enhanced antifungal activity vs. free ligands
- Effective at low dose against phytopathogenic fungi
- Improved stability and shelf life
- Reduced toxicity and eco-friendly nature

ABOUT THE PATENT

- The invention relates to **thiazole-based transition metal complexes**
- Focuses on their use as **novel fungicidal agents**
- Describes an **efficient and reproducible process of preparation**
- Metal complexation enhances **biological efficacy and stability**
- Shows **improved antifungal activity** over conventional fungicides
- Effective against **major phytopathogenic fungi**
- Designed to work at **low concentrations**
- Emphasizes **eco-friendly and cost-effective formulation**
- Applicable in **agriculture and plant disease management**

APPLICATIONS



PATENT CERTIFICATE

(12) PATENT APPLICATION PUBLICATION

(21) Application No.202311076116 A

(19) INDIA

(22) Date of filing of Application :08/11/2023

(43) Publication Date : 01/12/2023

(54) Title of the invention : THIAZOLE BASED TRANSITION METAL COMPLEXES AS FUNGICIDES AND PROCESS OF PREPARATION THEREOF

(51) International classification :C07D0417040000, G01N0033530000, A61K0031443900, C07D0513040000, B01J0025990000

(86) International Application No

Filing Date

(87) International Publication No

Filing Date

(61) Patent of Addition to Application Number

Filing Date

(62) Divisional to Application Number

Filing Date

(71) Name of Applicant :

1)Chaudhary Charan Singh University, Meerut

Address of Applicant :Meerut - 250004, Uttar Pradesh, India

Meerut -----

Name of Applicant : NA

Address of Applicant : NA

(72) Name of Inventor :

1)Moni Verma

Address of Applicant :Department of Chemistry, N.A.S. (PG)

College, Meerut (UP) - 250001 Meerut -----

2)Mukti Verma

Address of Applicant :Department of Chemistry, Chaudhary

Charan Singh University, Meerut (UP) -250004 Meerut -----

(57) Abstract:

The present invention provides for a thiazole based complexes as fungicides and a process for preparation thereof. Further, the present invention relates to thiazole based complexes of transition metals as fungicides. In particular the invention provides for a thiazole based complexes of transition metals with 2-amino-4-(p-methoxy phenyl) thiazole. Furthermore, the present disclosure relates to a thiazole based complexes of transition metals as fungicides in agriculturally acceptable salt or isomeric form. Moreover, the present disclosure relates to a process of preparation of said thiazole based complexes of transition metals, agriculturally acceptable salt or isomers thereof.

No. of Pages :26 No. of Claims : 8



CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

Product Code: System & Method for Examination of cognitive Patterns
in Individuals Using Wearable Sensors

PATENT NO:
PATENT APPLICATION NO: 202311090260
PATENT PUBLISHED: 23 February 2024
PATENT GRANTED:
APPLICANT: I. P. India
INVENTORS: Dr. Mukti Verma

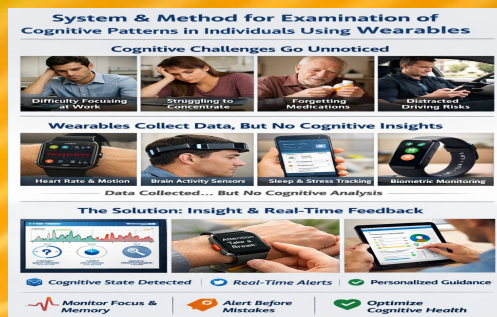
TECHNICAL SPECIFICATION

Wearable device with multi-sensor integration
Sensors: HR, HRV, motion, stress, sleep, optional EEG
Real-time physiological data acquisition
Wireless data transmission to mobile device
Machine-learning based cognitive pattern analysis
Detection of attention, fatigue, stress, distraction
Edge/cloud data processing architecture
Mobile application with cognitive dashboard
Real-time alerts and notifications
Personalized feedback and recommendations

ABOUT THE PATENT

- Relates to cognitive pattern examination using wearables
- Integrates physiological sensors with AI analysis
- Enables real-time monitoring of cognitive states
- Detects attention, stress, fatigue, and distraction
- Provides alerts and personalized feedback
- Non-invasive and continuous monitoring system
- Applicable in health, education, and workplace safety

NEED OF INVENTION



PATENT CERTIFICATE

 Office of the Controller General of Patents, Designs & Trade Marks Department for Promotion of Industry and Internal Trade Ministry of Commerce & Industry, Government of India	
(http://ipindia.nic.in/index.htm)	
 (http://ipindia.nic.in/index.htm)	
Application Details	
APPLICATION NUMBER	202311090260
APPLICATION TYPE	ORDINARY APPLICATION
DATE OF FILING	31/12/2023
APPLICANT NAME	1. Ms. Reeta Mishra 2. Mr. Mohammed Sadiq Pachapuri 3. Mr. Mahesh Tubaki 4. Mr. Prabhat Kumar 5. Monika Gaur 6. Dr. Ravi Lingannavar 7. Mr. Nagaraj K. Kelageri 8. Mrs. Geeta M Kodabagi 9. Dr. Mukti Verma 10. Dr. Ramu Agrawal 11. Dr. Afireen Fatima 12. Dr. Reshma Farhat
TITLE OF INVENTION	SYSTEM & METHOD FOR EXAMINATION OF COGNITIVE PATTERNS IN INDIVIDUALS USING WEARABLE SENSORS
FIELD OF INVENTION	BIO-MEDICAL ENGINEERING
E-MAIL (As Per Records)	a2zsofttech.2010@gmail.com
ACQUISITION/E-MAIL (As Per Records)	
E-MAIL (UPDATED) (Optional)	
DATE OF FILING	

Applications of Wearable-Based Cognitive Monitoring





CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

Product Code: Extraction, Purification and heavy metal binding
efficiency of Anthocyanin from Rosa Indica

PATENT NO:
PATENT APPLICATION NO: 202511028188
PATENT PUBLISHED: 11. April,2025
PATENT GRANTED:
APPLICANT: C. C. S .University, Meerut
INVENTORS: Dr.Mukti Verma, Ranu Agarwal
Prerna, Ritu Jain

TECHNICAL SPECIFICATION

- Plant source: *Rosa indica* petals (fresh/dried)
- Pigment extracted: Anthocyanin (natural flavonoid)
- Extraction method: Acidified aqueous/ethanolic solvent
- Operating pH: Acidic ($\approx$ pH 1–3)
- Temperature: Low–moderate to prevent degradation
- Purification: Filtration + solvent evaporation / column chromatography
- Characterization: UV–Vis, FTIR (optional HPLC)
- Target metals: Pb^{2+} , Cd^{2+} , Cr^{3+} , Hg^{2+}
- Binding mechanism: Chelation via hydroxyl groups
- Metal removal efficiency: High at optimized pH
- Nature of process: Eco-friendly, non-toxic, cost-effective
- Application suitability: Water treatment & bioremediation

ABOUT THE PATENT

- The invention relates to a plant-based method for anthocyanin extraction from *Rosa indica*.
- It provides an optimized process for extraction and purification of high-purity anthocyanin.
- The extracted anthocyanin exhibits efficient binding of toxic heavy metals.
- The invention offers an eco-friendly and sustainable alternative to synthetic adsorbents.
- It enables effective removal of Pb, Cd, Hg and related metal ions from aqueous systems.
- The process uses low-cost, easily available natural raw material.
- The invention is suitable for environmental remediation and water treatment applications.



PATENT CERTIFICATE

(12) PATENT APPLICATION PUBLICATION (21) Application No.202511028188 A
(19) INDIA
(22) Date of Filing of Application 25/03/2025 (43) Publication Date : 11/04/2025

(54) Title of the invention : EXTRACTION, PURIFICATION AND HEAVY METAL BINDING EFFICIENCY OF ANTHOCYANIN FROM ROSA INDICA

(51) International classification : A23L0005450000, C08B0061000000, A23L0033105000, A61K0039120000, A23G0009420000
(86) International Application No : NA
Filing Date : NA
(87) International Publication No : NA
(61) Patent of Addition to Application Number : NA
Filing Date : NA
(62) Divisional to Application Number : NA
Filing Date : NA
(71) Name of Applicant :
1) Chaudhary Charan Singh University, Meerut
Address of Applicant : Meerut – 250004, Uttar Pradesh, India Meerut
Name of Applicant : NA
Address of Applicant : NA
(72) Name of Inventor :
1) Dr. Mukti Verma
Address of Applicant : Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut
2) Dr. Ranu Agarwal
Address of Applicant : Department of Applied Science, Sri Chhotu Ram Institute of Engineering and Technology Chaudhary Charan Singh University, Meerut (UP)-250004 Meerut
3) Prerna
Address of Applicant : Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut
4) Ritu Jain
Address of Applicant : Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut

(57) Abstract :
The present invention provides for extraction and purification of anthocyanins from *Rosa indica* by chemical treatment and isolation of anthocyanin. Further, the present invention relates to the anthocyanin's capability of binding and detoxifying heavy metals and the complex thereof. Furthermore, the present invention relates to an efficient purification method that enhances the stability and functional properties of the extracted anthocyanins. Moreover, the present invention provides for a method of preparation of anthocyanin-based transition metal complexes wherein the said method is simple, user friendly and highly efficient.

No. of Pages : 14 No. of Claims : 5

APPLICATIONS of Cyanidin from *Rosa indica*

Heavy metal binding to remove Pb^{2+} , Cd^{2+} , Hg^{2+} from contaminated food & water

Natural skincare from *Rosa indica* extract

Natural food coloring agent (non-toxic & safe)

Pb^{2+} , Cd^{2+} , Hg^{2+} from contaminated food & water

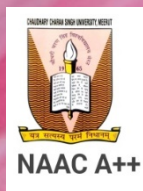
Natural skincare from *Rosa indica* extract

Natural food coloring agent (non-toxic & safe)

Eco-Friendly

Sustainable

Non-Toxic



CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

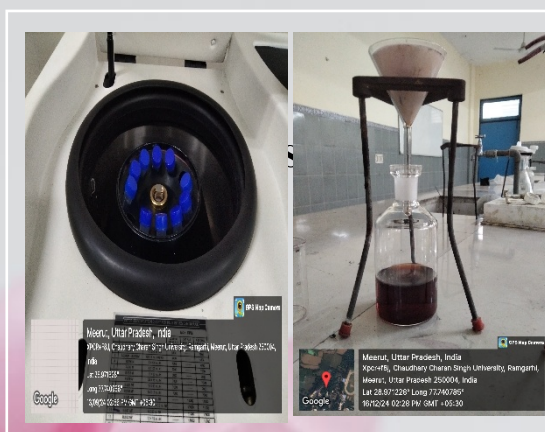
Product Code: Extraction, Characterization of Anthocyanin from Hibiscus and their binding affinity with Arsenic metal ions thereof

PATENT NO:
PATENT APPLICATION NO: 202511028185
PATENT PUBLISHED: 11. April,2025
PATENT GRANTED:
APPLICANT: C. C. S. University, Meerut
INVENTORS: **Dr. Mukti Verma**, Ranu Agarwal
Mitali Yadav, Tanisha

TECHNICAL SPECIFICATION

- **Source Method:** Acidified **Material:** Hibiscus flower petals rich in anthocyanins
- **Extraction** ed alcoholic solvent extraction
- **Purification:** Filtration and solvent evaporation / chromatographic separation
- **Active Component:** Anthocyanin pigments (polyphenolic compounds)
- **Characterization Tools:** UV-Vis, FTIR, HPLC (optional)
- **Target Metal Ion:** Arsenic (As^{3+} / As^{5+})
- **Binding Mechanism:** Chelation via $-OH$ and $C=O$ functional groups
- **Operating pH:** Acidic to near-neutral range
- **Form of Interaction:** Anthocyanin-Arsenic complex formation
- **Application Medium:** Aqueous solutions / contaminated water
- **Key Advantage:** Natural, biodegradable, non-toxic biosorbent
- **Outcome:** Efficient arsenic removal using plant-based technology

NEED OF INVENTION



ABOUT THE PATENT

- Plant-based invention using *Hibiscus sabdariffa*
- Extraction and characterization of anthocyanin (cyanidin)
- Cyanidin confirmed by UV-Visible spectroscopy
- Natural binding agent for arsenic metal ions
- Efficient removal of toxic metals from food and water
- Eco-friendly, non-toxic, and biodegradable approach
- Safer alternative to chemical remediation methods
- Applicable in water purification, food safety, and healthcare

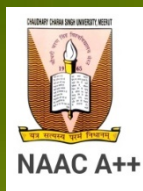
PATENT CERTIFICATE

(12) PATENT APPLICATION PUBLICATION (19) INDIA (22) Date of filing of Application: 25/03/2025	(21) Application No. 202511028185 A (43) Publication Date: 11/04/2025
(54) Title of the invention: EXTRACTION AND CHARACTERIZATION OF ANTHOCYANINS FROM HIBISCUS AND THEIR BINDING AFFINITY WITH ARSENIC METAL IONS THEREOF	
(51) International classification: A61K0005000000, C10L0003000000, A23L0003100000, A23L0005000000, C09B0061000000	(71) Name of Applicant: J Chaudhary Charan Singh University, Meerut Address of Applicant: Meerut-250004, Uttar Pradesh, India Meerut
(86) International Application No. Filing Date	Name of Applicant: NA Address of Applicant: NA
(87) International Publication No. Filing Date	(72) Name of Inventor: 1 Dr. Mukti Verma Address of Applicant: Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut
(61) Patent of Addition to Application Number Filing Date	2 Dr. Ranu Agarwal Address of Applicant: Department of Applied Science, Sir Chhotu Ram Institute of Engineering and Technology Chaudhary Charan Singh University, Meerut (UP)-250004 Meerut
(62) Divisional Application Number Filing Date	3 Mitali Yadav Address of Applicant: Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut
	4 Tanisha Address of Applicant: Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut
(57) Abstract: The present invention provides that using UV-vis spectroscopy, the current work effectively isolated and described anthocyanins from Hibiscus sabdariffa, determining that cyanidin was the main anthocyanin. The study confirmed cyanidin's potential for heavy metal remediation by demonstrating its significant binding affinity with arsenic. Following contact with arsenic, a bathochromic shift in UV-vis spectra showed that a stable cyanidin-metal complex had formed. This points to potential uses in human health, pharmaceuticals, food sciences, and environmental detoxification. Furthermore, cyanidin's anti-inflammatory, anti-cancer, and antioxidant qualities underscore its potential for therapeutic uses, and its non-toxic nature makes it a safe substitute for natural food coloring.	
No. of Pages: 13 No. of Claims: 6	

Applications of Cyanidin

Extracted from Hibiscus ("*Hibiscus sabdariffa*")





CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

Product Code: Detection of heavy metal Lead from Anthocyanin

PATENT NO:
PATENT APPLICATION NO: 202511028189
PATENT PUBLISHED: 11. April, 2025
PATENT GRANTED:
APPLICANT: C. C. S. University, Meerut
INVENTORS: Dr. Mukti Verma, Ranu Agarwal
Prerna, Payal Singh, Shruti Chaudhary

TECHNICAL SPECIFICATION

- **Sensor Material:** Plant-derived anthocyanin pigment
- **Target Analyte:** Lead ions (Pb^{2+})
- **Detection Principle:** Metal-ligand complexation
- **Response Mechanism:** Visible color change
- **Color Transition:** Purple $\rightarrow$ Pink/Red in presence of Pb^{2+}
- **Detection Medium:** Aqueous samples (water/effluent)
- **Sensitivity:** Detects Pb^{2+} at low ppm/ppb levels
- **Selectivity:** Higher affinity toward Pb^{2+} over other metal ions
- **Analysis Time:** Rapid (seconds to minutes)
- **Instrumentation:** Naked-eye / UV-Vis optional
- **Eco-friendly:** Non-toxic, biodegradable sensing agent
- **Portability:** Suitable for paper strip or solution-based kits

ABOUT THE PATENT

- Uses **anthocyanins** (natural plant pigments) to detect **lead (Pb^{2+})** ions.
- Anthocyanins are extracted from plants using acidified ethanol and purified.
- When anthocyanins interact with Pb^{2+} , they form complexes that show **visible color change** and **UV-Vis spectral shifts**, indicating lead presence.
- The color change and spectral shift help detect lead in samples.
- Claimed to be **eco-friendly** and **cost-effective** for environmental/industrial lead detection.

NEED OF INVENTION



PATENT CERTIFICATE

(12) PATENT APPLICATION PUBLICATION	(21) Application No. 202511028189 A
(19) INDIA	
(22) Date of Filing of Application: 25/03/2025	(43) Publication Date: 11/04/2025
(54) Title of the invention: DETECTION OF HEAVY METAL LEAD FROM ANTHOCYANIN	
(71) Name of Applicant : Dr. Chaudhary Charan Singh University, Meerut Address of Applicant: Meerut - 250004, Uttar Pradesh, India Meerut	
Name of Applicant : NA Address of Applicant : NA (72) Name of Inventor : 1) Dr. Mukti Verma Address of Applicant: Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut 2) Dr. Ranu Agarwal Address of Applicant: Department of Applied Science, Sri Chota Ram Institute of Engineering and Technology Chaudhary Charan Singh University, Meerut (UP)-250004 Meerut 3) Prerna Address of Applicant: Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut 4) Payal Singh Address of Applicant: Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut 5) Shruti Chaudhary Address of Applicant: Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut	
(57) Abstract: Anthocyanins, a class of natural flavonoid pigments, exhibit strong metal-chelating properties, making them potential biosensors for detecting heavy metals such as lead (Pb^{2+}). This study explores the extraction, purification, and application of anthocyanins in detecting Pb^{2+} through UV-Vis spectroscopy and colorimetric analysis. Anthocyanins were extracted from plant sources using acidified ethanol and purified via liquid-liquid extraction and column chromatography. Upon interaction with Pb^{2+} , spectral shifts and visible color changes were observed, indicating the formation of stable anthocyanin-lead complexes. The UV-Vis spectra showed a bathochromic shift and intensity changes, confirming lead binding at specific hydroxyl and carbonyl sites. These findings demonstrate anthocyanins as an effective, eco-friendly, and cost-efficient alternative for lead detection in environmental and industrial samples.	
No. of Pages: 22 No. of Claims: 10	





CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

**Product Code: Portable and Eco-friendly Colorimetric Strip for Visual
Detection of Heavy Metals and Preparation Method Thereof**

PATENT NO:

PATENT APPLICATION NO: 202511081166

PATENT PUBLISHED: 19.September,2025

PATENT GRANTED: In Process

APPLICANT: C. C. S .University, Meerut

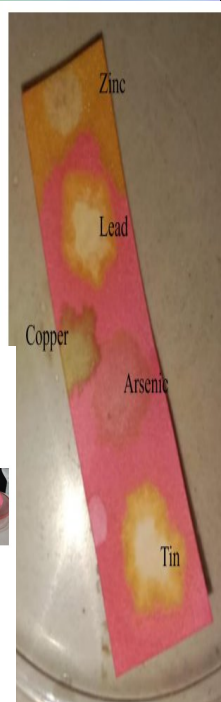
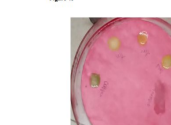
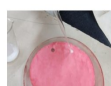
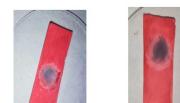
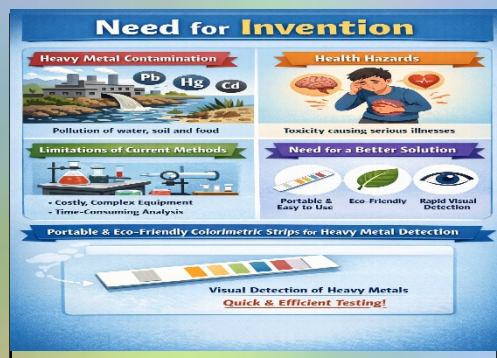
**INVENTORS: Dr.Mukti Verma, Ranu Agarwal
Prerna**

TECHNICAL SPECIFICATION

- Paper/polymer-based biodegradable substrate.
- Coated with eco-friendly natural or green-synthesized colorimetric reagent.
- Specific binding sites for heavy metals (Pb^{2+} , Hg^{2+} , Cd^{2+} , As^{3+} etc.).
- Visible color change within 1–5 minutes.
- Detection based on metal–ligand complex formation.
- Semi-quantitative analysis using color chart comparison.
- Optional quantitative analysis via smartphone image processing.
- Detection range: ppm to ppb level (depending on metal).
- No requirement of sophisticated laboratory instruments.
- Room temperature operation.
- Long shelf-life with moisture-resistant packaging.
- Non-toxic and environmentally safe materials.
- Simple dip-and-read method.
- Applicable for water, soil extract, and food sample testing.
- Low-cost, portable, and field-deployable design.

ABOUT THE PATENT

- Relates to a portable, low-cost colorimetric strip for rapid detection of heavy metals.
- Based on visible color change due to metal–ligand complex formation.
- Utilizes eco-friendly, non-toxic, and biodegradable materials.
- Designed for on-site and real-time monitoring.
- Detects metals such as Pb^{2+} , Hg^{2+} , Cd^{2+} , As^{3+} , etc.
- Simple dip-and-read mechanism; no sophisticated instruments required.
- Provides semi-quantitative or quantitative analysis via color comparison chart or smartphone.
- Includes a novel preparation/coating method for improved stability and sensitivity.
- Offers enhanced shelf-life and moisture resistance.
- Suitable for water, soil extract, food samples, and industrial effluents.
- Cost-effective alternative to conventional laboratory techniques (AAS, ICP-MS).
- Field-deployable for environmental monitoring and public health applications.



PATENT CERTIFICATE

(12) PATENT APPLICATION PUBLICATION

(19) INDIA

(22) Date of Filing of Application: 27/08/2025

(21) Application No.202511081166 A

(43) Publication Date : 19/09/2025

(54) Title of the Invention : PORTABLE AND ECO-FRIENDLY COLORIMETRIC STRIP FOR VISUAL DETECTION OF HEAVY METALS AND PREPARATION METHOD THEREOF

(51) International classification G01N31/22, G01N21/75, G01N21/77, G01N21/78

G01N31/04, G01N21/91, G01N33/20

(86) International Application No. NA

(87) International Publication No. NA

(61) Patent of Addition to Application Number NA

(62) Divisional to Application Number NA

Filing Date NA

(71) Name of Applicant :
1)Chaudhary Charan Singh University, Meerut
Address of Applicant : Meerut – 250004, Uttar Pradesh, India Meerut

Name of Applicant : NA
Address of Applicant : NA

(72) Name of Inventor :
1)Mukti Verma
Address of Applicant: Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut

2)Prerna
Address of Applicant: Department of Chemistry, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut

3)Ranu Agarwal
Address of Applicant: Department of Applied Science, SCRIET, Chaudhary Charan Singh University, Meerut (UP)-250004, India Meerut

(57) Abstract:

The present invention provides for a portable and eco-friendly colorimetric strip for detecting heavy metals and a method preparing the said colorimetric strip. The present invention further provides for a colorimetric strip capable of providing on-site detection of multiple heavy metals in minutes. Furthermore, the said colorimetric strip is stable and has long-shelf life and is accurate and efficient. Moreover, the present invention provides for a method of preparation of heavy metal detection colorimetric strip wherein the method is easy, simple, efficient and economical. Figure 1

No. of Pages : 23 No. of Claims : 9





NAAC A++

CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

Product Code: Novel System and Method for Algae Based Biofuel Generation

PATENT NO:

PATENT APPLICATION NO: 202611055815

PATENT PUBLISHED: 26.June,2026

PATENT GRANTED:

APPLICANT: C. C. S. University, Meerut

INVENTORS: Dr. Mukti Verma, Ayaan Ansari,
Mohd. Maaz, Vanshika Aulakh

TECHNICAL SPECIFICATION

Algal cultivation unit – grows high-lipid microalgae under controlled conditions.

CO₂ supply system – provides CO₂ to enhance algal biomass production.

Nutrient/wastewater unit – supplies nutrients using suitable treated wastewater.

Monitoring system – controls pH, temperature, light and biomass concentration.

Harvesting unit – separates algal biomass from culture medium.

Dewatering unit – concentrates harvested algal biomass.

Cell-disruption unit – breaks algal cells to release intracellular lipids.

Lipid extraction unit – extracts oil from algal biomass.

Transesterification reactor – converts algal oil into biodiesel.

Purification unit – separates and purifies the produced biofuel.

Recycling system – recycles water, solvent and nutrients wherever feasible.

By-product recovery – utilizes glycerol and residual biomass for value-added products.

Control unit – automatically regulates cultivation and biofuel-production parameters.

Final product – purified algae-based biodiesel/biofuel.

ABOUT THE PATENT

Field: Renewable energy and green technology.

Purpose: Production of biofuel from algal biomass.

Raw material: Lipid-rich microalgae.

Cultivation: Controlled algal growth using light, nutrients and CO₂.

Harvesting: Separation and concentration of algal biomass.

Lipid recovery: Extraction of oil from algal cells.

Conversion: Conversion of algal oil into biodiesel by transesterification.

Purification: Separation and purification of the produced biofuel.

Recycling: Reuse of water, nutrients and solvents.

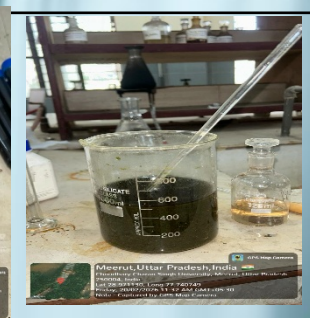
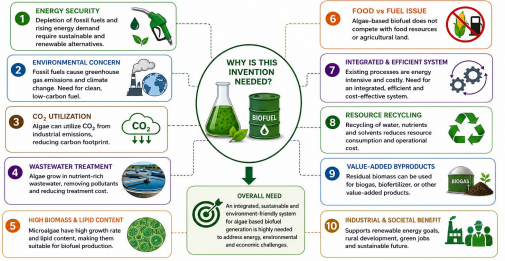
By-products: Recovery/utilization of glycerol and residual biomass.

Innovation: Integration of cultivation, harvesting, lipid extraction and biofuel generation in one system.

Benefit: Provides a sustainable, low-waste and potentially cost-effective biofuel production system.

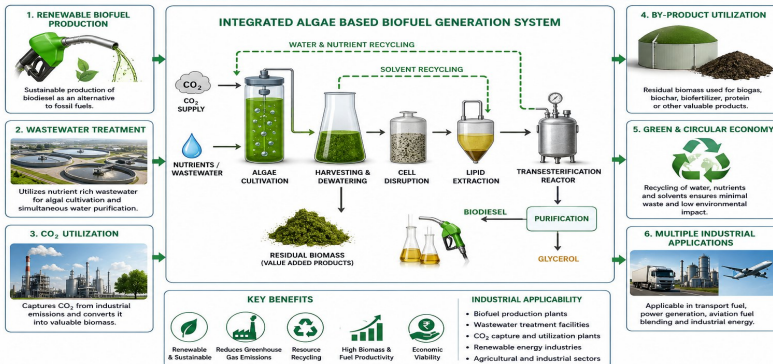
NEED FOR THE INVENTION OF THE PATENT

Novel System and Method for Algae Based Biofuel Generation



APPLICATIONS OF THE PATENT

NOVEL SYSTEM AND METHOD FOR ALGAE BASED BIOFUEL GENERATION



(12) PATENT APPLICATION PUBLICATION

(19) INDIA

(22) Date of Filing of Application: 01/05/2026

(21) Application No: 202611055815 A

(43) Publication Date: 26/06/2026

(54) Title of the invention: NOVEL SYSTEM AND METHOD FOR ALGAE BASED BIOFUEL GENERATION

(51) International classification

(31) Priority Document No

(32) Priority Date

(33) Name of priority country

(86) International Application No

Filing Date

(87) International Publication No

Filing Date

(61) Patent of Addition to Application Number

Filing Date

(62) Divisional to Application Number

Filing Date

(71) Name of Applicant:

1) Chaudhary Charan Singh University, Meerut

Address of Applicant: Meerut - 250004, Uttar Pradesh, India

Address of Inventor:

1) Dr. Mukti Verma

2) Ayaan

3) Muhammad Maaz

4) Vanshika Aulakh

(57) Abstract:

The present invention relates to an advanced and sustainable process for the production of biofuels utilizing algae as a renewable and environmentally friendly feedstock. More particularly, the invention discloses integrated methods and systems for the cultivation of microalgae and/or macroalgae in controlled environments, including photobioreactors and open pond systems, wherein key growth parameters such as light intensity, temperature, pH, nutrient concentration, and carbon dioxide supply are precisely regulated to enhance biomass productivity and lipid accumulation. The extracted algal lipids are subsequently converted into biofuels, particularly biodiesel, through optimized transesterification processes. Additionally, the residual biomass is utilized for the production of other biofuels such as biogas, bioethanol, and hydrogen, thereby ensuring maximum resource utilization.

No. of Pages: 15 No. of Claims: 9



CHAUDHARY CHARAN SINGH UNIVERSITY, MEERUT, UTTAR PRADESH, INDIA, 250004

Product Code: Process for Isolation of Anthocyanin from Butterfly Pea and Binding Interaction with Lead Metal

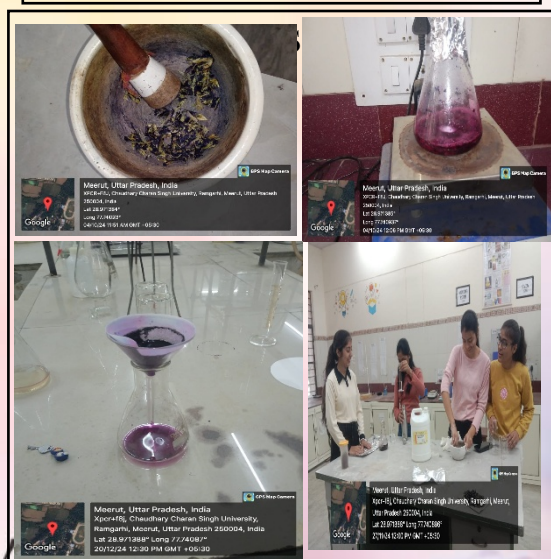
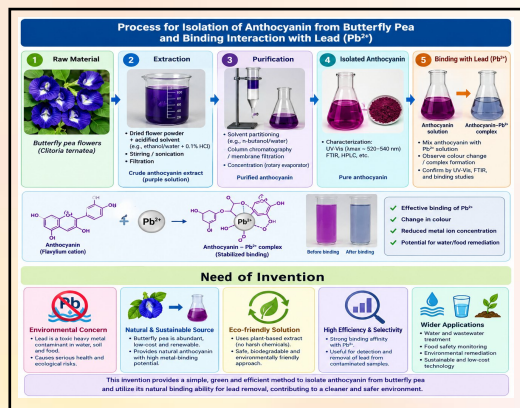
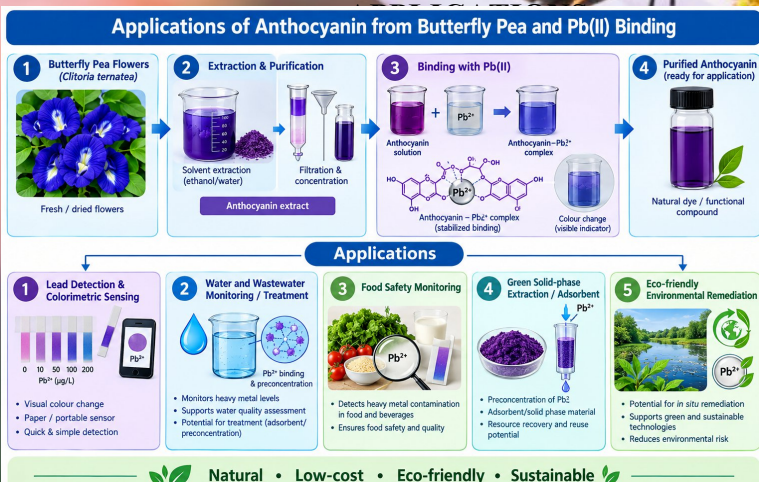
PATENT NO:
PATENT APPLICATION NO: 202611081441
PATENT PUBLISHED: 26. August, 2026
PATENT GRANTED:
APPLICANT: C. C. S. University, Meerut
INVENTORS: Dr. Mukti Verma, Payal Singh, Dr. Arpit Chhabra, Dr. Manav Bansal

TECHNICAL SPECIFICATION

Source material: Butterfly pea flowers (*Clitoria ternatea*).
Pre-treatment: Flowers are washed, shade-dried and powdered.
Extraction: Anthocyanins are extracted using a suitable aqueous/alcoholic solvent.
Filtration: Extract is filtered to remove solid residues.
Concentration: Filtrate is concentrated under controlled conditions.
Purification: Anthocyanin-rich fraction is separated and purified.
Characterization: Extract is analysed using UV-Vis, FTIR and/or HPLC.
Lead interaction: Purified anthocyanin is contacted with Pb^{2+} solution.
Binding: Functional groups of anthocyanin interact/coordinate with Pb^{2+} .
Detection: Pb^{2+} interaction produces a measurable colour/spectral change.
Application: Developed as an eco-friendly colorimetric lead sensor.
Key novelty: Natural anthocyanin extraction combined with Pb^{2+} binding and visual detection.
Advantage: Simple, low-cost, rapid and environmentally friendly approach

ABOUT THE PATENT

Title: Isolation of Anthocyanin from Butterfly Pea and Binding Interaction with Lead Metal.
Source: Butterfly pea (*Clitoria ternatea*) flowers.
Core invention: Extraction and purification of natural anthocyanin.
Key feature: Interaction of anthocyanin with Pb^{2+} ions.
Detection principle: Pb^{2+} binding causes a detectable colour/spectral change.
Purpose: Rapid and eco-friendly detection of lead contamination.
Application: Colorimetric sensor or anthocyanin-based detection strip.
Advantages: Natural, low-cost, simple and environmentally friendly.
Novelty: Combines plant-derived anthocyanin isolation + Pb^{2+} binding + visual detection.
Potential use: Monitoring lead in water and environmental samples



(2) PATENT APPLICATION PUBLICATION	(21) Application No. 202611081441 A
(8) INDIA	
(22) Date of Filing of Application: 01/07/2026	(43) Publication Date: 21/08/2026
(54) Title of the invention: PROCESS FOR ISOLATION OF ANTHOCYANIN FROM BUTTERFLY PEA AND BINDING INTERACTION WITH LEAD METAL ION	
(51) International classification	:C07B63/00, C08B61/00, C07B63/00, C08B61/00, C07B63/00, C08B61/00
(61) Priority Document No	:NA
(62) Priority Date	:NA
(63) Name of priority country	:NA
(66) International Application No	:
Filing Date	:01/01/1900
(67) International Publication No	:NA
(61) Patent of Addition to Application Number	:NA
Filing Date	:NA
(62) Divisional to Application Number	:NA
Filing Date	:NA
(57) Abstract:	(71) Name of Applicant: 1) Chaudhary Charan Singh University, Meerut Address of Applicant: Meerut-250004, Uttar Pradesh, India, Meerut Uttar Pradesh India (72) Name of Inventor: 1) Dr. Mukti Verma 2) Payal Singh 3) Dr. Arpit Chhabra 4) Dr. Manav Bansal
The present study used UV-vis spectroscopy to carefully extract and identify anthocyanin compounds from <i>Clitoria ternatea</i> , commonly known as butterfly pea flower, revealing delphinidin as the predominant anthocyanin. This discovery highlights butterfly pea flower as a remarkable natural source of bioactive pigments with significant scientific and industrial promise. Delphinidin demonstrated exceptional chelating ability toward lead ions, establishing itself as a powerful and eco-friendly solution for heavy metal remediation. The stable delphinidin-lead complex formed was clearly confirmed by a bathochromic shift observed in the UV-vis absorption spectra upon lead exposure.	
No. of Pages : 14 No. of Claims : 6	