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From the Editor's

Dear Readers,

In the September issue of our Newsletter, we received several popular articles from diverse fields. All the authors deserve great appreciation for sharing articles in huge numbers. Please continue sending articles to our Publication team and share published newsletter with your friends also.

I would like to thank the Editorial team including Print, Designer and Publication committee for their efforts throughout the edition.

Your suggestions are always welcomed for improvement.

Dr. R. S. Tomar
Editor-in-Chief
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THE CULTURAL SIGNIFICANCE AND ECONOMIC CONTRIBUTION OF EARTHEN LAMPS IN DIWALI

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In India, Diwali is the festival of lights, symbolizing the triumph of light over darkness and good over evil. Earthen lamps hold special significance during this festival. Traditionally, homes, temples, and streets are decorated with these lamps. They are not only a means of decoration, but also a symbol of Indian culture, environmental balance, and folk art.

The potter community has been engaged in the making of earthen lamps since ancient times. The demand for lamps



increases significantly during Diwali, providing potters with an opportunity for additional income. This is an important economic resource for them. This tradition continues to be the basis of livelihood for many families in the rural economy.

Current Situation

In today's times, the demand for traditional earthen lamps has declined somewhat due to cheap electric lights and decorative lamps. As a result, the potter community has been economically affected. Nevertheless, growing environmental awareness and initiatives like "Make Local" are slowly reviving the popularity of clay lamps. Government and societal efforts are needed to encourage these artisans to preserve this traditional art and livelihood.

A WONDER HERB FROM BASTAR: *URGINEA INDICA*

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Introduction: *Urginea indica* is a Indian medicinal plant belonging to family Liliaceae, commonly called as sea onion. It is a glabrous herb commonly known as “Indian squill” and locally as “Jungli piyaz”. Although, all parts of this plant are reported to have therapeutic potentiality but recently the bioactive compounds of bulbs have received much attention due to its anti-cancer properties. Wild onions have a very sharp flavour and strong odour with broad spectrum of therapeutic benefits.

Description: *Urginea indica* is a perennial geophyte and the flowers bloom in April and May after first shower. The round conical, pear-shaped bulbs with transparent white outer scales consisting of fleshy coats are thin and papery orange brown or red in colour. It has fibrous roots of about 6-10 inches in length, starting from the base of the bulb. It exhibits phyllotaxy which is whorled hysteranthus or synanthus. Generally, the bulb is three fourth immersed in the sand and sends several long linear lanceolate, cauline, lorate, sessile, radical, pointed and undulated shining, dark green leaves with a base sheathing, becomes two feet when completely grown.

Distribution: *Urginea indica* is polytypic genus and endemic to India, Africa and Mediterranean regions. In Indian scenario nine species were reported to be most common under the genus *Urginea*. Deb and Dasgupta in a taxonomic revision recognized five species of this genus pertaining to India. It is found in a wide range of habitats ranging from forests, grassland, shrub, and desert to sand dunes.

Therapeutic Potential: Wild onion is reported to have diverse medicinal value. It enhances immune activity. Its bulb is used as anthelmintic, digestive, expectorant, stomachic, diuretic, emmenagogue, purgative, and cures paralysis, rheumatism, leprosy, skin diseases and infectious wound, antimicrobial, antioxidant, antiangiogenic and pro-apoptotic, laxative and spasmodic, hypoglycaemic and anticancer. The bulbs are used in whooping cough, arthritis, tumors, edema, male sterility, gout, chronic cough, psoriasis, swellings, pulmonary troubles, expectorant, diuretic properties, cardiac tonic.

Site of Study: Bastar district (19.1071°N, 81.9535°E) is located in southern part of Chhattisgarh and has an area of 4029.98 km^2. The population of the district is 1,411,644 according to the 2011 census. It is surrounded by Bijapur, Dantewada, Kondagaon, Narayanpur and Sukma districts of the state. The Koraput district of Odisha also adjoins the Bastar on its east. Bastar district is divided into seven Tehsils *viz*., Jagdalpur, Bastar, Bakawand, Bastanar, Darbha, Lohandiguda and Tokapal. Bastar, the land of tribals and natural resources, is also surrounded with

dense forests, hilly mountains, natural caves, waterfalls and streams. Jagdalpur is both district and divisional headquarter of Bastar district (Figure 1). The city lies on the southern bank of river Indravati with an average elevation of 562 meters. It has a total forest area of 292130 ha which is more than 19 % of the total land area of the district.

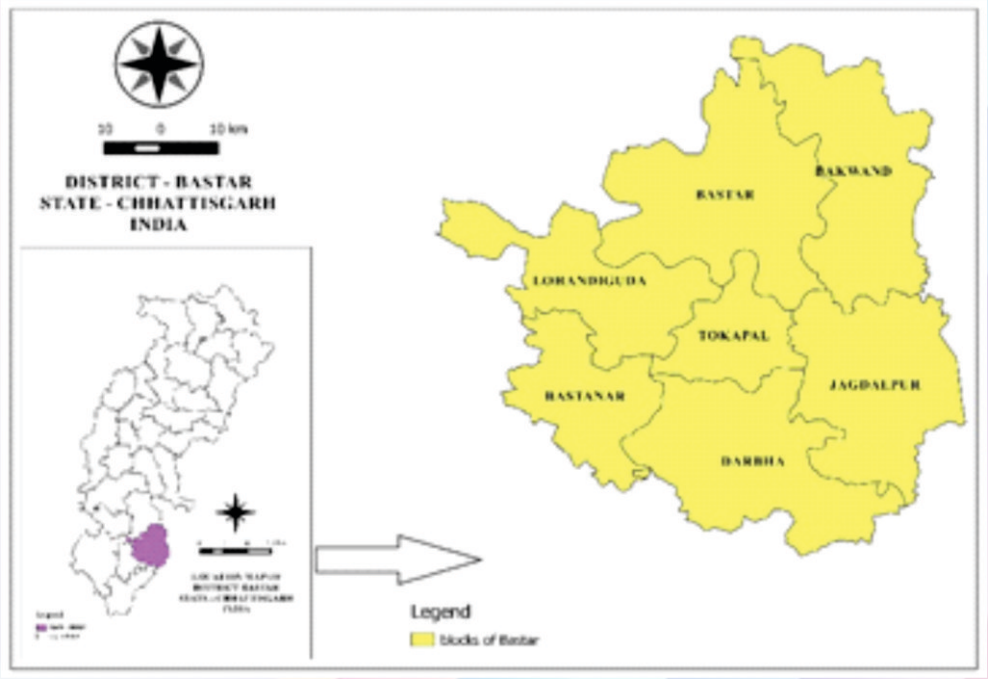

Fig. 1: Map of Bastar district showing sample collection area.

Sample Collection and Identification: *Urginea indica* (Family: Liliaceae) was collected from Bastar region based on its traditional usage by the tribal community of Bastar district in curing several ailments and its ethno-medicinal importance as herbal drug. The bulb, stem and leaves of fresh and apparently healthy plant of *Urginea indica* (Figure 2) were collected from the nursery and field area within the campus of Shaheed Gundadhur College of Agriculture and Research Station, Kumhrawand, Jagdalpur, Chhattisgarh, India after its authentication and identification at department of Agronomy and Horticulture, SGCARS, Jagdalpur, Chhattisgarh, India.

Kingdom	Plantae
Division	Magnoliophyta
Class	Liliopsida
Order	Liliales
Family	Liliaceae
Genus	*Urginea*
Species	*indica*

Fig. 2: Sample collection from Bastar region of Chhattisgarh.

Drying and Grinding of the Sample:
The collected plant samples were washed thoroughly under running tap water to remove debris and were separated into bulb, stem and leaf and shade dried at room temperature for about three weeks to attain a constant weight. Exposure to direct sunlight was avoided to prevent the loss of active compounds from the sample. The dried samples were mechanically grinded by pestle & mortar and finally powdered by grinding machine (Remi), packed in plastic bags and stored in airtight bottles at 4°C for further use (Figure 3).

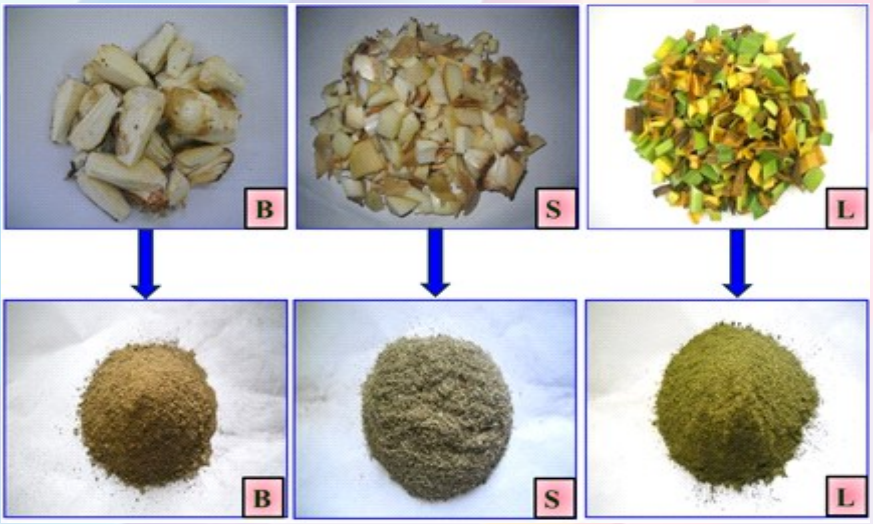

Fig. 3: Dried and Powdered Sample of *Urginea indica* (B-Bulb, S-Stem, L-Leaf).

Extraction Method:
The extraction was done through hot extraction. In soxhlet apparatus powdered material was placed in a thimble of filter paper, which was loaded into the extracting unit of the apparatus. The extracting unit was placed onto round bottom flask containing the solvent and the top was equipped with a condenser. The entire assembly was set on a heating mantle with temperature regulator. The solvent in the flask was heated and its vapour traveled up to the distillation arm and after condensation flew into the extracting unit housing the thimble (Figure 4). The powdered material was extracted sequentially in four different solvents *viz*., chloroform, acetone, methanol and aqueous. 15g powdered material was extracted in 150 ml of chloroform, acetone, methanol and in aqueous according to their increasing polarity index in the soxhlet apparatus (Tempo) for 8-10 hours at a temperature not exceeding the boiling point of the respective solvents. The extracted material was dried to residue.

Figure 4: Soxhlet Apparatus for Extraction.

High Performance Liquid Chromatography: The sample after extraction and column chromatography was further analyzed for their purity by HPLC. In case of purified fraction of *Urginea indica* acetonitrile: ethanol (85:15) was taken as the mobile phase with a flow rate 1ml/ min at 209 nm and the percentage of purity of the compounds were detected with a HPLC of Schimadzu, Column-C_{18}-(250 x 4.6 and 5μ pore size) LC-20AT (Pump), SPD-20A (UV Detector) with a flow rate of 1ml/ min. Four major peaks were recorded with the retention time 3.750 min, 5.633 min, 7.407 min and 16.877 respectively (Figure 5). The HPLC of acetone bulb extract of *Urginea indica* purified fraction (96.61%) showed the saturation peak at the retention time 3.750 min, the characteristics peak showed similarity with that of -sitosterol whereas; impurities showed three peaks with retention time of 5.633, 7.407 and 16.877.

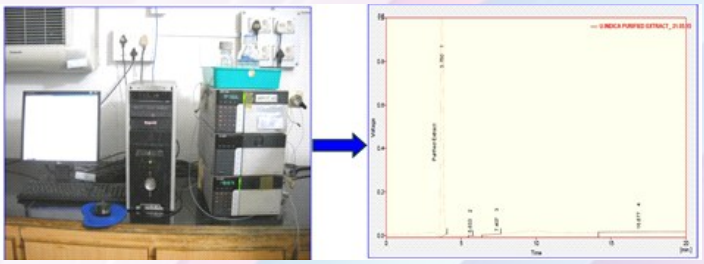

Figure 5: HPLC Chromatogram of *Urginea indica*.

Conclusion: The present investigation is an attempt to study the ethno-medicinal importance and to extract the bioactive compound present in *Urginea indica* conferring immense therapeutic potentiality. The fresh bulb, stem and leaf samples were collected from the sample collection site of SGCARS, Bastar, Jagdalpur, Chhattisgarh, India. The samples were washed, dried and grinded in the research laboratory and subsequently extracted using four different solvents *viz*., chloroform, acetone, methanol and aqueous by the Soxhlet apparatus and the extracts so obtained were subjected to column chromatography followed by HPLC. The HPLC of acetone bulb extract of *Urginea indica* purified fraction (96.61%) showed the saturation peak at the retention time 3.750 min, the characteristics peak showed similarity with that of -sitosterol. Further, investigation of the bulb extract with sophisticated analytical instruments such as UV-Visible spectroscopy, FTIR, NMR (^{1}H & ^{13}C) and ESI-MS data revealed that the dipolar bioactive compound predominated in the acetone bulb extract of *Urginea indica* was elucidated to be structurally similar to *-sitosterol* which is the lead bioactive compound in the bulb of *Urginea indica* conferring tremendous therapeutic bio-efficacy. Thus, the above study clearly illustrates the wide clinical applications and significance of the bulb of *Urginea indica* to be regarded as a wonder herb for the discovery of vital bioactive compound for better human health in years ahead.

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Chief Editor

HOW A BIRD IS BEING MADE ENDANGERED THROUGH OUR SOCIO- RELIGIOUS PRACTICES

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Introduction

The Indian roller (*Coracias benghalensis*), widely known in India as neelkanth or palapitta, is a brightly coloured, widely distributed bird that plays an important ecological role (insect control) and holds deep cultural and religious significance across many Indian states. Although globally listed as Least Concern, local populations are showing worrying declines where cultural practices and festival-related trapping occur. Evidence from recent reports shows deliberate capture and mistreatment during festivals (especially Dussehra/Dussera), which—together with habitat loss and other threats—puts local populations at risk.

The Indian roller is medium-sized, vivid turquoise/blue on wings and belly with a cinnamon/buff body. It is commonly found perched conspicuously on wires, roadside trees and in open scrub, feeding on large insects, small reptiles and other pest species—thereby benefiting agriculture. It nests in cavities and human structures and often occupies human-modified landscapes.

Cultural and socio-religious significance

Across India the bird features strongly in folklore and religion. It is called neelkanth (blue-throated) and associated with deities such as Shiva and Vishnu; spotting the bird during auspicious days like Dussehra is widely considered a good omen. In several regions traditional beliefs attribute benefits to the bird or its feathers—examples include using feathers in rituals or folk remedies. The species is also a state bird in some states (e.g., Telangana/Odisha/Karnataka), which highlights its cultural prominence.

Harmful religious/festival practices and their impacts

Several culturally rooted practices around festivals and superstitions are actively harming individual birds and, cumulatively, local populations. During Dussehra/Dussera and related observances, people sometimes attempt to catch Indian rollers because seeing one is considered very lucky. Reports document birds being captured, having wings glued or bound, or feet tied, often causing injury, inability to forage or fly, and death. These captures are sometimes public and repeated each year Use of feathers or body parts in folk remedies such as adding feather fragments to cattle fodder due to beliefs about increasing milk—have historically encouraged handling or killing of birds for body parts.

Even when not widespread, such practices create markets and incentives for capture. Even when birds are released, the stress and injury from handling reduce survival and breeding success; taken together at scale, repeated festival captures can reduce local numbers over seasons. News sources documenting multiple captures in urban areas (for example Hyderabad) indicate an ongoing, repeat pressure. Recent local reports cited declines in sightings in some cities and suggested population drops in particular urban areas—evidence that these practices are not harmless folklore but have measurable conservation consequences locally.

Legal status and conservation context

The Indian roller is currently listed as Least Concern on the IUCN Red List, and its overall range remains large; BirdLife notes populations are stable or even expanding in some altered landscapes. However, the species is protected by Indian law (it is listed under schedules of the Wildlife

(Protection) Act), meaning capture and trade are illegal without permission. Local, repeated illegal capture and killing during festivals therefore represent both a conservation threat and a legal violation.

Recommendations
Awareness campaigns around festivals could unclude targeted messaging before Dussehra/Dussera—using temples, local leaders, schools and social media—explaining that capturing or harming palapitta is illegal, cruel and ecologically harmful. Use the emotional resonance of the bird (its cultural value) to encourage protection rather than capture.

Encouraging priests and community elders to discourage capture rituals and to instead promote protected, symbolic ways to honour the bird (e.g., community birdwatching events on Dussehra). Strengthen local wildlife law enforcement during festival periods and publicise hotlines for reporting injured or captured birds; some city authorities and NGOs already do this—scaling that up will deter illegal catching.

Training and equipping local animal rescue groups to treat and rehabilitate captured or injured rollers and educate the public through visible success stories. Supporting urban and rural monitoring to quantify local population trends and festival-related mortality so interventions can be evaluated and adapted.

Conclusion
The Indian roller remains a widespread and ecologically valuable bird, and its deep cultural significance gives a strong platform for conservation. Unfortunately, some long-standing religious and superstitious practices—especially festival-time capture and misuse—are directly harming birds and causing local declines. Combining respectful community engagement, clearer legal enforcement during vulnerable periods, and public education can transform cultural reverence into active protection rather than unintended persecution.

CANADA'S FRESHWATER ECOSYSTEMS: NEW THREATS & CHALLENGES

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"To conserve, protect and restore Canada's freshwater ecosystems and their water resources for present and future generations" – that's been Canada's mission statement since 1970. But what does that really mean and why is it important?

Many Canadians have heard that Canada is home to 20% of the world's freshwater, which makes ordinary Canadians overconfident about their water resources. But the true reality is that most of that water is considered non-renewable, meaning it's not part of the global water cycle because it's locked up in reservoirs and glaciers, for example. In addition, more than half of Canada's renewable freshwater flows northward into the Arctic Ocean and Hudson Bay | making it unavailable to most of Canada's population living within a few hundred kilometres of Canada's southern border. This leaves much of the remaining water supply – under intense demand and stress!

But it's not just about water. Freshwater ecosystems include rivers, streams, wetlands, and lakes where freshwater is found. An ecosystem is a complete community of living things that interact with each other and with their physical environment, including water, soil, rocks, air, and other habitat components. Freshwater ecosystems are often hotspots of biodiversity, supporting not only aquatic species (such as fish and shellfish) but also birds, mammals, amphibians, insects, fungi, and a wide variety of plants. But freshwater ecosystems are also among the most threatened environments due to a variety of human activities, including dams, diversions, floodplain development, overexploitation, habitat destruction and deforestation, excessive and unnecessary water use, and water pollution, and the introduction of invasive alien species.

These worrying factors, along with the effects of climate change, have led to a freshwater biodiversity crisis. And despite our water resources, Canada is not immune to these threats. In fact, Canada's false sense of abundance can contribute to the deterioration of water quality, availability, and habitat health. A 2022 study, which reviewed the conservation status of more than 3,000 freshwater species in Canada, found that about 12% of these species were considered "at risk" and another 18% were considered "of special concern" (at risk of becoming endangered or threatened).

Declining Canadian freshwater biodiversity - an early

warning signal about the state of Canada's freshwater ecosystems and resources should exist In addition to the dangers to Canada's biodiversity, communities across Canada are increasingly facing challenges related to freshwater: from blue-green algae to various aquatic weeds that make the water unsafe for swimming, to water pollution and fish consumption. From floods that threaten lives and infrastructure to droughts that threaten food production, stress municipal drinking water supplies, and create challenges in wastewater treatment, freshwater issues are affecting communities across Canada, and everyone is paying the price.

These are the reasons why there is an urgent need to conserve, protect, and restore these ecosystems, and Canada is taking important steps to effectively conserve freshwater. They are monitoring water quality and quantity, as well as aquatic communities and their habitats. This includes protecting and restoring native aquatic species, assessing them, and collecting and monitoring data on their life cycles.

Our work on Canada's rivers and riparian corridors is to build resilience to climate change by planting trees and using low-tech process-based restoration to kick-start the natural recovery of rivers impacted by human activities. The results: improved water quality and water security, increased resilience, increased local biodiversity, reduced impacts of floods and droughts, shelter from increased air and water temperatures, improved connections and understanding of our Canadian natural places and heritage, and much more.

Healthy and functioning freshwater ecosystems are essential not only for fish. These systems provide drinking water, water for industry and agriculture, wastewater treatment, recreational opportunities, food and medicine, and habitat for countless species. They also buffer the effects of extreme weather events such as floods, droughts, and fires, and play a vital role in nutrient cycling and carbon storage. Canada's freshwater ecosystems, including the spaces they occupy and the species they support, are part of our Canadian heritage and identity and have spiritual and cultural value that is impossible to put a price on. While governments play a critical role in protecting them, we cannot rely solely on the Government of Canada to protect what is important to Canadians. Ordinary Canadians must also step up and cooperate.

Photo Credit: ***Saikat Kumar Basu***

Plant Tree **Save Environment**

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- Editor-in-Chief

REPORT ON THE HENNA PLANT AND ITS IMPORTANCE IN TRADITIONAL ORNAMENTATION

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The henna plant (*Lawsonia inermis*), also known as mehendi, holds immense cultural, social, and traditional significance across many regions of Asia, the Middle East, and North Africa. This small shrub, native to tropical and subtropical areas, is cultivated primarily for its leaves, which contain a natural dye used for centuries in body art, ornamentation, and rituals.

When the leaves of henna are dried, ground into powder, and made into a paste, they release a reddish-brown pigment called lawsone. This dye binds strongly to skin,

hair, and fabrics, creating intricate designs and patterns that last for days or weeks.

In traditional ornamentation, henna has been an indispensable element, especially in weddings, festivals, and sacred ceremonies. In Indian, Middle Eastern, and North African cultures, brides adorn their hands and feet with elaborate henna patterns, symbolizing joy, prosperity, and marital bliss. The application is not just aesthetic but also carries ritualistic meaning, believed to ward off evil and bring good fortune. Henna also plays a role in various religious observances, where it is applied during celebrations such as Eid, Diwali, and other community gatherings. Its cooling properties further connect it with well-being and comfort in hot climates. Beyond body art, henna has been historically used to dye textiles, hair, and leather, showing its versatile ornamental and practical value.

In conclusion, the henna plant is far more than a source of natural dye—it is a cultural symbol deeply embedded in tradition and identity. Its use in ornamentation reflects an age-old practice that combines beauty, ritual, and heritage, continuing to enrich social and ceremonial life across diverse cultures.

Photo credit: **Laki Banik**

FOREST FRAGMENTATION IN LALITPUR: A THREE-DECADE TRANSFORMATION

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Forest fragmentation has emerged as one of the most critical dimensions of landscape change influencing ecosystem integrity, biodiversity conservation, and environmental sustainability. Fragmentation refers to the process by which large, contiguous forest areas are divided into smaller, isolated patches due to natural disturbances or, more commonly, anthropogenic pressures such as agriculture, urban expansion, infrastructure development, and resource extraction. While global forest cover trends often emphasize net area gain or loss, the spatial configuration and connectivity of forests provide a deeper understanding of ecological stability and resilience. In this context, assessing the degree and pattern of fragmentation becomes vital for formulating sustainable forest management and restoration strategies.

Lalitpur district, located in the southernmost part of Uttar Pradesh within the semi-arid Bundelkhand region, offers a compelling case for studying long-term forest transformation. The region's landscape is characterized by undulating terrain, dry deciduous vegetation, and a mosaic of agricultural and forested land. Over the last three decades, Lalitpur has witnessed substantial shifts in land use due to population growth, road construction, quarrying, and agricultural expansion. Despite various afforestation and soil conservation programs implemented by the state, questions remain regarding the quality, contiguity, and ecological functionality of the restored forests. Hence, a temporal analysis of forest fragmentation provides a more realistic picture of landscape health than simple area statistics.

Advancements in remote sensing and geospatial analytics have enabled detailed monitoring of forest dynamics over time. Multi-temporal satellite data, especially from Landsat missions, allow for consistent, spatially explicit assessment of vegetation cover and configuration. When combined with landscape metrics derived from analytical tools such as FRAGSTATS and the Landscape Fragmentation Tool (LFT), these datasets can quantify the extent of forest fragmentation, patchiness, edge effects, and changes in core habitat size. Such an integrated approach offers a robust framework for evaluating how forests in Lalitpur have evolved structurally over the past three decades.

Understanding forest fragmentation in Lalitpur is particularly important for biodiversity conservation, as the district forms part of the northern fringe of the Deccan biogeographic zone and hosts species adapted to dry deciduous forest conditions. Fragmentation not only reduces habitat connectivity but also increases vulnerability to soil erosion, alters microclimates, and disrupts ecological processes like pollination, seed dispersal, and hydrological regulation. Therefore, examining the temporal and spatial dynamics of forest cover in Lalitpur between 1994 and 2024 provides insights into how development pressures and conservation initiatives have jointly reshaped the landscape. The present study aims to assess this transformation through a geospatial lens, highlighting the interplay between forest expansion, fragmentation, and ecological integrity.

Forest area in Lalitpur rose by 22% from 1994 to 2024, but the spatial integrity of that forest declined markedly, producing a more fragmented landscape and the loss of many medium and some large core blocks. This synthesis reports methods, key results, interpretation, limitations, and clear management recommendations. The analysis used multi-temporal Landsat imagery for 1994, 2002, 2014 and 2024. Images were atmospherically and topographically corrected, resampled to 30 m resolution, and classified by supervised maximum likelihood. Classification accuracy was assessed with a stratified random design and 250 ground control points. Forest fragmentation was quantified using the Landscape Fragmentation Tool (LFT) and FRAGSTATS. Metrics included patch counts, edge and core areas, Largest Patch Index and contagion. Temporal rates of change were computed to identify phases of landscape change.

Total forest area increased from 3,468.69 km² in 1994 to 4,243.47 km² in 2024 (net gain 774.78 km², +22.34%). However, this apparent gain masks major structural shifts. Open forest declined from 2,601.90 km² to 418.18 km² (−83.92%), while dense forest area rose. Non-forest area fell from 1,580.30 km² to 805.54 km² (−49.02%). Fragmentation classes show pronounced degradation of transitional forms: edge forest decreased from 897.66 km² to 127.57 km² (−85.81%) and perforated forest from 863.33 km² to 76.54 km² (−91.13%). Medium core blocks (250–500 acres) disappeared entirely. Large core areas (>500 acres) declined from 489.76 km² to 338.26 km² (−30.93%). Patch forest area increased from 33.15 km² to 71.47 km² (+115.66%) and the number of patches rose during 1994–2014 before partial stabilization by 2024. These patterns indicate that gains in area occurred largely as smaller, isolated units or through canopy closure in formerly open areas rather than through maintenance of contiguous core habitat.

Temporal dynamics reveal three phases. The period 1994–2002 saw rapid structural simplification and conversion of open forest to other uses. The interval 2002–2014 experienced intensified fragmentation, likely driven by urban expansion and infrastructure growth, that reduced largest patch size and increased patchiness. From 2014–2024 the landscape showed partial recovery in some metrics but retained a novel, more fragmented configuration with small mean patch sizes and reduced core area relative to 1994. The loss of medium and many large cores implies increased isolation of habitat and elevated edge effects, with likely negative implications for species movement, population viability and ecosystem services such as soil retention and water regulation.

The findings are robust at the 30-meter scale but have

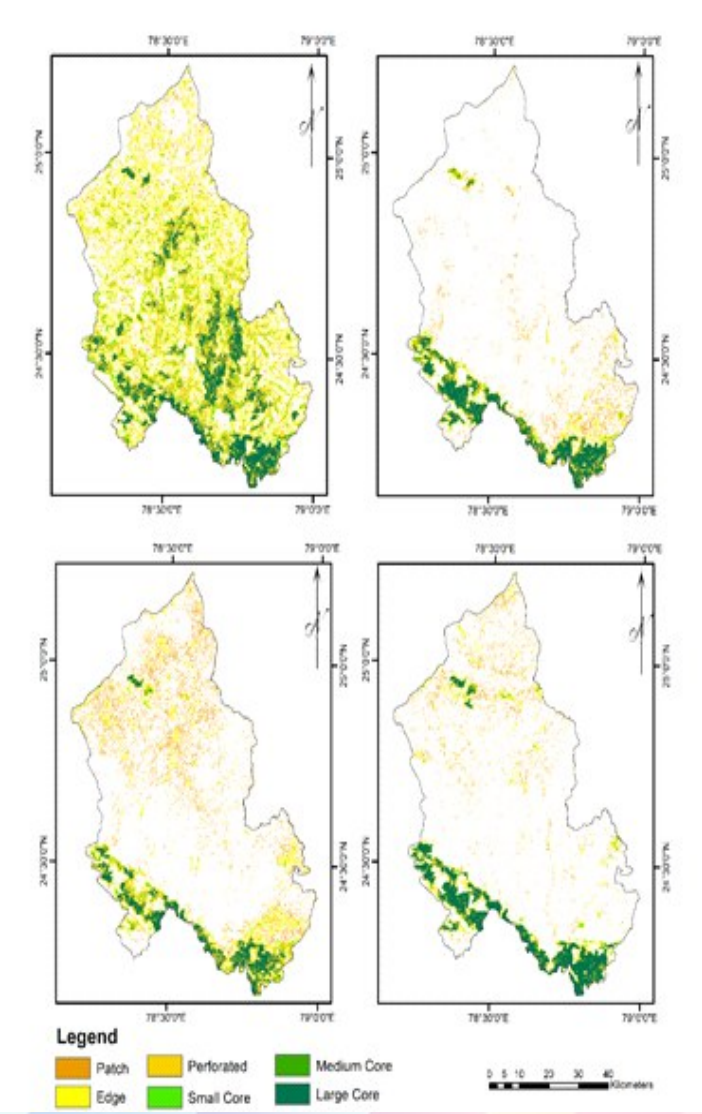


Figure 1: Map showing different Fragmentation categories

limitations. Landsat resolution cannot detect narrow corridors, small linear features, and isolated trees. Seasonal and sensor differences may introduce classification noise despite correction procedures. Fragmentation metrics quantify structure but do not directly measure species responses or ecological function. Therefore, ecological risk is inferred from established links between configuration and function rather than field-based biological measures.

For future research, higher-resolution satellite data and systematic biodiversity surveys are recommended to link structural change to species outcomes. Shorter interval time-series analysis would identify active disturbance windows and policy impacts. Conservation targets should combine area and configuration metrics. Area gains alone can mask declines in ecological quality; combining core area, edge density, and largest patch index with social and governance indicators will produce better outcomes. Lalitpur's case shows that increasing forest area is

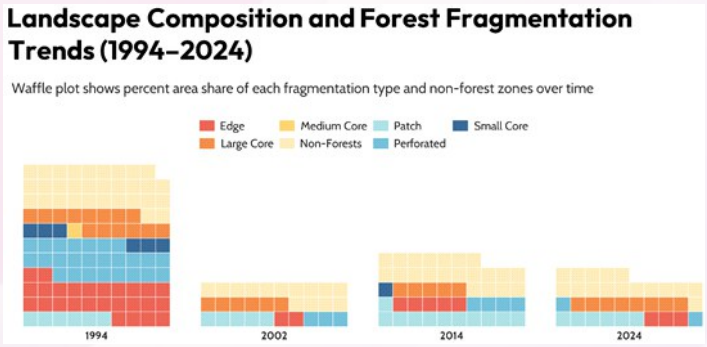
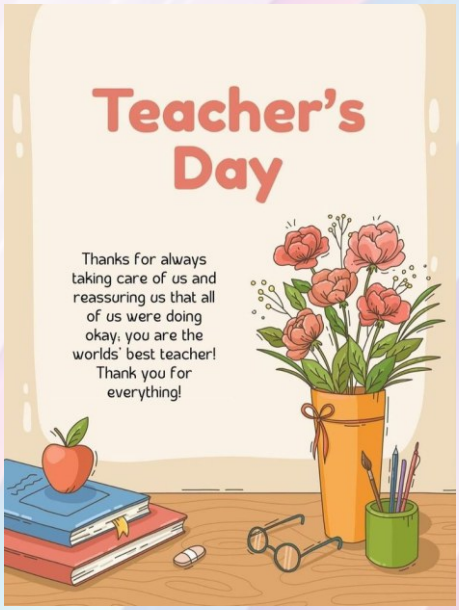
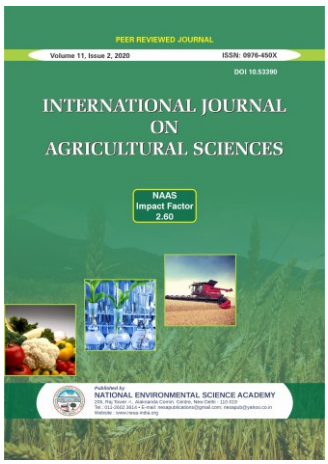
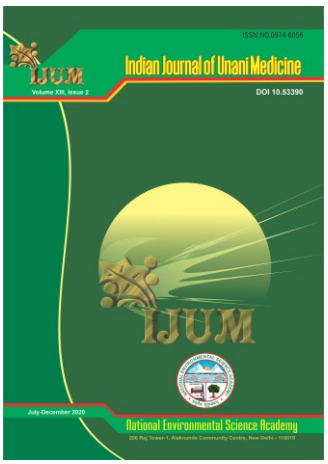


Figure 2 : Graph representing Total Area Percentage and Fragmentation Categories.

necessary but not sufficient for ecological recovery. Policy and practice must emphasize spatial integrity to sustain long-term ecosystem function and biodiversity.







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RICE HUSK ASH (RHA): A WASTE MATERIAL FOR WATER REMEDIATION AND SCOPES OF REUSE IN VEGETABLE CULTIVATION

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Introduction

Rapid industrialization and agricultural activities have led to severe contamination of water resources worldwide. Heavy metals, dyes, and organic pollutants discharged into water bodies pose serious risks to human health and aquatic ecosystems. In this context, low-cost and sustainable materials for water remediation are gaining attention. Rice husk ash (RHA), an agricultural and industrial waste generated from rice milling and husk combustion, has emerged as a promising material for water purification.

Rice Husk Ash as an Industrial Waste

Rice husk is the outer protective covering of rice grains and accounts for nearly 20% of the total rice weight. When rice husk is burned for energy generation or disposal, it produces rice husk ash. Large quantities of RHA are generated annually in rice-producing countries, and improper disposal causes air pollution, land degradation, and waste management problems. Converting this waste into a useful material for environmental remediation offers a sustainable solution.

Properties Favorable for Water Treatment

Rice husk ash is rich in amorphous silica and possesses a porous structure with high surface area. These properties make it suitable for adsorption-based water treatment. The surface of RHA contains functional groups that can interact with dissolved pollutants, allowing contaminants to attach to the ash particles and be removed from water.

Applications in Wastewater Treatment

Rice husk ash has been successfully applied in laboratory-scale treatment of industrial wastewater, particularly from textile, electroplating, and tanning industries. It has demonstrated high efficiency in removing colored dyes and toxic metals, reducing both water toxicity and environmental impact. Modified forms of RHA, such as acid-treated or thermally activated ash, show enhanced adsorption capacity compared to raw ash.

Mechanism of Pollutant Removal

The primary mechanism involved in water remediation using RHA is adsorption. Pollutants such as heavy metal ions and dye molecules adhere to the surface of the ash through physical attraction or chemical bonding. Factors such as pH, contact time, particle size, and ash dosage influence the efficiency of contaminant removal. Studies have shown that RHA can effectively adsorb metals like lead, cadmium, chromium, and copper from aqueous solutions. Below are some details about mechanism involved in RHA based polluted water remediation.

a. Role of Surface Chemistry of RHA

Rice husk ash is composed predominantly of amorphous silica (SiO_2), along with minor amounts of alumina, carbon, potassium and metal oxides. On contact with water, the silica surface becomes hydroxylated, forming silanol groups (≡Si–OH). These surface hydroxyl groups act as active adsorption sites and play a crucial role in binding pollutants. Depending on the solution pH, these groups may exist as neutral (≡Si–OH), protonated (≡Si–OH_2^+), or deprotonated (≡Si–OH) species, thereby controlling the surface charge of RHA.

b. Electrostatic Interaction and pH Dependence of RHA particles

Electrostatic attraction is one of the dominant mechanisms for ionic pollutant removal. At higher pH values, deprotonation of silanol groups generates negatively charged sites (≡Si–O^-), which strongly attract positively charged metal ions such as Pb^{2+}, Cd^{2+}, Cu^{2+}, and Cr^{3+}. Conversely, at lower pH, excess H^+ ions compete with metal ions for adsorption sites, reducing removal efficiency. Thus, adsorption is highly pH-dependent, with optimal metal uptake usually occurring in neutral to slightly alkaline conditions.

c. Surface Complexation and Chemical Bonding with RHA

Beyond simple electrostatic attraction, surface complexation occurs when metal ions form inner-sphere or outer-sphere complexes with functional groups on RHA. In inner-sphere complexation, metal ions directly bond with oxygen atoms of silanol groups, forming relatively strong and stable chemical bonds. This mechanism is particularly important for heavy metals such as lead and chromium and explains why RHA can retain metals even after washing, indicating chemisorption rather than weak physical adsorption.

d. Physical Adsorption and Porous Structure

Rice husk ash possesses a highly porous micro- and mesoporous structure, which provides a large surface area for

pollutant attachment. Organic pollutants and dye molecules are primarily removed through physical adsorption, driven by van der Waals forces and pore diffusion. Larger dye molecules become trapped within the pores, while hydrophobic interactions further stabilize their attachment to the ash surface. This mechanism is especially effective for textile dyes and aromatic organic compounds.

e. Ion Exchange Mechanism

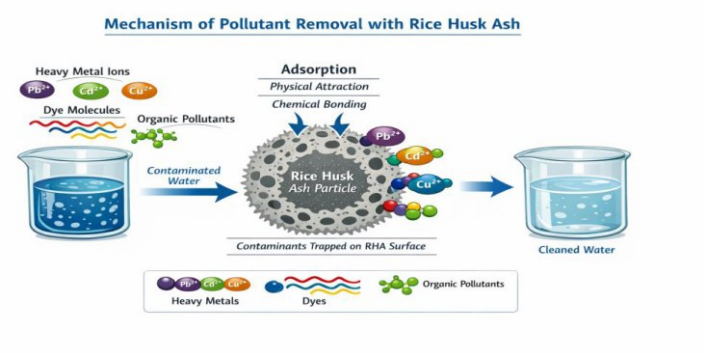
Ion exchange also contributes to pollutant removal, particularly for divalent and trivalent metal ions. Naturally occurring alkali and alkaline earth metal ions (such as Na^+, K^+, Ca^{2+}) present on the ash surface can be exchanged with toxic heavy metal ions in solution. This process enhances metal uptake and is reversible under certain conditions, making regeneration of RHA possible.

f. Influence of Ash Modification

Chemical or thermal modification significantly enhances adsorption mechanisms. Acid treatment removes impurities and increases surface silanol density, while thermal activation improves porosity and surface area. Modified RHA exhibits stronger surface complexation, higher electrostatic attraction, and improved diffusion of pollutants into internal pores, resulting in superior adsorption capacity compared to raw ash.

g. Synergistic Mechanism

In practical water remediation, pollutant removal by rice husk ash is not governed by a single process. Instead, electrostatic attraction, surface complexation, physical adsorption, and ion exchange act simultaneously, with their relative contributions depending on pollutant type, pH, temperature, and ash preparation method. This synergistic behavior explains the broad applicability of RHA for removing diverse contaminants from water.



Mechanism of RHA-Based Remediation of Wastewater in Sewage Treatment Plant (STP) and their reuse potential in vegetable cultivation

Vegetable crops are highly sensitive to water quality due to their short growth cycle and direct human consumption. Irrigation with untreated STP effluent risks metal accumulation in edible tissues. RHA-treated wastewater, on the other hand, shows:

- Reduced metal uptake by roots and shoots
- Improved plant growth and biomass as there are residual loads of nutrients remain in the treated water which helps in crop gain
- Better leaf chlorophyll content due to balanced nutrient availability
- Lower risk of food chain contamination

Crops such as tomato, okra, brinjal, spinach, and cabbage can particularly benefit when irrigation water is properly treated and monitored.

Rice husk ash–based remediation offers an effective, low-cost, and environmentally sustainable approach for polishing sewage treatment plant effluent. When properly treated and monitored, STP wastewater can be safely reused for vegetable cultivation, reducing freshwater stress while ensuring crop safety and soil health. This integrated approach not only enhances wastewater reuse but also converts agricultural waste into a valuable environmental resource.

Environmental and Economic Benefits

The use of rice husk ash in water remediation offers several advantages. It is inexpensive, abundantly available, and environmentally friendly. Utilizing RHA reduces the need for commercial adsorbents like activated carbon, lowers waste disposal issues, and supports circular economy principles by converting waste into a valuable resource.

Challenges and Future Prospects

Despite its potential, challenges remain in the large-scale application of rice husk ash for water treatment. Variability in ash quality, safe disposal of spent adsorbent, and lack of standardized processing methods limit widespread adoption. Future research should focus on improving adsorption efficiency, regeneration of used ash, and scaling up treatment systems for real-world applications.

Conclusion

Rice husk ash represents an excellent example of how industrial and agricultural waste can be transformed into an effective material for environmental protection. Its application in water remediation not only helps in removing pollutants but also addresses waste management and sustainability concerns. With further research and technological development, RHA could play a significant role in affordable and eco-friendly water treatment solutions. RHA-based polishing of sewage treatment plant effluent enables safe reuse of wastewater for vegetable cultivation by reducing toxic contaminants, improving irrigation water quality, and supporting sustainable agriculture, horticulture within a circular economy framework.

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AFLATOXIN CONTAMINATION IN VEGETABLES AND VEGETABLES DERIVED PROCESSED PRODUCTS: A DISTINCT PERSPECTIVE

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Although aflatoxin contamination is most commonly associated with cereals, oilseeds, and spices, vegetables also require separate consideration, particularly when they are dried, stored, or processed. Fresh vegetables are generally considered low-risk for aflatoxin contamination because they are harvested and consumed within a short time and their high moisture content leads to rapid spoilage before toxin-producing fungi can establish. Under normal marketing conditions, fresh vegetables such as tomato, brinjal, cabbage, cauliflower, gourds, and leafy greens rarely accumulate aflatoxins to levels of concern. But why it is still a concern, is discussed in this popular article.

What Are Aflatoxins?

Aflatoxins are a group of naturally occurring toxic compounds produced mainly by the fungi *Aspergillus flavus* and *Aspergillus parasiticus*. *A. flavus* often shows a lighter yellow-green halo with a powdery center. *A. parasiticus* tends to have a darker green center with a more velvety texture and less radial furrowing. Reverse plate pigmentation is a useful diagnostic cue: reddish-brown for *A. parasiticus*, golden for *A. flavus*. They commonly contaminate a wide range of food commodities, including vegetable-derived products, particularly under warm and humid conditions. Among the different aflatoxins, B_1, B_2, G_1 and G_2 are most frequently detected in foods. Of these, aflatoxin B_1 is the most toxic and hazardous, and is recognized globally as a Group-1 human carcinogen because of its strong link with liver cancer. Aflatoxins are invisible, tasteless and highly stable, making them difficult to detect and eliminate once they are formed.

Classification of Aflatoxins

Aflatoxins are classified into different types based on their fluorescence properties and chemical structure. The most important ones in food safety are aflatoxins B_1, B_2, G_1 and G_2, which commonly occur together in contaminated foods. Aflatoxin M_1 is a metabolite of aflatoxin B_1 and is mainly detected in milk and dairy products following consumption of contaminated feed. Among all forms, aflatoxin B_1 poses the greatest risk to human health due to its high toxicity and carcinogenic potential (Table 1).

Table 1: Types of aflatoxins and major sources of food wherein aflatoxin contamination is reported.

Aflatoxin Type	Major Source	Relative Toxicity	Remarks
*Aflatoxin B_1 (AFB_1)	Cereals, spices, oilseeds, vegetable powders	Highest	Most toxic and carcinogenic; primary food safety concern
Aflatoxin B_2 (AFB_2)	Along with AFB_1	Moderate	Usually occurs with AFB_1
Aflatoxin G_1 (AFG_1)	Some spices and legumes	High	Less common but still hazardous
Aflatoxin G_2 (AFG_2)	Along with AFG_1	Moderate	Lower toxicity than G_1
Aflatoxin M_1	Milk (from contaminated feed)	High	Metabolite of AFB_1

(*Among these, Aflatoxin B_1 is considered the most dangerous and is classified as a Group-1 human carcinogen.).

Permissible Limits and Safety Thresholds

Because aflatoxins are extremely toxic even at very low concentrations, strict maximum permissible limits have been established worldwide. For vegetable-derived foods such as spices, dried vegetables, vegetable powders and processed products, the allowable limit of aflatoxin B generally ranges from 5 to 10 μg kg ^{1}, while the limit for total aflatoxins (sum of B , B , G and G) is commonly set

between 10 and 20 $\mu g\ kg^{-1}$, depending on national and international standards. For infant foods, these limits are much lower. These threshold values highlight the fact that even trace amounts of aflatoxins, measured in parts per billion, can pose serious health risks.

Different countries and international agencies prescribe maximum allowable limits for aflatoxins to protect consumer health. These limits are particularly strict for vegetable-derived foods such as spices, dried vegetables, and powders (Table 2).

Table 2: Permissible limits and safety threshold limit in different food types.

Food Category	Aflatoxin B_1 (μg/kg or ppb)	Total Aflatoxins ($B_1+B_1+G_1+G_1$) (μg/kg)
Spices & dried vegetable products (EU)	5	10
Spices & vegetable foods (Codex)	10	15
General foods (many countries)	5–10	10–20
Infant foods	≤0.1	≤0.5

*[1 μg/kg = 1 part per billion (ppb). Even these very small quantities are considered unsafe, highlighting the extreme toxicity of aflatoxins.]

Chemical Nature and Toxicity of Aflatoxins

The toxicity of aflatoxins is closely linked to their chemical structure. Chemically, aflatoxins are difuranocoumarin compounds consisting of a coumarin nucleus fused with furan rings. In aflatoxin B , the presence of a reactive double bond enables it to bind strongly with DNA and proteins, leading to mutations and cellular damage. This chemical stability also explains why aflatoxins cannot be destroyed by common food processing methods such as cooking, drying or roasting, making prevention the only effective control strategy.

Risk in Dried and Processed Vegetables

However, the risk increases significantly when vegetables undergo drying, dehydration, or long-term storage. Dried vegetables such as chilli, onion flakes, garlic, okra, and dried leafy vegetables provide favourable conditions for the growth of aflatoxin-producing fungi when drying is slow or incomplete. Traditional sun drying on bare ground, exposure to intermittent rainfall or dew, and drying under humid conditions often allow *Aspergillus* species to colonize the produce. Once vegetables are converted into powders or dehydrated forms, even limited fungal contamination can lead to uniform distribution of aflatoxin throughout the product.

Root, Tuber and Leguminous Vegetables

Root and tuber vegetables, including potato, sweet potato, cassava, carrot, and yam, generally show low aflatoxin incidence when consumed fresh. Nevertheless, mechanical damage during harvesting and storage under warm, humid conditions can facilitate fungal growth, especially in traditional storage systems with poor ventilation. When such tubers are processed into dried chips, flour, or slices, the risk of aflatoxin contamination increases if proper drying and storage conditions are not maintained. Leguminous vegetables and pulses represent an intermediate category of risk. Fresh green pods are usually safe, but dried legumes and stored pulses can support aflatoxin production when moisture levels exceed safe limits. This is particularly relevant in tropical climates where post-harvest drying and storage are often inadequate.



Processed vegetable products and aflatoxin risks

Processed vegetable products such as powders, dehydrated mixes, pickles, and chutneys also deserve attention. Although processing may improve shelf life, it does not destroy aflatoxins, and contaminated raw materials inevitably result in contaminated finished products. Because vegetable-based powders and seasonings are consumed regularly in small quantities, the risk of chronic exposure becomes significant over time.

Public Health and Food Safety Implications

In recent years, increasing demand for dehydrated vegetables and value-added vegetable products has expanded the scope of aflatoxin risk beyond traditional commodities. Climate variability, rising humidity, and prolonged storage further intensify this challenge. Therefore, vegetables especially in their dried and processed forms must be recognized as an important component of aflatoxin risk assessment and management. Ensuring rapid drying, hygienic handling, proper storage, and routine monitoring is essential to safeguard consumer health and maintain the safety of vegetable-derived foods.

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RICE HUSK ASH–BASED CO-COMPOSTING FOR CROP CULTIVATION

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Introduction

Rice husk ash (RHA) is an abundant by-product produced from rice milling and biomass energy generation. Traditionally considered an agricultural waste, improper disposal of RHA can contribute to air pollution and land degradation. However, co-composting RHA with biodegradable organic wastes such as crop residues, kitchen green and moistened waste, vegetable waste, farmyard manure, or sewage sludge offers a sustainable solution. This process not only recycles agricultural residues but also produces a nutrient-rich soil amendment suitable for crop cultivation, creating a link between waste management and sustainable agriculture.

Role of RHA in Co-Composting

In co-composting systems, RHA plays multiple critical roles. It's porous structure improves aeration and water retention in the compost pile, promoting microbial activity and accelerating organic matter decomposition. The alkaline nature of RHA helps buffer pH fluctuations during composting, preventing excessive acidification in the early stages caused by organic acid formation. Silica and metal oxides present in RHA also contribute to the immobilization of heavy metals, reducing their bioavailability in the final compost and making it safer for agricultural applications.

Mechanism of Co-Composting

Co-composting involves the synergistic breakdown of organic materials by diverse microbial communities. In the presence of RHA, microbes experience a more favorable environment: improved aeration ensures aerobic conditions, stabilized moisture prevents drying or water logging, and buffering capacity reduces stress from pH changes. During the thermophilic phase (50–65°C), pathogenic organisms are destroyed, while microorganisms efficiently decompose organic matter into stable humus-like compounds. The porous structure of RHA also provides additional surface area for microbial colonization, enhancing enzymatic degradation processes. This combination results in faster composting, reduced odor, and a nutrient-rich end product.

Steps followed in RHA based co-composting

In RHA-based co-composting, the process begins with the collection of organic waste such as crop residues, kitchen waste, or farmyard manure, which is then pre-treated by removing non-biodegradable materials and chopping large pieces. Rice husk ash (RHA) is added at a mixing ratio of 5–15% of the total mixture, with the remainder being organic waste, providing a bulking agent, pH buffer, and heavy metal immobilizer. The materials are thoroughly mixed and layered to form compost piles or pits, ensuring good aeration and uniform decomposition. Moisture is maintained at around 50–60%, and the pile is turned periodically to facilitate oxygen flow and microbial activity. During the thermophilic composting phase, temperatures rise to 50–65°C, promoting rapid decomposition of organic matter while RHA supports microbial stabilization and nutrient retention. After 4–6 weeks of active composting, the material is allowed to mature for an additional 2–4 weeks, resulting in a dark brown, crumbly, nutrient-rich compost that is ready for application in crop cultivation.

Nutrient dynamics
Although RHA is low in nitrogen, it improves nutrient retention in co-composting systems. By reducing ammonia volatilization, RHA helps conserve nitrogen, while contributing potassium, calcium, and silica, which are essential for plant growth. The final compost demonstrates enhanced cation exchange capacity (CEC), ensuring slow and sustained nutrient release when applied to soil. This property is especially important in agriculture, where controlled nutrient availability supports steady crop growth without nutrient leaching.

Application in crop cultivation
RHA-based co-compost can be applied to a wide variety of crops including vegetables, cereals, pulses, and horticultural plants. Its application improves soil physical properties such as structure, porosity, and water-holding capacity, facilitating root development and nutrient uptake. Crops irrigated or grown in soils amended with RHA compost often exhibit improved biomass production, yield, and overall plant health. The silica content can enhance plant resistance to environmental stress and certain pests, while the immobilization of heavy metals reduces the risk of toxic accumulation in edible plant tissues, contributing to food safety.

Environmental and sustainability benefits
RHA-based co-composting embodies circular economy principles by transforming an agricultural waste into a productive input for farming. It reduces reliance on chemical fertilizers, lowers greenhouse gas emissions associated with waste burning or landfill disposal, and contributes to carbon sequestration in soils. Moreover, it prevents the environmental problems associated with unmanaged RHA disposal, such as dust pollution and soil alkalinity issues, while promoting sustainable soil fertility management and eco-friendly agriculture.

Challenges and considerations
Despite its many benefits, RHA-based co-composting requires careful management. Optimal mixing ratios, typically 5–15% RHA with 85–95% organic waste, are necessary to maintain appropriate pH and nutrient balance. Excess RHA may increase alkalinity, whereas insufficient amounts may not provide the desired bulking and stabilization effects. Moisture, temperature, and turning frequency must be monitored to ensure uniform composting. Additionally, the quality of RHA (from rice mills or biomass plants) should be consistent and free of contaminants to produce safe, high-quality compost.

Conclusion
Rice husk ash–based co-composting is a practical and sustainable strategy to recycle agricultural residues, enhance compost quality, and improve soil fertility. By supporting microbial activity, stabilizing nutrients, and producing a safe, nutrient-rich compost, this approach enables the sustainable cultivation of vegetables, cereals, and horticultural crops. Its adoption promotes environmentally responsible farming, reduces chemical fertilizer dependency, and exemplifies the integration of waste management with sustainable agricultural practices.

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ROLE OF THE UNIVERSITY SOPHISTICATED INSTRUMENTATION CENTRE (USIC) IN RESEARCH AND DEVELOPMENT

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The University Sophisticated Instrumentation Centre (USIC), JSS AHER, Mysuru is a state-of-the-art research facility equipped with advanced, cutting-edge technologies that support high-quality research and innovation across disciplines. The centre houses High-dimensional Flow Cytometry (FACS), Confocal Microscopy (CM), Gas Chromatography–Mass Spectrometry (GC-MS/MS), Nuclear Magnetic Resonance (NMR), High-Resolution Mass Spectrometry (HR-MS), and Attenuated Total Reflectance–Fourier Transform Infrared Spectroscopy (ATR-FTIR). These major facilities have been established through funding support from national agencies such as the Department of Biotechnology (DBT) and the Department of Science and Technology (DST).

USIC plays a crucial role in addressing fundamental and translational research questions. Advanced imaging and single-cell analysis platforms, particularly flow cytometry and confocal microscopy, enable detailed understanding of disease pathogenesis and facilitate the discovery of novel biomarkers and therapeutic targets in cancer, autoimmune disorders, and infectious diseases. Complementary analytical platforms such as GC-MS/MS, HR-MS, NMR, and ATR-FTIR support structural characterization of compounds, protein analysis, and investigation of complex chemical mixtures.

For example, at the University Sophisticated Instrumentation Centre (USIC), flow cytometry is routinely

Fig. 1: Representative images of the advanced research instrumentation facilities at the University Sophisticated Instrumentation Centre (USIC), JSS AHER, Mysuru, Karnataka, India

employed for the analysis of human blood samples using the TBNK panel. This platform enables comprehensive immune profiling to better understand disease pathogenesis and to identify novel biomarkers that can help predict treatment response and clinical outcomes.

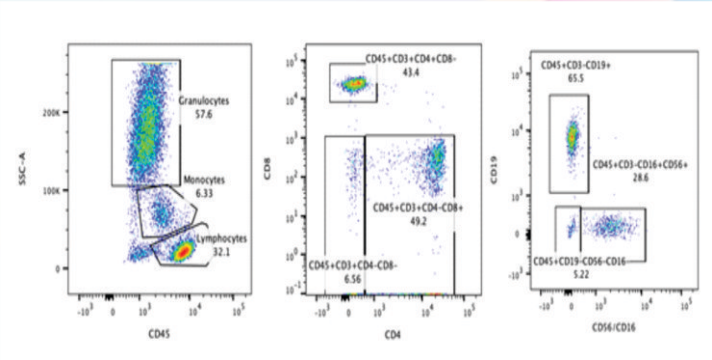

Fig. 2: Gating strategy used to identify and define major leukocyte populations from a healthy individual. The analysis was performed using the TBNK panel, which enables quantification of T cells, B cells, and natural killer (NK) cells, along with T-cell subsets including $CD4^+$ and $CD8^+$ cells. This assay is routinely employed in the evaluation of immune status in viral infections such as HIV/AIDS and in cancer. Flow cytometry-based immune phenotyping provides a comprehensive assessment of immune cell composition and can be extended to study various diseases using disease-specific antibody panels.

In addition to biomedical research, USIC provides strong support to industrial and environmental studies, including air pollution monitoring, pesticide analysis, and environmental contaminant profiling. With its comprehensive instrumentation, expert technical support, and multidisciplinary applications, USIC offers some of the finest analytical and research services available in India, significantly contributing to research excellence and innovation.

PESTICIDE EXPOSURE AND THE DEVELOPMENT OF BLOOD CANCERS IN HUMANS

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Abstract
Pesticides play a crucial role in modern agriculture and vector control; however, their widespread and long-term use has raised serious concerns regarding human health. Among the various adverse outcomes, hematological malignancies have attracted significant attention. Blood cancers, including leukemia, lymphoma, and multiple myeloma, arise from abnormal proliferation and differentiation of hematopoietic or lymphoid cells. Growing epidemiological and experimental evidence suggests a strong association between chronic pesticide exposure and the development of these malignancies. Several pesticide classes such as organochlorines, organophosphates, carbamates, and herbicides have been implicated. The underlying mechanisms involve genotoxicity, oxidative stress, immune dysregulation, endocrine disruption, and epigenetic modifications. Agricultural workers, children, and individuals residing in farming communities are particularly vulnerable. Strengthening regulatory frameworks and promoting safer pest control strategies are essential to reduce pesticide-associated blood cancer risk.

Introduction
Hematological malignancies constitute a major public health burden worldwide, contributing substantially to cancer-related morbidity and mortality. These malignancies primarily include leukemia, lymphoma, and multiple myeloma, all of which originate from abnormal growth of blood-forming or immune cells in the bone marrow and lymphatic system. While genetic susceptibility plays an important role, environmental exposures have increasingly been recognized as critical risk factors.

Pesticides are inherently toxic chemicals designed to eliminate pests but may also adversely affect non-target organisms, including humans. Continuous exposure through occupational, dietary, and environmental routes has made pesticides an important concern in cancer epidemiology. Agricultural workers and populations in rural areas experience particularly high exposure, especially in developing countries where safety regulations and protective measures are often inadequate.

Key Mechanisms
- **Genotoxicity:** DNA damage and chromosomal abnormalities in hematopoietic stem cells

- **Oxidative stress:** Excess ROS leading to DNA and cellular damage
- **Immune dysregulation:** Impaired immune surveillance and lymphocyte function
- **Endocrine disruption:** Hormonal imbalance affecting cell proliferation
- **Epigenetic changes:** Altered gene expression without DNA sequence changes

Classes of Pesticides Associated with Blood Cancers

Several pesticide classes have been linked to hematological malignancies. Organochlorine pesticides, such as DDT and lindane, are persistent and bioaccumulative and have been associated with increased risk of leukemia and non-Hodgkin lymphoma. Organophosphate and carbamate pesticides, widely used insecticides, have been shown to induce DNA damage, oxidative stress, and immune suppression. Herbicides, particularly phenoxy herbicides (e.g., 2,4-D) and triazines (e.g., atrazine), are also implicated due to their immunotoxin and endocrine-disrupting properties.

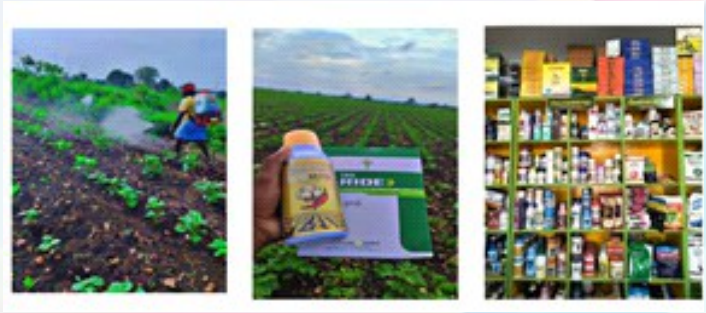

Fig. 1: Schematic representation of pesticide application in agricultural fields, illustrating the spread of different types of pesticides. The figure highlights potential exposure routes during spraying and through subsequent food consumption.

Routes of Exposure

Humans are exposed to pesticides through multiple routes, including occupational handling during mixing and spraying, dermal absorption, inhalation of aerosols, and ingestion of contaminated food and water. Chronic low-dose exposure is of particular concern, as it may lead to cumulative biological damage. Prenatal and early-life exposure is especially critical due to the high sensitivity of developing hematopoietic and immune systems.

Epidemiological Evidence

Numerous occupational studies have reported elevated risks of leukemia and lymphoma among farmers and pesticide applicators. Large cohort studies, such as the Agricultural Health Study, have demonstrated dose-response relationships between pesticide exposure and cancer incidence. Residential exposure has also been associated with increased childhood leukemia risk. Meta-analyses consistently support a positive association between pesticide exposure and hematological malignancies.

Future Research Directions

To pinpoint precise molecular targets, comprehend gene-environment interactions, and create biomarkers for early detection, more investigation is needed. Developments in molecular epidemiology and toxicogenomic have the potential to enhance risk assessment and prevention.

Conclusion

Current scientific evidence strongly supports a link between chronic pesticide exposure and the development of blood cancers in humans. The risk is particularly high among occupationally exposed populations and children. Implementation of stricter regulations, improved awareness, and adoption of safer pest management strategies are essential to reduce pesticide-related cancer burden.

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"It is our collective and individual responsibility to protect and nurture the global family, to support its weaker members, and to preserve and tend to the environment in which we all live."

— Dalai Lama

Let's clear the air for Earth's future.

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NOTIFICATION NO. 3

APPLICATIONS ARE INVITED FOR NESA ANNUAL AWARDS – 2025

LAST DATE EXTENDED TO : 31st October, 2025

This is to notify that applications are invited for the **NESA Annual Awards 2025** from the Life Members of the Academy. The prescribed application forms for the following categories can be downloaded from our website: www.nesa-india.org • https://nesa-india.org/nesa-annual-awards-2025/

Separate applications should be submitted for independent awards. For detailed guidelines the website of NESA may be approached by log in to website: https://nesa-india.org/nesa-annual-awards-2025/

The last date for all the categories of awards is 31st October, 2025

(1) NESA FELLOWSHIP AWARD - 2025
(2) NESA EMINENT SCIENTIST AWARD - 2025
(3) NESA DISTINGUISHED SCIENTIST AWARD - 2025
(4) NESA SCIENTIST OF THE YEAR AWARD - 2025
(5) NESA ENVIRONMENTALIST AWARD - 2025
(6) NESA GREEN TECHNOLOGY INNOVATIVE AWARD - 2025
(7) WOMEN EXCELLENCE AWARD - 2025
(8) NESA YOUNG SCIENTIST AWARD - 2025
(9) NESA JUNIOR SCIENTIST AWARD - 2025

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