Determination of Total Dissolved Solids (TDS) of RO Purified Drinking Water Samples in Raipur

Sudheer Bhoi[1,*], Chunendra Kashyap[1], Sagar Kumar Rajak[1], Shobhana Ramteke[1]
[1] School of Studies in Environmental Science, Pt. Ravishankar Shukla University Raipur (Chhattisgarh) 492010. India.

*Corresponding author: bhoisudheer08@gmail.com

Abstract

This research work deals with the TDS and physiochemical parameters of RO purified drinking water in Raipur region. Current pollution trends taught us that it is necessary to drink RO purified water but we must have to know the quality of RO purified drinking water because many peoples used RO water for consumption. This paper deals about RO water with special reference to TDS, but another physical parameter *viz*. pH, EC, Salt, Temperature and chemical parameter *viz*. Hardness (total hardness, calcium hardness & magnesium hardness) and Total alkalinity and NA^+, K^+ of RO purified water also tested and studied. We are able to know about the correlation between TDS and many physiochemical parameter after study about this research paper. 20 water samples collected from different places of Raipur city. The purpose of the research paper is to ensure the quality of RO purified water that people using for drinking purpose. Many samples of RO purified waters TDS level is below the permissible limit of BIS guidelines in the part of result and discussion the samples are mentioned properly in this present paper. Peoples should aware about the consequences which can occur after long term consumption of RO purified drinking water.

Keywords: RO purified drinking water, physiochemical parameters, TDS, BIS, WHO.

Introduction

Raipur district is not only the capital of Chhattisgarh but also heart of Chhattisgarh state. Very huge number of peoples are living in Raipur city. Raipur city is highly polluted because of large number of industries and large population. Due to high pollution of water, peoples are allowed to use RO purified water for safe drinking. But it is necessary to know that RO water is healthy for us or not. Hence it is important to know about physical and chemical parameter of RO purified drinking water. The physical parameters like EC, TDS, pH, Salt and temperature are mostly notable. The TDS of water is commonly becomes low after purification using RO. This phenomena leads to remove essential minerals from drinking water which can cause severe health consequences after long term consumption of RO purified water.

TDS correlates positively with EC and affects pH, the higher the TDS the higher the conductivity and lower the pH, towards the acidity. Similarly TDS strongly correlated with TH and Ca^{2+} etc. According to BIS & WHO the upper limit of TDS levels in water is 500 & 300 ppm respectively. But both high and low TDS levels is harmful for human beings. A certain levels of TDS is required for consumption. Hence the aim of this research work is to understand the quality of water with special reference to TDS because it is essential to aware people about the quality of water they are consuming.

Materials and methods

Sampling Area and Collection

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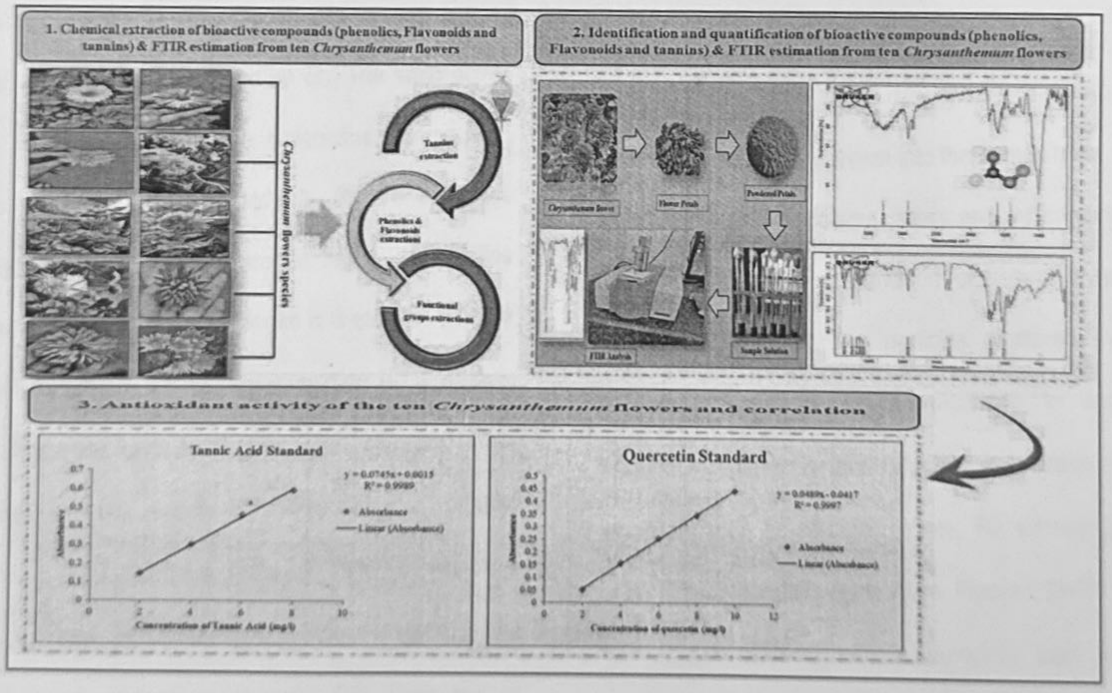
Phytochemical Estimation of *Chrysanthemum* flowers by FTIR Spectroscopy

[1*]Shobhana Ramteke, [2]Chandrakiran Gangber, [3*]Bharat Lal Sahu

[1]School of Studies in Environmental Science, Pt. Ravishankar Shukla University, Raipur-492010, CG, India
[2]School of Sciences, MATs University, Raipur-493441, CG, India
[3]Department of Chemistry, Guru Ghasidas Central University, Bilaspur, CG 495009, India.
Email – [2]shubrmtk21@gmail.com, [3]bharatred007@gmail.com

Abstract: *The purpose of this study was to assess the total phenol, tannin, alkaloid, and flavonoid contents in the Chrysanthemum flower extracts in petroleum ether, ethyl acetate, and methanol. Petroleum ether, ethyl acetate, and methanol were used as solvents in a continuous hot percolation method in a soxhlet apparatus to extract powdered wood material. For the Folin-Ciocalteu method of determining total phenol and tannin, gallic acid was utilised as the standard. Quercetin was used as a standard in the chloride colorimetric method to determine the total alkaloid content. Using atropine as a standard, the results demonstrated that ethyl acetate extract had a high concentration of total phenol, tannin, alkaloid, and flavonoid contents when compared to bromocresol green solution. Total flavonoid content was determined by aluminium to petroleum ether, ethyl acetate and methanol extracts. Ethyl acetate extract contained the total phenol of 30.18 and tannins of 83.03 as mg of gallic acid equivalents (GAE), alkaloids of 66.01 as mg of atropine equivalents (AE) and flavonoids of 91.01 as mg of quercetin equivalents (QE).*

Key Words: *Phenol, flavonoid; alkaloid; tannin;* Chrysanthemum *flower.*



Graphical Abstract

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NOTE

Contamination, speciation, and health risk assessment of arsenic in leafy vegetables in Ambagarh Chowki (India)

Madhuri Khute[1] · Saroj Sharma[1] · Khageshwar Singh Patel[2] · Piyush Kant Pandey[2] · Jasmina Allen[2] · Warren Corns[3] · Nelina Georgieva[3] · Elena Bozhanina[4] · Borislav Blazhev[4] · Milosz Huber[5] · Simge Varol[6] · Pablo Martín-Ramos[7] · Yanbei Zhu[8]

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Abstract
Green leafy vegetables are essential for a balanced diet, providing vital nutrients for overall well-being. However, concerns arise due to contamination with toxic substances, such as arsenic, posing risks to food safety and human health. This study analyzes inorganic (iAs), monomethyl (MMA), and dimethyl arsenic (DMA) in specific leafy vegetables (*Amaranthus tricolor* L., *Corchorus olitorius* L., *Cordia myxa* L., *Hibiscus sabdariffa* L., *Ipomoea batatas* (L.) Lam., *Moringa oleifera* Lam., and *Spinacia oleracea* L.) grown in the heavily polluted Ambagarh Chouki region, Chhattisgarh, India. Concentrations of DMA, MMA, and iAs ranged from 0 to 155, 0 to 7, and 131 to 3579 $mg{\cdot}kg^{-1}$, respectively. The health quotient (HQ) for iAs ranged between 0.37 and 3.78, with an average value of 2.58 ± 1.08.

Keywords Arsenic speciation · Pollution · Leafy vegetables · Chhattisgarh · India

Introduction

Arsenic, a potent carcinogenic pollutant in the contemporary global environment, stems from both natural occurrences and human activities, posing a severe toxicity threat. Naturally occurring origins include the erosion and breakdown of rocks/minerals, the intermingling of geothermal fluids with near-surface groundwater, and volcanic events [1]. On the other hand, human-induced actions contributing to arsenic pollution encompass mining, coal and hydrocarbon exploitation, geothermal activities, agricultural practices, the application of fertilizers and pesticides, and the generation of industrial and urban waste [2]. Arsenic pollution adversely affects groundwater and surface water, which are utilized for drinking and irrigation, and it also has detrimental effects on soil, biota, and air quality [3].

The toxicity of arsenic in biological systems is contingent on its speciation pattern, with varying levels of toxicity observed across distinct species [4]. The discharge of arsenic into the environment poses significant threats to human health, especially through the consumption of contaminated drinking water and the contamination of the food chain. Numerous studies have demonstrated that arsenic exposure leads to various diseases, such as cancers, diabetes, hyperkeratosis, hypertension, ischemic heart diseases, lung diseases, melanosis, and peripheral vascular diseases [5–9].

Arsenic pollution and its associated health issues are prevalent in several countries, including Argentina, Bangladesh, Chile, China, India, Japan, Mexico, Mongolia, Nepal, Poland, Taiwan, and Vietnam [9–21]. Among these countries, India is at the forefront of combating arsenic pollution and the problems caused by exposure to it. In India, exposure to arsenic primarily occurs through the consumption of polluted drinking water and contaminated food sources [22]. Groundwater is the primary contributor to arsenic pollution across India, leading to arsenic-related issues in various states, such as Assam, Chhattisgarh, Jharkhand, Uttar Pradesh, and West Bengal, due to excessive exploitation of groundwater resources [23–25].

Presently, agricultural products in many regions of India are also affected by arsenic pollution, as it accumulates in the soil, groundwater, and irrigation water. Extensive studies conducted throughout the country have revealed the extent of this issue in different regions [26–31]. Within the spectrum of plant-based foods, leafy vegetables pose a notable health hazard as a result of arsenic contamination [32–36]. This is particularly concerning because leafy and green vegetables are widely consumed throughout the year in India

Extended author information available on the last page of the article

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RESEARCH

Multi-element Contamination and Health Risks in Green Leafy Vegetables from Ambagarh Chowki, Chhattisgarh, India

Bhagyashri Wakhle[1] · Saroj Sharma[1] · Khageshwar Singh Patel[2] · Piyush Kant Pandey[2] · Mavro Lučić[3] · Željka Fiket[3] · Sema Yurdakul[4] · Simge Varol[5] · Pablo Martín-Ramos[6] · Hanan Mohamed Al-Yousef[7] · Ramzi Ahmed Mothana[7]

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Abstract

Leafy plants are commonly consumed as vegetables in India due to their high nutrient and vitamin content. This study, conducted in Ambagarh Chowki (India), investigated the accumulation potential of 52 elements (including Al, As, Ba, Be, Bi, Ca, Cd, Ce, Co, Cr, Cu, Dy, Er, Eu, Fe, Ga, Gd, Ge, Ho, K, La, Li, Lu, Mg, Mn, Mo, Na, Nb, Nd, Ni, P, Pb, Pr, Rb, Sb, Sc, Se, Sm, Sn, Sr, Tb, Te, Th, Ti, Tl, Tm, U, V, W, Y, Yb, and Zn) in seven leafy vegetable species, namely *Amaranthus tricolor* L., *Corchorus olitorius* L., *Cordia myxa* L., *Hibiscus sabdariffa* L., *Ipomoea batatas* (L.) Lam., *Moringa oleifera* Lam., and *Spinacia oleracea* L. Technique: Inductively coupled plasma mass spectrometry (ICP-MS) was employed for analysis. The maximum concentrations of elements such as Al, Ba, Be, Bi, Cd, Co, Cr, Fe, Ga, Ge, Li, Mn, Ni, Pb, Sb, Th, Tl, U, V, W, and REEs were observed in *S. oleracea* leaves, indicating their highest accumulation potential. In contrast, the maximum concentrations of As were found in *H. sabdariffa* leaves; Ca and Si in *M. oleifera* leaves; Mg, Sr, and Mo in *A. tricolor* leaves; and P, K, Cu, and Zn in *C. myxa* leaves, respectively. Twenty-one elements (Cr, Cd, Pb, Ni, Co, V, Cu, Zn, Fe, Mn, Th, Sb, Ba, Be, Li, Sr, Tl, U, Se, Sn, and REEs) exceeded permissible limits set by the WHO. The elevated hazard index values indicated significant non-carcinogenic effects. The sources of these elements could be attributed to a combination of geological factors and agricultural practices. This study highlights the need for further investigation into the potential health implications of consuming these vegetables in the aforementioned region.

Keywords Leafy vegetables · Multielement accumulation · Trace and toxic elements · Health assessment · ICP-MS

✉ Khageshwar Singh Patel
patelkhageshwarsingh@gmail.com

Bhagyashri Wakhle
wakhlebhagyashri@gmail.com

Saroj Sharma
ssharmagr8@gmail.com

Piyush Kant Pandey
pkpandey@rpr.amity.edu

Mavro Lučić
mlucic@irb.hr

Željka Fiket
zeljka.fiket@irb.hr

Sema Yurdakul
semayurdakul@sdu.edu.tr

Simge Varol
simgevarol@sdu.edu.tr

Pablo Martín-Ramos
pmr@uva.es

Hanan Mohamed Al-Yousef
halyousef@ksu.edu.sa

Ramzi Ahmed Mothana
rmothana@ksu.edu.sa

[1] Department of Chemistry, Government Nagarjuna Post Graduate College of Science, Raipur, CG, India

[2] Department of Applied Sciences, Amity University, Baloda-Bazar Road, Raipur 493225, CG, India

[3] Laboratory for Inorganic Environmental Geochemistry and Chemodynamics of Nanoparticles, Division for Marine and Environmental Research, Ruđer Bošković Institute, Zagreb, Croatia

[4] Environmental Engineering Department, Suleyman Demirel University, Isparta 32260, Turkey

[5] Department of Geology, Faculty of Engineering, Suleyman Demirel University, Isparta 32260, Turkey

[6] ETSIIAA, Universidad de Valladolid, Avenida de Madrid 44, 34004 Palencia, Spain

[7] Pharmacognosy Department, College of Pharmacy, King Saud University, 11451 Riyadh, Saudi Arabia

Contamination and Sources of Surface Water in Korba Coal Basin, Chhattisgarh, India

Khageshwar Singh Patel

patelkhageshwarsingh@gmail.com

Amity University

Piyush Kumar Pandey

Amity University

Bharat Lal Sahu

Guru Ghasidas University

Shobhana Ramteke

Pt. Ravishankar Shukla University

Irena Wysocka

Polish Geological Institute

Sema Yurdakul

Suleyman Demirel University

Dalchand Jhariya

National Institute of Technology Raipur

Pablo Martín-Ramos

ETSIIAA, Universidad de Valladolid

Mohammad Mahmudur Rahman

Global Centre for Environmental Remediation, College of Engineering, Science and Environment, Adustralia

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Research Article

Keywords: Surface water, quality, sources, Korba basin, India

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Research paper

Spatial and temporal variations of dug well water quality in Korba basin, Chhattisgarh, India: Insights into hydrogeological characteristics

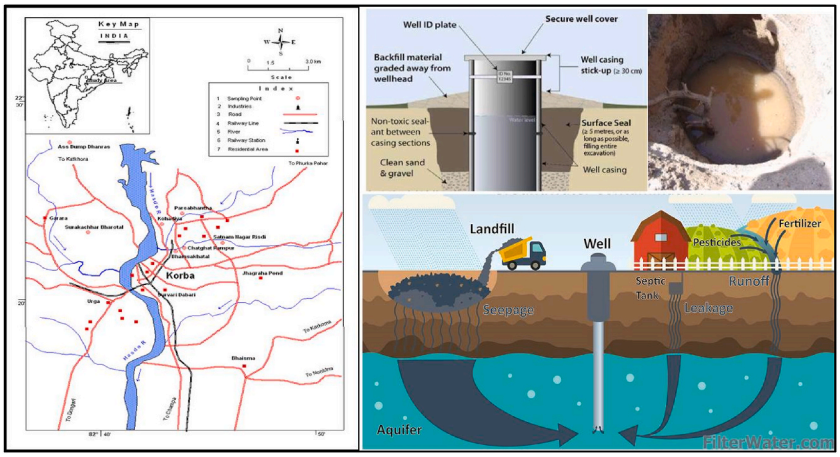
Khageshwar Singh Patel [a,*], Piyush Kant Pandey [a], Sanjay Kumar Sharma [b], Bharat Lal Sahu [c], Shobhana Ramteke [d], Irena Wysocka [e], Sema Yurdakul [f], Simge Varol [g], Pablo Martín-Ramos [h], Dalchand Jhariya [i], Mohammad Mahmudur Rahman [j], Prosun Bhattacharya [k]

[a] Department of Applied Sciences, Amity University, Baloda-Bazar Road, Raipur, 493225, CG, India
[b] Department of Mechanical Engineering, Amity University, Baloda-Bazar Road, Raipur, 493225, CG, India
[c] Department of Chemistry, Guru Ghasidas University, Koni, Bilaspur, Chhattisgarh 495009, India
[d] School of Studies in Environmental Science, Pt. Ravishankar Shukla University, Raipur, 492010, CG, India
[e] Polish Geological Institute, Rakowiecka, Street-00-975, Warsaw, Poland
[f] Department of Environmental Engineering, Suleyman Demirel University, 32260, Isparta, Turkey
[g] Department of Geological Engineering, Suleyman Demirel University, 32260 Isparta, Turkey
[h] ETSIIAA, Universidad de Valladolid, Avenida de Madrid 44, 34004, Palencia, Spain
[i] Department of Applied Geology, National Institute of Technology Raipur, G.E. Road, Raipur, CG, 492020, India
[j] Global Centre for Environmental Remediation, College of Engineering, Science and Environment, The University of Newcastle, Callaghan, NSW, 2308, Australia
[k] KTH-International Groundwater Arsenic Research Group, Department of Sustainable Development, Environmental Science and Engineering, KTH Royal Institute of Technology, Teknikringen 10B, SE-100 44, Stockholm, Sweden

HIGHLIGHTS

- Hydrogeochemical characteristics of water from dug wells in Korba basin were presented.
- Nitrate and fluoride contamination in dug well water of the basin were detected.
- Water of the Korba is mainly Ca-Mg-HCO_3 type, influenced by rocks and water interaction.
- Both geogenic and anthropogenic sources are responsible for dug wells pollution in the basin.
- Water quality evaluation data showed that most waters were suitable for irrigation.

GRAPHICAL ABSTRACT



* Corresponding author.
E-mail addresses: patelkhageshwarsingh@gmail.com, kspatel@rpr.amity.edu (K.S. Patel), pkpandey@rpr.amity.edu (P.K. Pandey), sksharma@rpr.amity.edu (S.K. Sharma), bharatred007@gmail.com (B.L. Sahu), shubrmtk21@gmail.com (S. Ramteke), iwys@pgi.gov.pl (I. Wysocka), semayurdakul@sdu.edu.tr (S. Yurdakul), simgevarol@sdu.edu.tr (S. Varol), pmr@uva.es (P. Martín-Ramos), dcjhariya.geo@nitrr.ac.in (D. Jhariya), mahmud.rahman@newcastle.edu.au (M.M. Rahman), prosun@kth.se (P. Bhattacharya).

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ORIGINAL PAPER

Characterization of Organic Aerosols in the Ambient Air of Raipur, Central India: Distribution, Seasonal Variations, and Source Apportionment

Shobhana Ramteke[1] · Bharat Lal Sahu[2] · Khageshwar Singh Patel[3] · Piyush Kant Pandey[3] · Sema Yurdakul[4] · Pablo Martín-Ramos[5] · Hong Ren[6] · Pingqing Fu[6]

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Abstract

Due to their influence on climate and human health, organic aerosols, a substantial component of atmospheric particulate matter (PM), are a major area of scientific focus. This study investigates the distribution, seasonal variations, and sources of organic constituents —including *n*-alkanes, alkanol acids, alkanols, sugars, phthalate esters, lignin and resin products, sterols, and polycyclic aromatic hydrocarbons (PAHs)— in the coarse mode (PM_{10}) of ambient air samples collected in Raipur, India. The total concentration of the organic aerosols ranged from 5106 to 29,099 ng m^{-3}, with a mean value of 16,701 ± 3355 ng m^{-3}. Fatty acids, phthalates, and levoglucosan were the major components. Seasonal analysis revealed higher concentrations of *n*-alkanes, PAHs, and lignin products during the winter, while alcohols, fatty acids, sterols, and sugars exhibited elevated levels in both autumn and winter. Size segregation analysis showed that all organic species, except phthalates and PAHs, accumulated predominantly in the fine and ultrafine particle fractions. Source apportionment through factor analysis revealed a complex mixture of sources shaping aerosol composition, including vehicular emissions, various combustion activities (biomass burning and charbroiled cooking), natural background factors, and the combination of urban dust and biogenic materials. The findings highlight the significant climatic and health implications of organic aerosols in the study region, necessitating urgent mitigation measures to address air pollution.

Keywords Distribution · PM_{10} · Seasonal variations · Source apportionment · Toxicity

✉ Khageshwar Singh Patel
patelkhageshwarsingh@mail.com

Shobhana Ramteke
shubrmtk21@gmail.com

Bharat Lal Sahu
bharatred007@gmail.com

Piyush Kant Pandey
pkpandey@rpr.amity.edu

Sema Yurdakul
semayurdakul@sdu.edu.tr

Pablo Martín-Ramos
pmr@uva.es

Hong Ren
renhong@mail.iap.ac.cn

Pingqing Fu
fupingqing@mail.iap.ac.cn

[1] School of Studies in Environmental Science, Pt. Ravishankar Shukla University, Raipur, CG 492010, India

[2] Department of Chemistry, Guru Ghasidas Central University, Bilaspur, CG 495009, India

[3] Department of Applied Science, Amity University, Baloda-Bazar Road, Raipur, CG 493225, India

[4] Environmental Engineering Department, Suleyman Demirel University, Isparta 32260, Turkey

[5] ETSIIAA, Universidad de Valladolid, Avenida de Madrid 44, Palencia 34004, Spain

[6] Atmospheric Chemistry & Biogeochemistry, Institute of Atmospheric Physics, LAPC, Chinese Academy of Sciences, Beijing 100029, China

toxics

MDPI

Article

Multi-Element Exposure and Health Risks of Grains from Ambagarh Chowki, Chhattisgarh, India

Bhagyashri Wakhle [1], Saroj Sharma [1], Khageshwar Singh Patel [2,*], Piyush Kant Pandey [2], Antonela Blažević [3], Željka Fiket [3], Sema Yurdakul [4], Simge Varol [5], Pablo Martín-Ramos [6], Hanan M. Al-Yousef [7] and Ramzi A. Mothana [7]

1 Department of Chemistry, Government Nagarjuna Post Graduate College of Science, G. E. Road, Raipur CG 492010, India; wakhlebhagyashri@gmail.com (B.W.); ssharmagr8@gmail.com (S.S.)
2 Department of Applied Sciences, Amity University, Baloda-Bazar Road, Raipur CG 493225, India; pkpandey@rpr.amity.edu
3 Division for Marine and Environmental Research, Ruđer Bošković Institute, Bijenička Cesta 54, 10000 Zagreb, Croatia; ablazev@irb.hr (A.B.); zeljka.fiket@irb.hr (Ž.F.)
4 Environmental Engineering Department, Suleyman Demirel University, 32260 Isparta, Turkey; semayurdakul@sdu.edu.tr
5 Geological Engineering Department, Faculty of Engineering and Natural Sciences, Suleyman Demirel University, 32260 Isparta, Turkey; simgevarol@sdu.edu.tr
6 ETSIIAA, Universidad de Valladolid, Avenida de Madrid 44, 34004 Palencia, Spain; pmr@uva.es
7 Department of Pharmacognosy, College of Pharmacy, King Saud University, Riyadh 11451, Saudi Arabia; halyousef@ksu.edu.sa (H.M.A.-Y.); rmothana@ksu.edu.sa (R.A.M.)
* Correspondence: patelkhageshwarsingh@gmail.com or kspatel@rpr.amity.edu

Abstract: Rice, wheat, and maize grains are staple foods, widely consumed for their mineral and nutritional values. However, they can accumulate toxic elements from contaminated soils, posing health risks. This study investigates the bioaccumulation patterns of 52 elements (including nutrients, heavy metals, and rare earth elements) in various parts (grain, husk, straw, and root) of cereals grown in a heavily polluted region. The results revealed that rice grains exhibited a higher accumulation (Σ33.4 mg/kg) of toxic elements (As, Cu, Cr, Ni, and Pb) than wheat (Σ26.6 mg/kg) and maize (Σ16.2 mg/kg) grains, with the high-yield RI64 cultivar (Σ47.0 mg/kg) being the most susceptible. Across the rice plant, accumulation increased in the order of grain < husk < straw < root. Elements like P, K, Cu, and Zn showed the highest enrichment. Worryingly, the most toxic elements, such as As, Pb, and Cd, exceeded permissible limits across grains, straws, and husks. Health risk assessment indicated that wheat and maize pose greater non-cancer and cancer risks than rice. Despite being grown in a highly contaminated region, the study identifies some rice cultivars like *Luchai* and *Sarna* as relatively safer options due to a lower accumulation of toxic elements.

Keywords: grains; health hazards; mineral; potentiality; toxicity

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1. Introduction

Cereals are among the most widely produced agricultural products worldwide. Cereals serve as a major energy source for humans, meeting the body's carbohydrate requirements [1]. Grains (seeds) of *Poaceae* grasses, such as rice, wheat, and maize, are extensively cultivated due to their use as food, nutrient, fiber, minerals, protein, vitamin, and antioxidant sources, and as renewable energy resources [2–5]. They are the main source of several trace elements (Mn, Fe, Co, Cu, Zn, and Se) needed for the proper growth and development of living organisms [6]. Iron plays a crucial role in oxygen transport, and its

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Determination of Physico-chemical Analysis of Different Soft Drinks Brands in Raipur City

[1]Bhanupriya Sahu, [1*] Dr. Shobhana Ramteke, and [2]Dr. Bharat Lal Sahu
[1]School of Studies in Environmental Science, Pt. Ravishankar Shukla University, Raipur-492010, CG, India
[2]Assistant Professor, Department of Chemistry, Guru Ghasidas Central University, Bilaspur, CG 495009, India.
Email – [1]shubrmtk21@gmail.com

Abstract: *Since soft drinks are consumed by many people all over the world, research into their qualitative and quantitative analysis is essential. We examined ten different soft drink brands that we got from the Raipur, Chhattisgarh, local market in order to achieve this. While pH, conductivity, density, potassium, sodium, and total soluble solids were estimated quantitatively, carbon dioxide, glucose, sucrose, ascorbic acid, phosphates, caffeine, and alcohol were analysed qualitatively. The different techniques determined this physico-chemical analysis. The obtained results showed that the phosphates and carbon dioxide in these soft drinks caused them to be highly acidic, ranging from 2.834±0.218. Because of the soluble ions, all of the soft drinks had a high conductivity. In a similar vein, the high sugar content made the density greater than that of water. At 1.0346±0.075 mg/L, the concentration of total soluble solids—most commonly known as sucrose—was likewise high. The majority of cold beverages have a small amount of calcium (7.8±2.240 mg/L), a small amount of sodium (23.4±8.925 mg/L), and a potassium concentration of 45±32.468 mg/L. Calcium concentration, on the other hand, is extremely low. A titrimetric method was used to quantify the acid strength; the maximum concentration of acid is 167.942±119.178 mg/L.*

Key Words: *Soft drinks, Identification, Qualitative analysis, Flame photometer.*

1. INTRODUCTION:

The beverage industry in Raipur, Chhattisgarh, has expanded quickly in the past few years. A broad variety of products, including soft drinks, squashes, fruit juices, milk, energy drinks, and more, are now produced by this industry [1–5]. The beverage industry in Raipur has grown by 30% more in the last few years, according to the statistics. Additionally, it has been noted that Raipur is home to over 170 beverage industrial units [6–10]. There are two categories for beverages: alcoholic and non-alcoholic, with the latter further divided into hot and cold varieties [11–14].

The early 1959s saw the advent of the cold drink/soft drink era, but due to the industry's attraction and profitability, numerous multinational corporations introduced their products in a variety of flavours under various brand names, including Sprite, 7up, Pepsi, Mountain Dew, Fanta, Mirinda, etc. People drink these beverages based on their moods and body temperatures. For example, it's commonly thought that Sprite, Fanta, and Mirinda make you feel lighthearted, while Pepsi and Coke make your heart and brain work harder. Soft drink brands and varieties abound, distributed nationwide by diverse brewing industries [15–20]. These beverages are frequently drink on a daily basis, particularly after engaging in taxing activities like sports and hard labour [21]. Additionally, because of their reasonably low costs, they are widely consumed on leisure and relaxation excursions and are provided to the public for events like traditional marriages, weddings, funerals, etc. [22]. Soft drinks are highly consumed because of their distinct flavour and taste as well as their capacity to slake thirst [25]. These qualities are determined by the ingredients included, which include sugar for sweetness, carbonated water (water compressed with carbon dioxide to relieve extreme thirst), and flavouring agents for enhancing drink flavour [26]. Soft drinks offer more than just flavour; they also include nutrients and health benefits to the body in the form of vitamins, phosphates, acids, and antioxidants [27–30]. However, because soft drinks are consumed in large quantities and are in high demand, quality control may be difficult to maintain throughout the production process, particularly during sterilisation and purification.

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Arsenic Speciation and Contamination in Cereals from Chhattisgarh, India

Madhuri Khute[1], Saroj Sharma[1], Khageshwar Singh Patel[2*], Piyush Kant Pandey[2], Jasmina Allen[3], Warren Corns[3], Nelina Georgieva[4], Elena Bozhanina[4], Borislav Blazhev[4], Simge Varol[5], Pablo Martín-Ramos[6], Yanbei Zhu[7]

[1]Department of Chemistry, Government Nagarjuna Post Graduate College of Science, India
[2]Department of Applied Sciences, Amity University, India
[3]PS Analytical Ltd, United Kingdom
[4]Central Laboratory for Chemical Testing and Control, Bulgaria
[5]Department of Geology, Suleyman Demirel University, Turkey
[6]Agricultural and Forestry Engineering Department, ETSIIAA, Universidad de Valladolid, Spain
[7]National Institute of Advanced Industrial Science and Technology (AIST), Japan

ABSTRACT

Cereals serve as a major food source for humans and animals. This investigation explored the presence of arsenic species in cereal crops grown in the contaminated area of Ambagarh Chouki (Chhattisgarh, India). Rice, wheat and maize, along with husk, straw and soil samples, were analyzed using hydride generation–atomic fluorescence spectrometry (HG–AFS), and inductively coupled plasma-mass spectrometry (ICP-MS). Significant inorganic arsenic (iAs) contamination was found in rice, wheat, and maize plants, with the highest levels in roots, followed by husk, straw, and grain. Inorganic arsenic content in rice grain ranged from 229.9 mg kg^{-1} to 684.7 mg kg^{-1}, while in wheat and maize it ranged from 84.6 mg kg^{-1} to 218.5 mg kg^{-1} and from 20.0 mg kg^{-1} to 26.2 mg kg^{-1}, respectively. All cases exhibited a hazard quotient exceeding 1. Organic arsenic, specifically monomethyl arsenic (MMAs) and dimethyl arsenic (DMAs), were detected in rice plants. The findings address speciation, enrichment, sources, transfer factors, and health risk assessment. Overall, this study emphasizes the detrimental health effects of consuming cereals grown in this region, necessitating intervention by the Indian Government.

Keywords: Arsenic speciation; Grain; Health risk assessment; Pollution; Toxicity

INTRODUCTION

Exposure to arsenic and heavy metals from contaminated drinking water and food sources is a major concern, prompting extensive research in this field [1-3]. Among these contaminants, the presence of arsenic in grains has garnered global attention due to its varying concentrations both within and across countries [4-7]. The toxicity of arsenic is intricately linked to their speciation patterns, which exhibit differences among different species [8]. Rice, in particular, is highly vulnerable to arsenic contamination, primarily due to its aquatic nature [9]. In the Ambagarh Chouki area of Chhattisgarh, India, the issue of arsenic contamination has become particularly prominent [10,11]. This study aims to investigate the contamination levels and sources of arsenic species in various organs (grain, husk, straw, and root) of cereal crops, including rice, wheat, and maize, cultivated in the contaminated soil of this region. By examining these aspects, we can gain valuable insights into the

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Corresponding author Khageshwar Singh Patel, Department of Applied Sciences, Amity University, India, E-mail: kspatel@rpr.amity.edu

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ORIGINAL PAPER

Particulate toxic elements' oxidative potential and gastrointestinal bioaccessibility features in the vicinities of coal-fired mineral processing industries, India

Archi Mishra · Shamsh Pervez · Yasmeen Fatima Pervez · Madhuri Verma · Princy Dugga · Sushant Ranjan Verma · Indrapal Karbhal · Kallol K. Ghosh · Manas Kanti Deb · Manmohan L. Satnami · Kamlesh Shrivas

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Abstract Particulate matter (PM) poses significant health risks due to its ability to generate reactive oxygen species (ROS) and transport toxic metal(loid)s into the human body. In this study, an in vitro physiologically based extraction test (PBET) method, allowing the simulation of the gastric phase (GPh) and intestinal phase (IPh) of human digestion, was applied to evaluate bioaccessibility of eleven potentially toxic elements (Al, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, and Zn) in airborne particulate matter (APM) samples collected from an urban-residential area in Chhattisgarh, India. Additionally, oxidative potential (OP) was assessed using the dithiothreitol (DTT) assay for a comprehensive understanding of PM toxicity. The bioaccessibility of metal(loid)s varied significantly across phases, with gastric phase solubility upto ~ 75%, attributed to its lower pH enhancing metal dissolution. Elevated DTT responses were recorded for PM_{10} and $PM_{2.5}$, driven primarily by Fe, Zn, and Pb, underlining their pivotal role in oxidative stress generation. Correlation analyses demonstrated strong associations between bioaccessible fractions and OP, especially in the GPh. The findings advance understanding by linking bioaccessibility with ROS generation and highlight the importance of particle size and solubility in assessing the health risks posed by PM. These insights provide a foundation for improved risk assessments and mitigation strategies targeting emissions from high-temperature processing industries, and vehicular activities, on a global scale.

Keywords In vitro bioaccessibility · DTT assay · Oxidative potential · Particulate matter · Reactive oxygen species

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A. Mishra · S. Pervez (✉) · M. Verma · S. R. Verma · I. Karbhal · K. K. Ghosh · M. K. Deb · M. L. Satnami · K. Shrivas
School of Studies in Chemistry, Pt. Ravishankar Shukla University, Raipur, Chhattisgarh 492010, India
e-mail: shamshpervez@gmail.com

Y. F. Pervez
Government Dr. Waman Wasudev Patankar Girls PG College, Durg, Chhattisgarh, India

P. Dugga
Government Danteshwari P.G. Mahila College, Jagdalpur, Chhattisgarh, India

Introduction

Particulate matter (PM) is a critical environmental and public health concern due to its ability to transport toxic metals and metalloids into the human body. These elements, often released during industrial processes, vehicular emissions, and coal combustion, pose significant risks ranging from respiratory ailments to cardiovascular and neurological disorders (Lin & Yu, 2019; Gao et al., 2020; Kumar et al.,

Fourier Transform Infrared Spectroscopy (FTIR) Spectral evaluation in *Chrysanthemum* flower species

Aishwariya Shukla[1], Shobhana Ramteke[1*], Bharat Lal Sahu[2], Manas Kanti Deb[1]

[1]School of Studies in Environmental Science, Pt. Ravishankar Shukla University, Raipur-492010, CG, India.

[2]Department of Chemistry, Guru Ghasidas Central University, Bilaspur, CG 495009, India.

***Corresponding author**: shubrmtk21@gmail.com

Abstract.

The current study's goal was to identify the various functional groups found in chrysanthemums using FTIR Spectroscopy. The FTIR spectrometer identifies 4000 series, with a scan range of 4,000–400 cm-1, was used to perform the FTIR analysis. The presence of distinct peak values with various useful mixtures of functional groups, including hydroxy groups (–OH), aliphatic, metal carbonyl, alcohols (–OH), nitrile (–C≡N), phenols, alkynes (CnH2n-2), ketones (C=O), carboxylic acids (R–COOH), amides (– CONH2), and aromatics, was revealed by FTIR spectroscopy analysis. The FTIR investigation showed that there were 17 functional groups in the chrysanthemum flowers. The FTIR spectra showed an intense peak that correlated to the hydroxyl groups, phenol alcohol, and aromatic compounds, respectively, at 3348.42 cm^{-1}, 1380.02 cm^{-1}, and 1480.33 cm^{-1} in various flower species. In light of this, the current investigation found that, in contrast to the extracts of *Chrysanthemum* flowers' leaves and bark, the flower extract had robust functional groups. FTIR spectroscopy was used to quantitatively analyse the flavonoids, phenolic acids, anthocyanins, and carotenoids present in the nine chrysanthemum cultivars' flowers.

Keywords: FTIR; Functional groups; *Chrysanthemum* flowers

Introduction

The present investigation assessed the total phenol, tannin, alkaloid, and flavonoid contents of *Chrysanthemum* extracts prepared in petroleum ether, ethyl acetate, and methanol. In order to extract the powdered wood material from the soxhlet device, a continuous hot percolation process was employed, with petroleum ether, ethyl acetate, and methanol serving as the solvents. The standard used was gallic acid. Utilizing the proportions of aluminum to ethyl acetate, petroleum, and petroleum ether. For many centuries, plants have given humans access to herbal remedies for a variety of illnesses. Herbal medicines have been the cornerstone of traditional Indian medicine systems like Ayurveda, Unani, and Sidha for the treatment and curing of a wide range of ailments. Since ancient times, crude medicines derived from plants and animals have been utilised for their therapeutic properties through a straight forward process that does not require the isolation of pure compounds. The components of a crude medication determine its pharmacological action.

Therefore, a plant species can be considered biosynthetic for the chemical compounds it produces, such as proteins, carbohydrates, and fats that animals and humans use as food, as well as for the vast array of other compounds it produces, such as alkaloids, terpenoids, flavonoids, glycosides, and others that have specific physiological effects. The majority of the intended positive attributes are caused by these chemical compounds. Asteraceae is the family of perennial plants that includes the species *Chrysanthemum* morifolium. One of the four most well-known *chrysanthemum* species in China is *Chrysanthemum* morifolium, also referred to as mums. *Chrysanthemum* morifolium has been described as having an affinity for the liver

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