Details on Information about latest innovations and technological developments from IIT Roorkee

Sl. No.	Title of Technology/Innovation	Brief Description about the technology/Innovation (including details about the innovator/developer)	If patented (Yes/No) with patent number	Technology Readiness Level (1-9)	Benefits	Potential Applications	Pictures/Videos, if any showcasing the Technology (Weblink)
1.	A DEVICE FOR ANALYTE DETECTION AND METHOD THEREFOR	The proposed technology introduces a portable, point-of-care potentiometric device capable of detecting various analytes for on-site analysis. The device utilises electrochemical principles, specifically Cyclic Voltammetry, to measure the potential difference between a working electrode and a reference electrode of a modified screen-printed electrode, allowing for the quantification of specific analytes based on pre-calibrated values. This Innovative project presents the development and comprehensive evaluation of a portable potentiometric device engineered using cyclic voltammetry (CV) for biosensing applications. The readable device, designed with off-the-shelf components, offers high performance, high resolution, and cost-effectiveness for three-electrode electrochemical biosensors. It	Yes Application no.: 202511047428	**4**	• Portability: Compact and lightweight design for easy transportation and use in various settings. • Speed: Rapid detection times, enabling timely decision-making. • User-friendliness: Intuitive interface and minimal training requirements. • Cost-effectiveness: Affordable so-	• Medical diagnostics: Disease screening, point-of-care testing, and patient monitoring. • Environmental monitoring: pollutant detection, and environmental impact studies. • Food safety: Detection of contaminants, allergens, and adulterants. • Industrial process control: Quality assurance, process optimization, and product testing.	https://drive.google.com/drive/folders/1Vxh5NLS78CUcLO2CQtBNHYFWULC_y7eB?usp=sharing

		connects to a PC via USB, allowing easy configuration of key electrochemical parameters through a user-friendly graphical user interface (GUI) created in Python. The GUI facilitates real-time data capture and storage, enhancing the usability of the device in various research settings. Electrochemical characterization was conducted using a range of modified electrodes, including those incorporating amine-functionalized graphene (AG). The results demonstrated the device's capability to effectively differentiate the electrochemical properties of various materials. This portable potentiometric device performance, combined with its ease of use and cost-effectiveness, underscores its potential as a valuable tool for field work and on-site analysis in resource-limited settings. This innovative device thus represents a significant advancement in electrochemical biosensing, with broad applications in clinical diagnostics and environmental monitoring.			lution compared to traditional laboratory methods.		

		Inventors: Gopinath Packirisamy, Deepanshu Sharma, Ayush Tiwari, Manoj Kumar Baghel, Ashish Kalkal and Rangadhar Pradhan					
2.	A METHOD FOR METAL FREE TRIFLUOROETHYLATION AND PERFLUOROALKYLATION OF AMINES AND APPLICATION THEREOF	This invention presents an efficient and scalable method for trifluoroethylation of amines using trifluoroacetic acid (TFA) and using borane as a reducing agent. It enables the functionalization of a wide range of amines, including aromatic, aliphatic amine, amino acids, dipeptides, and, in the case of perfluoro carboxylic acid under mild, energy-efficient conditions. The process offers high yields, selectivity, and minimal by-products, making it an environmentally friendly alternative to the traditional fluorination techniques that often require harsh reagents and conditions. . **Inventors:** Debasis Banerjee and Tarun	Yes Application no.: 202511049588	**4**	This invention benefits users by offering a cost-effective, efficient, and scalable method for trifluoroethylated/perfluorinated amines, including insightful compounds like aliphatic amines, amino acids, and dipeptides. Pharmaceutical companies can produce fluorinated drug candidates with higher yields and selectivity, while agrochemical firms gain an edge in developing fluorinated pesticides. Specialty chemical manufacturers can create fluorinated molecules more sustainably, and custom synthesis providers can offer	The invention would be valuable to academic researchers and postgraduate students in chemistry and biochemistry, particularly those studying fluorination techniques and bioactive molecule synthesis. Pharmaceutical companies developing fluorinated drug candidates and peptide therapeutics, agrochemical firms working on fluorinated pesticides, and specialty chemical manufacturers producing fluorinated intermediates would also benefit. Additionally, custom synthesis providers and businesses focused on green chemistry and sustainable manufacturing in the chemical industry would find the invention highly applicable.	**https://drive.google.com/file/d/1YJOcleecnWNb5Q-F9lNkZNBIf0Bk2GYK/view?usp=sharing**

					eco-friendly fluorination services.		
3.	A METHOD FOR N-METHYLATION OF AMINES USING A NI-BASED CATALYTIC SYSTEM	This invention presents a novel method for the N-methylation of amines using CO_2 as a sustainable C1 source and ammonia borane as a mild reducing agent, catalyzed by an earth-abundant Ni-based system. The process operates under mild, environmentally friendly conditions and is compatible with a wide range of primary and secondary amines, including N-heterocycles and complex, drug-like molecules. It offers a cost-effective, scalable, and green alternative to traditional methods that rely on toxic methylating agents and expensive noble metals, making it highly valuable for pharmaceutical, agrochemical, and fine chemical applications **Inventors:** Debasis Banerjee and Tarun	Yes Application no.: 202511049589	**4**	This invention offers users significant benefits, including a safer and more environmentally friendly alternative to traditional methylation methods, reduced production costs through the use of inexpensive catalysts, and broad applicability across diverse substrates. Its mild conditions and high selectivity make it ideal for modifying complex molecules and enhancing efficiency in pharmaceutical development, chemical manufacturing, and research applications.	This invention would be valuable to pharmaceutical and agrochemical companies, fine chemical manufacturers, and contract research organizations seeking greener and more cost-effective synthetic methods. It would also benefit academic researchers and industrial chemists focused on sustainable catalysis, CO_2,, utilization, and late-stage functionalization in drug development and materials science.	**https://drive.google.com/u/0/open?usp=forms_web&id=1GN88WmJCQzLh2ZyhdwPpJYxNERn6BfZy**
4.	A METHOD OF SYNTHESIS OF PARACETAMOL USING COBALT NANOCATALYST	The present process involves a simple, economical, and recyclable catalytic route for the synthesis of paracetamol using earth abundant heterogeneous cobalt nanocatalyst. The first step involves the reduction of p-nitro phenol to p-amino phenol	Yes Application no.: 202511049590	**4**	(1) Nitration of p-chloro benzene leads to mixture of product and its reduction using precious metal catalyst increases the	The present protocol has the capability to reduce the market price of paracetamol by 60%.	https://drive.google.com/file/d/1KhPEj4K8nEC65LRM6obzgHKm6I87SAnh/

		under neutral reaction condition where hydrogen gas is utilized for the clean reduction. In the second step, addition of acetic acid led to acetylation of p-amino phenol to give quantitative amount N-Acetyl-para-aminophenol (APAP), commonly known as Paracetamol. The solvent tetrahydrofuran and catalyst used can be recovered and reused for further reactions. The ICP-MS of the reaction aliquot of third time catalyst showed ppm level ingestion of cobalt into the reaction solution. **Inventors:** Debasis Banerjee and Shuvojit Haldar			expenses for the product development. Whereas our protocol uses non-precious metal catalyst for the reduction of p-nitro phenol to p-amino phenol. (2) The previous process for the paracetamol synthesis commonly uses acetic anhydride for acetylation of p-amino phenol where equal equivalent of acetate goes waste. But in our protocol, direct use of bio-mass derived acetic acid leads to product, N-Acetyl-para-aminophenol, paracetamol, generating only water as by-product.		view?usp=sharing
5.	A METHOD FOR SYNTHESIZING N-FORMYLATED AMINES USING CO_2 AS A GREEN FEEDSTOCK	This invention presents a novel, efficient method for the N-formylation of amines using carbon dioxide (CO_2) as a sustainable C1 source, catalyzed by a nickel-based system. The process offers an eco-friendly alternative to traditional methods that rely on toxic and expensive reagents such as formic	Yes Application no.: 202511049591	**4**	This process avoids using expensive and highly air-sensitive pincer catalysts, which require a multistep synthetic process. The protocol also helps users to use simple reaction setup	Cost-effective and environmentally friendly alternative to traditional methods for synthesizing APIs (Active Pharmaceutical Ingredients), intermediates, and fine chemicals involving formylated	**https://drive.google.com/file/d/1A5_veoIg55xZ6Xpq1LGNdZfVBln7wSeM/view?usp=sharing**

		acid or paraformaldehyde. Utilizing nickel, an earth-abundant and cost-effective transition metal, the catalytic system operates under mild reaction conditions with high selectivity and functional group tolerance. This method converts primary and secondary amines, nitrobenzenes, and amides into valuable formylated derivatives, which are essential for pharmaceuticals, agrochemicals, and specialty chemicals. Using this protocol, we successfully synthesized some special drug derivatives, including butamben, ciprofloxacin, lepidine derivatives, etc. **Inventors:** Debasis Banerjee and Tarun			to carry out the N-formylation process, without the need to use complex experimental setups to store hydrogen gas.	amines. This invention offers compliance-friendly, sustainable alternatives to outdated methods for industries which have been pressured by environmental regulations to adopt greener practices.	
6.	A METHOD OF SYNTHESIS OF BIS(PERFLUOROALKOXYIODO) BENZENE AND APPLICATION THEREOF	The present protocol demonstrated the first synthesis of bis(perfluoroalkoxyiodo)benzene derivatives using more sustainable and environmentally process using inexpensive and commercially available perfluoroalkylated acids. Further, more challenging late-stage functionalization of primary amides to perfluorinated amides were developed, which are quite expensive in nature. Therefore, this protocol will be highly useful for the	Yes Application no.: 202511050104	**4**	The inventions lead to the use of common reagents for alkylation of amide which reduces overall cost of the production for the agrochemical and pharmaceutical derivatives synthesis. This drives economic growth through the inventions in	The present protocol demonstrated the first synthesis of bis(perfluoroalkoxyiodo) benzene derivatives using more sustainable and environmentally process using inexpensive and commercially available perfluoroalkylated acids. Further, more challenging late-stage functionalization of primary amides to	https://drive.google.com/file/d/1VE9YyoDKR9OV7LlAIJQu3qsgIJGy0CR-/view?usp=sharing

		industries dealing with fluorinated amides. The present process involves a simple, economical, metal free route for the synthesis of Rf-embedded functionalized amides. The protocol is tolerant to a range of sensitive functional groups and perfluoro acids. **Inventors:** Debasis Banerjee and Shuvojit Haldar			medicine and public health	perfluorinated amides were developed, which are quite expensive in nature. Therefore, this protocol will be highly useful for the industries dealing with fluorinated amides.	
7.	SYSTEM AND METHOD FOR ENHANCING FAIRNESS IN IMAGING APPLICATIONS THROUGH MUTUAL CORRECTION AND GROUPWISE INTRA-CLASS SAMPLE INTERACTION	This innovation introduces a dual-branch deep learning architecture designed to ensure fairness in AI training without compromising performance or accuracy, especially across biased groups. The core technique involves intra-class image patch mixing, where patches from different samples of the same class are fused across branches to enhance diversity and reduce bias. Each branch specializes in learning from a different bias group, enabling mutual correction and fair knowledge transfer during training. The system has been validated across multiple data modalities and deep learning architectures, demonstrating both scalability and robust applicability in various AI tasks.	Yes Application no.: 202411037096	**3**	The proposed dual-branch deep learning architecture offers significant benefits in promoting fairness while maintaining or even enhancing model performance. By using intra-class image patch mixing and mutual correction between two bias-focused branches, the model learns more inclusive and representative features. This approach improves generalization, reduces bias-induced overfitting, and facilitates equitable knowledge transfer	This technology has wide-ranging applications across various sectors where fairness and performance are critical. In healthcare, it can ensure unbiased diagnostic predictions across different patient groups. In surveillance and security, it supports fair facial or behavioral recognition systems. Autonomous systems, such as drones and self-driving vehicles, can benefit from unbiased perception and decision-making. In finance, it enhances fairness in credit scoring and risk assessment models. The method is also well-suited for defense applications involving multi-sensor data	**https://drive.google.com/file/d/1tVi1pNgj9SMfeIw9Hi8e0MRTOgQxbgrG/view?usp=sharing**

		Inventors: Pravendra Singh, Anshul Pundhir and Balasubramanian Raman			across demographic or domain-specific groups. Additionally, the method is versatile and architecture-agnostic, meaning it can be easily integrated into existing AI models and scaled to larger datasets or tasks involving different data modalities such as images, text, or multimodal inputs.	classification, and in education technology, it can ensure fair evaluation in automated learning analytics and assessments.	
8.	Flexible infra-red metasurface absorber for large incident angles	The invention is related to optical absorbers where flexible and low-cost infrared (IR) metasurface absorbers were designed and fabricated experimentally verified for large incidence angles. The spectral region of absorbance can be tuned from near-infrared (NIR) to long wavelength infrared (LWIR) region by changing the dielectric material and modifying the number of layers in the structure. The invented IR absorbers can be shaped in terms of both wavelength and incidence angle. The one-dimensional (1D) metasurface structure enhances the absorbance value and the use of nano-imprinting lithography technique followed by simple physical evaporation deposition (PVD) method makes the	Yes Application no.: 202411038574	4	This invention introduces a flexible metasurface absorber capable of maintaining high infrared (IR) absorbance at large incident angles, including near-grazing incidence. The flexible and cost-effective metasurface absorbers (PA, BE, and MIM) are fabricated using nanoimprint lithography and demonstrate enhanced absorbance (up to 99%) at large incident angles (83o).	The high absorption at large incident angles and the flexibility of the structure makes them useful for real-world applications like infrared camouflage, smart windows, wearable health sensors, and passive radiative cooling.	**https://drive.google.com/drive/folders/1KdoGGjChQhM5x_3LVoUs1Y5OVu6LYYvs?usp=sharing** Patent Demonstration_A flexible metasurface structure for

		absorber simple and inexpensive. Three types of absorbers are proposed in this work: (i) Plasmonic absorber (PA): Thin film of any noble metal was deposited on 1D metasurface structure. An absorption peak in the near IR region was observed due to the surface plasmon resonance (SPR) at metal-air interface. (ii) Berreman (BE) mode metasurface absorber: Thin film of a polar dielectric material was deposited on 1D metasurface structure. An enhanced absorption peak in the LWIR region can be observed due to Berreman effect at the wavelength of longitudinal optic phonon mode for vanishing dielectric function (Re[εd] ≈ 0), when transverse magnetically (TM) polarized light is incident at non-zero angles. (iii) MIM absorber: metal-insulator-metal (MIM) layers were deposited on 1D metasurface structure. The thickness of middle I-layer plays an important role in MIM structure. For I ≤ 50 nm, an absorption peak in the NIR region was observed due to the excitation of surface plasmons at metal-air interface al large incidence angle (83o). For I ≥ 500 nm, trapping of incident light in the middle dielectric layer occurs at relatively smaller incidence angle (30o). This leads to an absorption peak in the mid-IR (MIR) region results due to the coupling of surface plasmons,			The application of these developed absorbers around a detector can improve the signal to noise ratio by absorbing the unwanted signal incident at oblique angles. The developed flexible IR absorbers are low-cost and easy to make using nanoimprint lithography, which is suitable for large-scale production.		large incident angles.mp4 **Video included**

		surface phonons and FP-like modes. Also, the use of polydimethylsiloxane (PDMS) substrate for all the above mentioned absorber originates the flexibility of the absorber. The experimental results were further validated theoretically using finite element method (FEM) method on COMSOL Multiphysics software. The high absorbance, lost cost fabrication with large-scale nanostructure and high throughput of the metasurface structure make the absorber a robust candidate for applications in photodetectors, thermal emitters and thermal imaging applications. **Inventors:** Sachin Kumar Srivastava and Jhuma Pan					
9.	A SUSTAINABLE ROOF-TOP HARVESTED RAINWATER FILTRATION SYSTEM BASED ON LOW-COST SINGLE STAGE VERTICAL FILTER	The present disclosure relates to filtration of roof-top harvested rainwater and, more particularly to a sustainable roof-top harvested rainwater filtration system based on low-cost single stage vertical filter. The present disclosure specifically focuses on fabricating a filter design for rainwater filtration that can provide safe potable water for mass consumption. The present disclosure also relates to various materials for storage and different storage technicalities after filtration	Yes Application no.: 202411044016	**9**	The present subject matter relates to a sustainable roof-top harvested rainwater filtration system based on low-cost single stage vertical filter for providing potable water for collective use. The single stage rapid sand filtration system is provided for improving the quality of the harvested rainwater through	1. A sustainable, low-cost, single-stage vertical filter with easily accessible material 2. A filter that provides a high filtration rate, resulting in filtered water suitable for potable mass domestic consumption 3. A filter with more than 99% efficiency in the removal of turbidity 4. An appreciable overall quality of the water in terms of its physio-chemical and microbiological characteristics.	**https://docs.google.com/document/d/1zDfpRlbly7HnnbsYURk3CzXNSwvbBNQt/edit?usp=sharing&ouid=117531627492426334516&rtpof=true&sd=true**

		to check the sustainability with time. **Inventors:** Deepak Khare and Sakshi Gupta			rooftops by targeting physiochemical and microbiological properties.		
10.	ACCIDENTAL QUASI-BOUND STATES IN THE CONTINUUM WITH EXTREMELY HIGH QUALITY FACTORS IN VISIBLE RANGE: SENSING AND SWITCHING APPLICATIONS	The invention describes a method to engineer A-QBICs with extremely high quality-factors (Q-factors) in the visible spectrum using simple-to-fabricate, symmetric, and periodic all-dielectric nanostructures (1-D or 2-D). A-QBICs can be realized on both stiff and flexible substrates that are transparent to visible light. The resulting sharp A-QBICs enables ultra-high figure of merit (FoM) optical sensing and efficient optical switching. The simplicity of the design and potential fabrication, along with its tunability and compatibility with various all-dielectric materials and substrates, make it ideal for scalable integration in photonic devices for health and environmental sensing applications. The inventors are Prof. Sachin Kumar Srivastava (Associate Professor, Dept. of Physics, IIT Roorkee) and Swapnil Khurana (PhD Student, Dept. of Physics, IIT Roorkee).	Yes Application no.: 202411046138	**3**	It enables ultra-high FoM sensing and efficient optical switching using simple-to-fabricate, symmetric and periodic all-dielectric nanostructures that too in visible range, along with tunability and compatibility with diverse all-dielectric materials and substrates (both stiff and flexible), thereby allowing its cost-effective mass production. It also allows easy integration into existing sensing platforms at both normal and oblique incidences.	This method can be used for various photonic applications like optical sensing and switching with ultra-high Q and FoM in various segments including healthcare, environmental monitoring, wearable sensors, etc.	https://iitraci n-my.sharepoin t.com/:v:/g/p ersonal/sachi n_srivastava_ ph_iitr_ac_in /ES6DTP7nr xlNvnGFcDs oH3UBFt3C _iRJ6Jnc1Ld VGfUX2A?e =wziHMp **Video included**

		Inventors: Sachin Kumar Srivastava and Swapnil Khurana					
11.	MICROWAVE ASSISTED SYNTHESIS OF MANGANESE-MOLYBDENUM BASED NANOFERTILIZER IN AQUEOUS MEDIUM	A method to synthesize manganese and molybdenum based nanofertilizer. Their invention discloses a method for preparation of nanofertilizer formulation that relates to a microwave assisted aqueous based manganese molybdate nanofertilizer in aqueous medium to enhance crop yield. Aqueous medium reduces the toxicity and the application of urea provides alkaline environment to the solution throughout microwave process which is essential to form nanoparticles of Mn-Mo otherwise it will lead to the formation of Manganese-oxy-hydroxides. Low solubility was enhanced by calcinating the synthesized particles. This invention also provides a method to enhance the particle yield. **Inventors:** Nitin Khandelwal and Prayas Prasad	Yes Application no.: 202511053783	**3**	It can replace two salts based fertilizers to provide manganese and molybdenum in the fields. The formulation provides manganese and molybdenum simultaneously in the medium. Also it can tackle the problems associated with salt based fertilizers like rapid dissolution, leaching to the groundwater etc.	As the release kinetics done in different soil and irrigation waters, which ensures the slow and consistent release of the nutrients, make it a potential application as a nanofertilizer in the field.	**https://drive.google.com/file/d/1hxht8tG4CCKN7N7lNKCPJ8ez1KSvJvnE/view?usp=sharing** **Video included**
12.	Aerosol foam assisted nanostructured lipid carriers for the treatment of psoriasis	The invention pertains to pharmaceutical compositions for topical drug delivery and methods for their manufacture and usage. Specifically, composition relates to nanostructured lipid carriers with at least one pharmaceutically active	Yes Application no.: 202411038524	**3**	The present invention provides an aerosol foam-assisted NLC composition for the treatment of psoriasis having the following advantages:	The invention pertains to pharmaceutical compositions for topical drug delivery and methods for their manufacture and usage.	**https://drive.google.com/drive/folders/133y--Y0JEAytsczNXtor9pkW**

		compound, preferably leukotriene receptor antagonists, flavonoids, or combinations thereof, integrated into pressurized containers with foaming agents, allowing foam formation upon release. **Inventors:** Ramasare Prasad and Amit Kumar Srivastava			• maintains the smoothening and soothing effect on the skin. • biodegrada-ble and envi-ronment friendly. • It is Non-irri-tant /Derma-tologically safe for hu-man skin for long-term use.		**s_E2fPSQ?usp=sharing**
13.	A printed patterns of thin film heaters on a quartz substrate using silver nanoparticle ink and its method of printing	The present invention relates to the thin film heaters fabricated by direct ink writing method using silver nanoparticle ink on quartz substrate. Three different structures of thin film heaters are being fabricated, namely, serpentine, spiral, and combination of both spiral and serpentine. These structures help provide varied temperature distribution over the heater surface, while conserving costly ink material. Temperature distributions can be readily controlled by varying the patterns and the applied voltages. The printed thin film heater is a good	Yes Application no.: 202411065129	**8**	Light weight, Efficient and uniform heating, precise temperature control, rapid response, repeatable performance under cyclic heating and cooling cycle, good electrical conductivity, low processing temperature and compatibility with various substrates.	Flexible and Wearable Electronics, Gas Sensors (e.g., metal oxide gas sensors), Defogging Systems on automotive windshields, Low-Power Space Heating and biomedical devices.	https://drive.google.com/file/d/16YseRj4vIPYInO1ucRUoWA92MiX0ulrA/view?usp=sharing **https://drive.google.com/file/d/1Zvc4UB61LgySf8Z**

		replacement for the conventional thin film heater fabricated by physical vapour deposition. Printing helps in conserving costly precursor material, is less expensive, takes less time for fabrication and is versatile in producing different designs without the need for expensive masks. These printed thin films can be calibrated and used as heaters for gas sensing. **Inventors:** Nikhila Patil, Sowmmya Venkatesh, Parasuraman Swaminathan and Sumathi Parasuraman					**CIWSwopI9z-FbMhNV/view?usp=sharing** **Video included**
14.	Coated zinc anode for zinc batteries and process for preparation thereof	This innovation pertaining to aqueous zinc batteries aims to enhance the performance of the zinc anode by applying a protective layer. A novel formulation comprising a porous carbon derived from waste biomass and non-toxic sulfur was developed to serve as the protective layer. After initial cycling, this protective layer is converted into a robust and conductive interface of carbon/ZnS that enhances zinc ion transport kinetics and effectively reduces the hydrogen evolution reaction and other water-based side reaction occurring at the zinc anode. In this way, this comprehensive solution addresses the key challenges associated with bare zinc anodes in aqueous zinc batteries. Aligning with	Yes Application no.: 202511030128	4	Eco-friendly materials, Low-cost, Easy fabrication, Scaleup capability, Enhanced anode life	Aqueous Zinc battery, Solar energy storage, Grid storage, Data power backup	**https://drive.google.com/file/d/1WpqxWuZMAYUD38j9uSKFJ6aTwU4l444/view?usp=sharing**

		the increasing demand for clean and green technologies, this innovation aims to improve the performance of aqueous zinc battery system that uses earth-abundant and non-toxic raw materials for both the anode and cathode. This technology is developed by Dinesh Patel, PhD student from Chemical Engineering Department and Dr. Ashwini Kumar Sharma, Associate Professor from Chemical Engineering Department. **Inventors:** Dinesh Patel and Ashwini Kumar Sharma					
15.	Biodegradable biopesticide formulation and preparation thereof	The present invention relates to a biopesticide formulation that reduces the risk of pest resistance, offering a more effective and sustainable alternative to conventional pesticides. The present invention ensures healthier crops, increased yields, and a more resilient agricultural system, benefiting both farmers and the environment for years to come. The present invention discloses a biopesticide formulation, wherein said formulation comprises a plant oil, a biosurfactant, and a biosolvent. The proposed biopesticide was formulated using isothermal dilution method. **Inventors:** Diksha Vats, Rittika Ray, Debabrata Sircar and Vimal Kumar	Yes Application no.: 202511039181	**3**	A biodegradable formulation, which combines plant oil, biosurfactants, and biodegradable bio-solvents. This unique blend effectively targets harmful pests, fungi, and bacteria while being safe for crops and the environment. Unlike chemical pesticides, this biopesticide significantly reduces environmental pollution and supports sustainable farming practices. It enhances soil health and promotes healthier food	Agriculture	**https://drive.google.com/file/d/1L1kWXslawoPIbu77tKnEtwUQHRzZnAuB/view?usp=sharing**

					production, offering a safer alternative to traditional pesticides. The invention provides an eco-friendlier solution for pest management, benefiting both the environment and agricultural productivity, while ensuring long-term sustainability in farming practices.		
16.	A barnyard millet based edible straws and its method of preparation	The present invention relates to a barnyard millets based edible straws and its method of preparation. The edible straws have excellent mechanical, thermal, and water resistance through citric acid cross-linking. The process involves mixing barnyard millet flour, locust bean gum, and citric acid (CA) as a green cross-linker with water, followed by homogenization and cooking. The formed sheet was then rolled into straws and dried at room temperature for 10 to 12 hours. **Inventors:** Kirtiraj K. Gaikwad and Tejaswini Dhanaji Patil	Yes Application no.: 202511046631	**3**	The present invention provides healthy and sustainable alternatives to petroleum-based plastics and paper straws. It also provides edible straws having excellent mechanical, thermal, and water resistance through citric acid crosslinking.	The present invention relates to the barnyard millets-based edible straws and their method of preparation	**https://drive.google.com/drive/folders/1qbWDGQqeJje27myMxoT0T_a4aR3Rbc-T?usp=sharing**

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