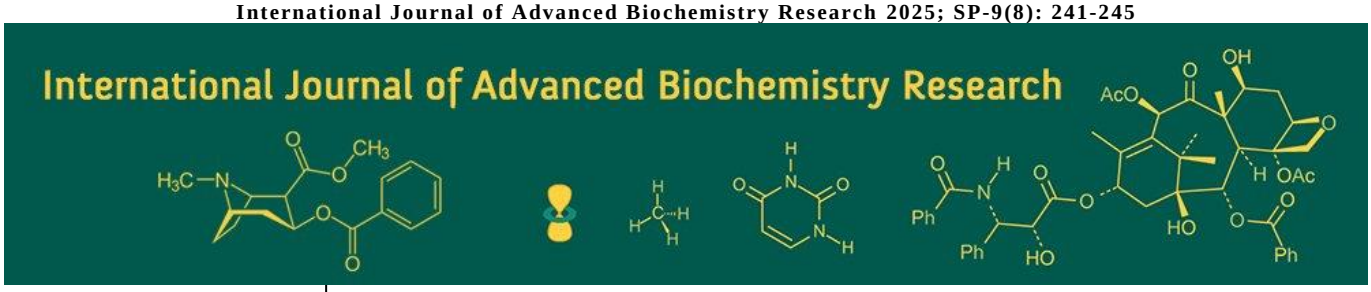

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The preparation of Geer cow urine distillation (CUD) and an investigation of inorganic metal ion in Geer CUD

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Abstract
Geer Cow Urine Distillate (CUD), a traditional biofluid with potential therapeutic and agricultural applications, was analyzed to evaluate its physicochemical quality, safety, and elemental composition. The study assessed pH, total dissolved solids (TDS), organoleptic properties, and toxicity using standard analytical techniques. The pH of CUD was found to be 8.0, aligning with World Health Organization (WHO) standards, while TDS was significantly reduced from 24.8 g/kg in fresh cow urine to 0.409 g/kg in CUD, indicating effective purification through distillation. Sensory analysis revealed the CUD to be colourless, odourless, and slightly bitter, and toxicity tests confirmed it to be non-toxic. Elemental analysis detected essential macro-elements such as calcium, potassium, sodium, magnesium, and iron, consistent with bovine metabolic needs. However, trace amounts of potentially toxic elements like arsenic (As), cadmium (Cd), and lead (Pb) were also present, warranting concern. These findings highlight the high quality and safety of CUD, while emphasizing the importance of environmental monitoring to minimize contamination risks. Overall, CUD exhibits promising characteristics for pharmacological, antimicrobial, and biostimulant applications.

Keywords: WHO, HIV, antibacterial, antifungal, antimicrobial, antioxidant activities, uric acid, Allantoin, TDS, inductively coupled plasma (ICP)

Introduction
The World Health Organization (WHO) defines biomedical waste as any waste generated during healthcare activities. Infectious materials like blood, bodily fluids, or tissues. Sharps like used needles, syringes, scalpels, and other sharp objects. Pharmaceuticals including expired, unused, or contaminated medicines. Radioactive materials used for diagnostics or treatments. In India, the Biomedical Waste Management and Handling Rules, 1998 provide guidelines for handling such waste, specifying how healthcare facilities should manage waste generated during diagnosis, treatment, immunization or research activities.

Waste should be segregated at the source into different categories (e.g., sharps, pharmaceutical waste and infectious waste). It's also commonly known as medical waste, healthcare waste or infectious waste. Different types of biomedical waste must be placed in specific color-coded bins for easy identification and safety. Waste must be stored in proper containers to prevent contamination or exposure. Waste must be transported safely to disposal or treatment facilities. Waste is treated to reduce its hazardous effects (e.g., sterilization or incineration). Final disposal involves rendering the waste safe for the environment, typically through methods like incineration or landfilling. Direct contact with contaminated needles or tissues can lead to the spread of diseases such as HIV, Hepatitis B & C**,** Tuberculosis, and others. Improper disposal of pharmaceuticals or chemicals can contaminate water supplies, soil and air. Healthcare workers, sanitation staff and waste handlers face a higher risk of exposure. Rag pickers and people in the surrounding area are also at risk of coming into contact with waste improperly discarded. Doctors, nurses, and other staff who handle biomedical waste face potential exposure to infections and hazardous substances**.** Sanitation Workers and Waste Handlers, t hose involved in cleaning and transporting the waste also risk exposure if proper safety procedures aren't followed. Improperly discarded waste in public spaces can harm vulnerable populations, especially in

areas without proper waste management infrastructure.

Gomutra is not classified as a toxic waste and has shown immune-modulatory effects in experimental settings. However, while traditional systems like Ayurveda regard it as therapeutic, its use in modern clinical medicine remains investigational and must be treated with scientific scrutiny and care. Gomutra is believed to exhibit antibacterial, antifungal and germicidal effects. It contains Urea as well-known antimicrobial agent. In higher concentrations, it can denature proteins and damage microbial cell walls. Creatinine may contribute mildly to antimicrobial action, though its exact role is less studied. Swarn Kshar (Aurum hydroxide) which traditionally believed to boost immunity and have antimicrobial effects. However, scientific validation is limited. Carbolic acid (phenol**)** and other phenolic compounds: Known disinfectants with strong germicidal properties.

Calcium and Manganese act as trace minerals essential for various physiological functions. Gomutra has been studied (primarily in animal models and *in vitro*) for its potential anti-cancer effects, which may be due to Uric Acid which acts as an antioxidant**,** scavenging free radicals that may lead to DNA damage and cancer, Allantoin is natural compound with cell-proliferation and tissue-repair properties, often used in wound healing. It's claimed to help prevent abnormal cell growth, but evidence for anti-cancer effects is limited and not clinically validated**.** It may support wound healing and cellular integrity.

Gomutra contains compounds that, have antimicrobial, wound-healing, and antioxidant properties. These support traditional claims to some extent**,** especially in Ayurvedic or ethano-medical contexts. However, modern medicine requires rigorous clinical evidence before gomutra can be recommended for therapeutic use especially for serious conditions like cancer.

The composition of cow urine encompasses approximately 95% aqueous phase, 2.5% urea content, with the remaining 2.5% comprising a complex mixture of minerals, salts, hormones, and enzymes. Biochemical analyses indicate the presence of sodium (Na), nitrogen (N), sulfur (S), potassium (K), copper (Cu), calcium (Ca), phosphate (PO_4), manganese (Mn), iron (Fe), silicon (Si), chlorine (Cl), magnesium (Mg), aurum hydroxide ($Au(OH)_3$), citric acid ($C_6H_8O_7$), succinic acid ($C_4H_6O_4$), hippuric acid ($C_9H_9No_3$), maleic acid ($C_4H_4O_4$), tartaric acid ($C_4H_6O_6$), carbolic acid (C_6H_6O), as well as vitamins A, B, C, D, and E, lactose, enzymes, creatinine, and various hormones.

Materials and Methods

1. Materials and Chemicals

Two necked round bottom flask, kipp's apparatus, glass connector, coiled condenser, zeolite column, glass beakers, TDS measurement machine, pH meter, heating mantal, cotton, whatmann filter paper 41. Electrical s/w on ICP instrument**,** fresh cow urine, silica, Aluminum oxide, stones, dust, deionized water, plasma gas, etc.

2. Methodology for CUD preparation

The fresh cow urine was firstly added into cleaned two necked round bottom flask. Then assembly was connected. And zeolite column was also prepared and assembled. Geer Cow urine was heated by using heating mantal instrument. After boiling of cow urine, the vapours of cow urine was passed through kipp's apparatus. Then vapours was cooled and converted into liquid form and settled into zeolite column through passing glass connecter and coiled condenser. Then fractions of CUD about 25-30 ml was collected into separate beakers.

Fig 1: CUD Assembly

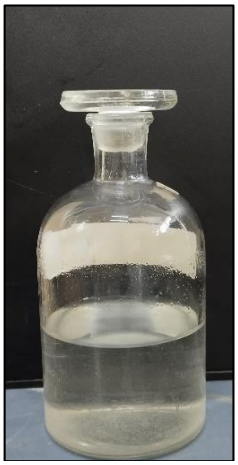

Fig 2: CUD sample

3. Procedure for inductively coupled plasma (ICP)

Sample preparation and analytical assessment: dilute the CUD sample was collected by distillation to 100-fold using deionized water (e.g., transfer 1 mL of the sample into 100 mL of DI water). Initiate the electrical software on the inductively coupled plasma (ICP) instrument. Manually activate the plasma gas and perform a purging sequence for the plasma gas. Control the chiller's operational status (on/off). Ensure the instrument has been energized and purged for a minimum duration of 2 hours. Assemble the tubing as per the provided guidelines in the Hardware Evaluation Protocol (HEP) within the ITEVA software for sampling. After confirming all interlock systems indicate green status, select the plasma icon followed by activation of the plasma. Access the ITEVA control center and select the analyst option. Calibrate the measurement methodology by selecting calibration from the 'run' menu. Aspirate the blank standard from the run sequence, subsequently repeat this for the high standard, and finalize the process by selecting done. Select 'unknown sample' from the run menu, designate the sample identifier, and initiate the run sequence. Post-analysis, perform a rinsing procedure with DI water. Select the plasma icon and deactivate the plasma. Proceed to power down the instrument.

Results

The fractions of the CUD sample were segregated into distinct beakers for analytical purposes. The total dissolved solids (TDS) and pH of these samples were quantitatively assessed utilizing TDS and pH meters. Furthermore, the toxicity of these samples was evaluated employing the iodine assay method. Sensory observations regarding the color and odor of the collected CUD samples were conducted. The comprehensive results regarding the CUD samples are enumerated as follows.

Table 1: CUD Data

Sr. No.	Organoleptic character	Fresh cow urine	CUD	Acceptable range	Status
1.	pH	7.9	8.0	<8.0 (WHO)	Excellent
2.	TDS	24.8 g/Kg	0.409 g/Kg	<0.5 g/Kg (WHO)	Excellent
3.	Color	Non	Non	-	Pass
4.	Odor	Non	Non	-	Pass
5.	Taste	Bitter	Slightly bitter	-	Pass
6.	Toxicity	Non	Non	-	Pass

Bovine urine commonly known as cow urine or Gomutra, is a liquid by-product of metabolism in cows**.** The freshly obtained cow urine exhibited a pH range is (6.9-8.7). Bovine urine comprises a variety of inorganic metallic elements, prominently including iron (Fe), Aluminum (Al), Arsenic (As), Boron (B), Barium (Ba), Bismuth (Bi), Calcium (Ca), Chromium (Cr), Potassium (K), Manganese (Mn), magnesium (Mg), Sodium (Na), Antimony (Sb), and Lithium (Li). Additionally, it encompasses trace concentrations of other metallic constituents such as Silver (Ag), Cadmium (Cd), Lead (Pb), Cobalt (Co), Gallium (Ga), Indium (In), and Nickel (Ni). These metallic elements manifest in diverse concentrations, collectively influencing the biochemical composition of the urine. The concentrations of these metallic elements exhibit variability influenced by factors such as bovine dietary intake, physiological health, and chronological age. These elements are sourced from dietary constituents and metabolic processes in bovines, subsequently being eliminated via renal excretion as a consequence of standard physiological operations. The chemical composition of cow urine is influenced by dietary intake, physical activity levels, body mass, and the climatic conditions of the geographical habitat.

Table 2: CUD Metal Ion.

Metals No.	Results (ppm)	Metals No.	Results (ppm)	Metals No.	Results (ppm)	Metals No.	Results (ppm)
Ag3280	0.0021	Bi2230	0.0326	Fe2599	0.0078	Ni2316	0.0155
Al1670	0.0374	Ca3179	32.6	Ga2943	0.0052	Pb203	0.0004
Al3082	0.0081	Cd2144	0.0002	In3256	0.0506	Sb1960	0.9366
As13961	0.502	Cd2265	0.0006	K_7664	12.23	Mg2790	14.78
B_2089	0.2114	Cd2288	0.0014	K_7698	12.37	Mg2795	14.25
B_2496	0.2061	Co2286	0.0051	Mn2576	0.3297	Mg2802	14.68
B_2497	0.2394	Cr3578	0.0231	Na5895	50.72	Li6707	0.638
Ba2348	0.062	Fe2382	0.0051				

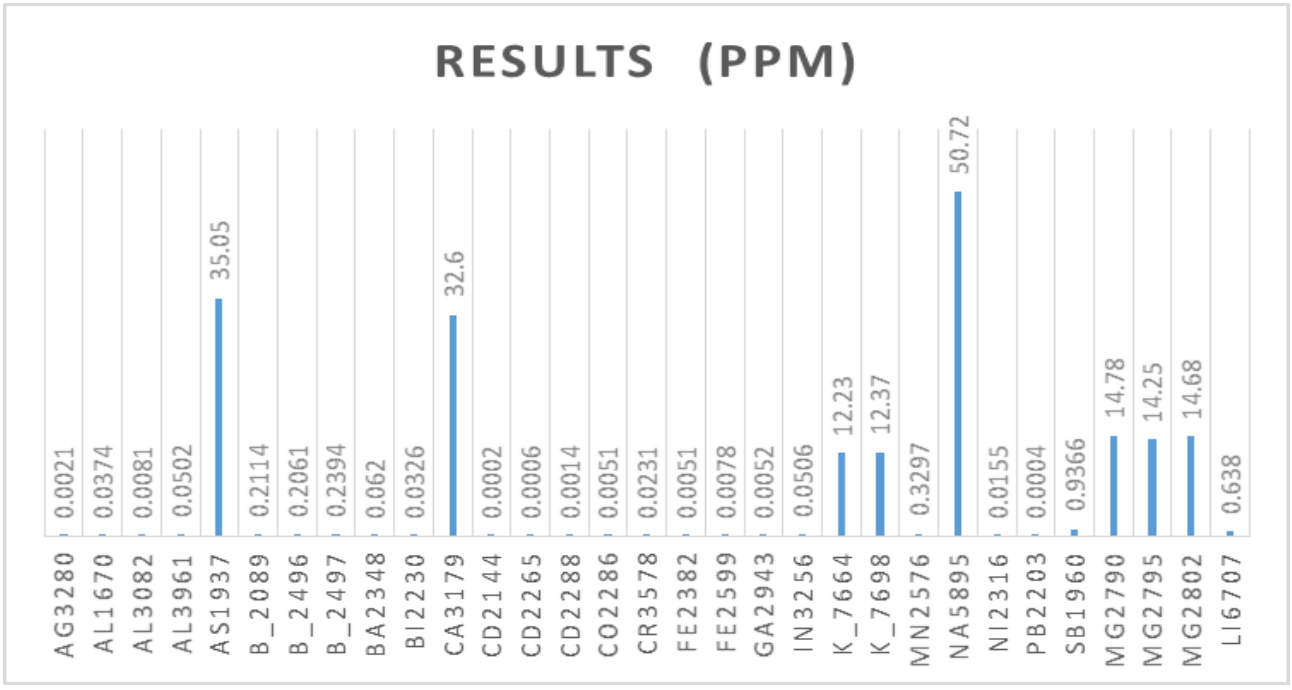

Fig 3: CUD Metal Graph

Discussion

The analytical results indicate that the processed Geer Cow Urine Distillate (CUD) meets or surpasses international quality standards set by the World Health Organization (WHO) for pH and TDS. The reduction in TDS from 24.8 g/kg in fresh urine to 0.409 g/kg in CUD signifies effective distillation and purification. The pH of CUD (8.0) is within the permissible alkaline range, suitable for potential therapeutic or agricultural applications. Sensory analysis revealed that the CUD is colorless, odorless, and only slightly bitter, enhancing its acceptability for further bioactive investigations. Importantly, the absence of toxicity, as indicated by the iodine assay, further supports the safety profile of CUD. These observations collectively suggest that the CUD preparation is of high quality and may serve as a viable candidate for pharmacological, antimicrobial or biostimulant applications. Elemental analysis indicated the presence of both macro and trace metallic elements. Inorganic elements such as calcium, potassium, sodium, magnesium, and iron were expected due to their essential physiological roles in bovine metabolism and their consistent dietary intake. However, the detection of toxic elements such as arsenic (As), cadmium (Cd), and lead (Pb), even in trace amounts, necessitates careful evaluation due to their potential bioaccumulative and toxic effects. Their occurrence is likely linked to environmental exposure or contaminated feed, underscoring the need for stringent monitoring of bovine diets and habitat quality.

The presence of rare metals such as gallium (Ga), indium (In), and bismuth (Bi) is noteworthy and may reflect geochemical peculiarities of the region where the bovines were raised. Variability in metal concentrations among samples further highlights the role of geographical and physiological factors, such as age and health status, in determining urine composition.

Sensory analysis of colour and odour, although qualitative, contributes to understanding the physical characteristics and potential usability of cow urine in traditional medicine, agriculture, or industry. Distinct odours and coloration may correlate with the metabolic state of the animal or the presence of specific compounds, such as volatile organic acids or nitrogenous waste.

In conclusion, the chemical and elemental diversity observed in the CUD samples emphasizes the complex nature of bovine urine as a biological fluid. While its composition is influenced by several factors including diet, climate and health the presence of both beneficial and potentially harmful constituents necessitates cautious utilization, especially in therapeutic or agricultural contexts. Future studies should aim for broader sample sizes, include longitudinal monitoring and incorporate advanced analytical techniques such as ICP-MS and GC-MS to further elucidate the biochemical dynamics of cow urine.

Conclusion

The comprehensive physicochemical and sensory evaluation of Geer Cow Urine Distillate (CUD) demonstrates that it meets the acceptable quality criteria set by WHO standards, particularly in terms of pH and TDS. The distillation process effectively reduces the total dissolved solids, enhances organoleptic properties and eliminates detectable toxicity, indicating a high level of purification and suitability for various applications. The presence of essential macro-elements like calcium, magnesium, potassium and iron reflects the physiological importance of these constituents in bovine metabolism and validates their natural origin.

However, the detection of trace levels of potentially hazardous elements such as arsenic, cadmium, and lead raises concerns about environmental and dietary contamination. This highlights the critical need for continuous monitoring of bovine feed and environmental conditions to ensure safety and minimize toxic accumulation.

Overall, the findings support the potential of CUD as a safe and bioactive agent, warranting further investigation into its pharmacological, antimicrobial, and agricultural utility, provided that rigorous quality control is maintained in its preparation

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Declaration

Conflict of Interest: The authors declare no competing interests.

Declaration of Generative AI & AI-Assisted Technologies in the Process: During the preparation of this work, the authors did not use AI or AI-assisted technology to write the manuscript and take responsibility for the publication's content.

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