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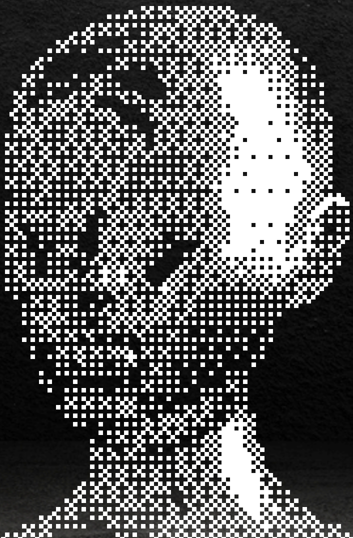

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CHARACTERIZATION AND IN VITRO BIOLOGICAL EVALUATION OF PYRAZOLINE DERIVATIVES AS POTENTIAL ANTIFUNGAL AGENTS

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Abstract

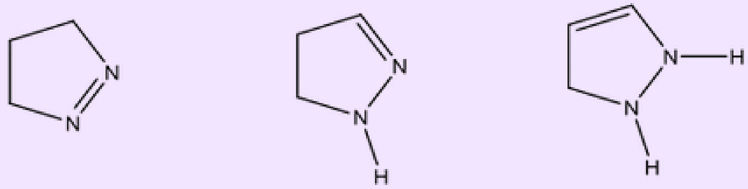
This study designed and successfully synthesized a number of novel alpha,beta-unsaturated carbonyl compounds and their pyrazoline derivatives. All synthesized compounds were characterized by IR, mass spectrometry, 1H NMR and 13C NMR spectroscopy. Pyrazoline is a dihydropyrazole with only one double endo cyclic bond. Due to established pharmacological results, the synthesis of pyrazoline derivatives from chalcones is an active area of investigation. In present study acetophenone and benzaldehyde were reacted to produce chalcones. After that, prepared chalcones interact with isoniazid in the presence of glacial acetic acid, resulting in the formation of pyrazoline derivative. Color, molecular weight, molecular formula, crystal structure, solubility, melting temperature, retardation factor (Rf), and yield percentage were among the other physical characteristics that were investigated. Each synthesized derivative's structure was confirmed by IR, 1HNMR, and MASS spectroscopic data and elemental analysis. Spectral analysis (IR, MASS, and NMR) was used to characterize all the synthesized compounds. These substances were tested for their antibacterial properties against gram-positive and gram-negative bacterial. Agar cup plate method was also used to perform antifungal activity. Agar streak dilution technique was also used to determine the compounds minimum inhibitory concentrations (MICs). The compounds that were synthesized were found to have the strongest in-vitro antifungal properties against A. niger and P. chrysogenum.

Keywords Antifungal properties, MIC, Pyrazoline, Spectral analysis.

Introduction:

Heterocyclic compounds have a wide range of biological potential, which makes them significant in medicinal chemistry. Nitrogen-containing heterocycles have always attracted researchers due to their versatility and variety of biological roles. Pyrazoline is an exciting member of the heterocyclic family that scientists have discovered in their search for new compounds with important and diverse features. Pyrazolines are often used scaffolds in the architecture of many important biological and pharmaceutical molecules. Black pepper (Piper nigrum) is one of the plants in the Piperaceae family that naturally contain pyrazolines. It has recently been discovered that the production of pyrazoline alkaloids by sponges, corals, and other marine species exhibits cytotoxic and anti-inflammatory properties. Nonetheless, pyrazole is included in the structures of several alkaloids, such as sesquiterpene pyrazolines, piperidine alkaloids, and pyrazoline alkaloids.

Through the formation of N–N bonds, natural pyrazoline has interacted with living things. As a result, pyrazoline derivatives are the most well-known heterocyclic compounds with potential biological activity, such as non-steroidal mineralocorticoids and HIV reverse transcriptase inhibitors, which are non-nucleoside antagonists of neurotensin receptors with analgesic effects. Antifungal , antimicrobial , antiviral, antitumor1, antitubercular, antimalarial, anti-amoebic, antidiabetic, antiinflammatory, anticancer. Pyrazoline, also known as a dihydro derivative of pyrazole, can exist in three different forms depending on the position of the double bond, i.e., 1-pyrazoline, 2-pyrazoline, ad 3-pyrazoline.



1-pyrazoline

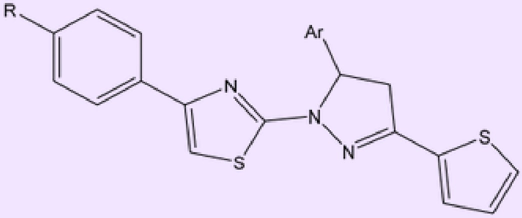
2-pyrazoline

1,3-pyrazoline

Fig-1 Different Structure of Pyrazolinee

Using the remarkable straight forward reflux reaction of α, β-unsaturated aldehydes and ketones with phenyl hydrazine in acetic-acid which quickly gained popularity Fisher and Knoevenagel synthesized and characterized 2-pyrazolines in the 19th century. Though pyrazolines green status is debatable, there have been numerous attempts to use it as a synthetic building block in the creation of good lead compounds in the library of new heterocyclic compounds.

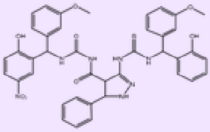
Antifungal and antibacterial properties Ozdemie et al. synthesized a number of 1-(4-aryl-2- thiazple)-3(2-thienyl)-5-aryl-2-pyrazoline derivatives, which were then tested for their antimicrobial properties against Salmonella typhimurium, Bacillus cereus, Escherichiacoli, Streptococusfaecalis, Staphylococcu saureus, Aeromonas hydrophila, Candidi glabrata, and Candida albicans. A notable degreeof activity was moted.



In the presence of glacial acetic acid, chalcones reacted with aryloxy acetyl hydrazines to produce a range of 1, 3, and 5 substituted pyrazoline derivatives with good yields (50-60 %). Research on the antibacterial, antifungal, and antitubercular properties of the synthesized compounds revealed that they exhibited considerable action against ampicillin and moderate to significant antifungal activity against griseofulvin.

Physical and analytical data of new synthesized pyrazolines derivatives

Compound -A **Structure**



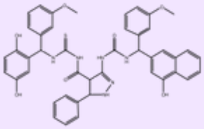
IUPAC NAME - N-((2-hydrox-5-nitrophenyl)(3- methoxyphenyl)methyl)carbamoyl)-3-(-3((2-hydroxyphenyl)(3- methoxyphenyl)methyl)thioureido)-5- phenyl-4,5dihro-1H-pyrazole-4-carboxamide.

Molecular Formula- $C_{41}H_{37}N_5O_{10}S$ **Color-** White **Yield-** 32%

Molecular Weight-775.84 **Melting Point-**165°C

Elemental Analysis- C(64.25%), H(4.99%), N(9.37%), O(17.12%), S(4.29)%

Compound- B **Structure**



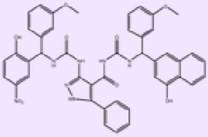
IUPAC NAME- N-((2,5-dihydroxphenyl)(3- methoxyphenyl)methyl)carbamothioyl)-3-(-3((4-hydroxynapthalen-2-yl)(3- methoxyphenyl)methyl)ureido)-5- phenyl-4,5dihydro-1H-pyrazole-4-carboxamide.

Molecular Formula- $C_{40}H_{40}N_6O_7S$ **Color-** Brown **Yield-** 46%

Molecular Weight-796.90 **Melting Point-**162°C

Elemental Analysis- C(66.32%), H(5.06%), N(10.55%), O(14.05%), S(4.02)%

Compound -C **Structure**



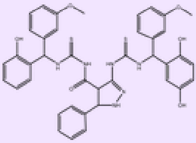
IUPAC NAME - 3-(3-((2-hydroxy-5-nitrophenyl)(3- methoxyphenyl)methyl) ureido-N-(((4-hydroxynapthalen-2-yl)(3- methoxyphenyl)methyl)carbomoyl)- 5-phenyl-4-1H-pyrazole-4-carboxamide.

Molecular Formula- $C_{44}H_{37}N_7O_9$ **Color-** Brown **Yield-** 32%

Molecular Weight-807.82 **Melting Point**-165^{0}C

Elemental Analysis- C(65.42%), H(4.62%), N(12.14%), O(17.82%)

Compound –D **Structure**



IUPAC NAME - 3-(3-((2,5-dihydroxyphenyl)(3-methoxyphenyl)methyl)thioureido-N-(((2-hydroxyphenyl)(3-methoxyphenyl)methyl)carbomothioyl)-5-phenyl-4,5-dihydro-1H-pyrazole-4-carboxamide.

Molecular Formula- $C_{40}H_{38}N_6O_6S_2$ **Color-** Brown **Yield-** 41%

Molecular Weight-762.90 **Melting Point**-170^{0}C

Elemental Analysis- C(62.98%),H(5.02%),N(11.02%),O(12.58%), S (8.40)%

Experimental Materials and methods

The compounds melting point are uncorrected and were measured in open capillaries. The 1H and 13CNMR spectra of compounds were recorded on a bruker 500 MHZ model in DMSO using TMS as an internal standard. The mass spectrometer was used to record the LC-MS spectra, and the thermonicolet FT-IR spectrophotometer was used to record the IR spectra data in KBR medium. All chemical reagents and solvents were sourced from commercial suppliers and were used without additional purification. The 1H and 13C-NMR experiments were conducted by utilising a Bruker Avance 500 MHz Ultrashield spectrometer. About 15 mg of the sample was dissolved in CDCl3. The chemical shift values were calculated in ppm and δ-scale, and the coupling constant, J, was calculated in Hertz (Hz), and their multiplicities expressed as m = multiplet, q = quartet, t = triplet, dd = double doublet, brd = broad doublet, d = doublet, brs = broad singlet, and s = singlet. The ESI-MS spectra were recorded on an ion trap LCQ Advantage Max mass spectrometer The melting point apparatus was utilised to obtain the melting points.

Result and discussion

The purified final synthesized compounds were characterized as pyrazoline derivatives on the basis of their spectral data (IR, 1H NMR, and Mass) and Elemental analysis.

Compound-A

Elemental Composition Calculated: C(64.25%), H(4.99%), N(9.37%), O(17.12%),S(4.29)%

IR(KBr)cm^{-1}: IR spectrum of the respective compound code I has shown characteristic peak of 3705(Ar-OH stretching),1710(C=O),1628(NO_2),3309(N-H stretching for 2^{nd} amines),1509(C=S),1085(C-N stretching),1372(OH bending), 773(N-H wagging).

^{1}HNMR($CDCl_3$)δ:13.12(s,1H,NH),8.12(d,1H,NH),9.92(d,1H,NH-Pyrazoline ring),2.5(d,1H,CH,Pyrazoline ring),3.9(dd,1H,CH,Pyrazoline ring),5.16(s,1H,CH),9.63(s,1H,Ar-OH),8.03,8.06,7.07(M,3H,ArH),6.80,7.05,6.93,7.24(M,4H,ArH),7.33,7.29,7.24,7.29,7.33(M,5H, Ar-H),3.67(S,3H,CH_3)

^{13}CNMR ($CDCl_3$) δ: 50.3 (1C,CH of Pyrazoline ring), 46.3(1C,CH of Pyrazoline ring), 170.3(1C,C=O), 185.0(1C,C=S), 155,135,136,120,127(6C-C_6H_5), 128(6C- C_6H_5), 58.0(1C,CH), 55.8(1C,OCH_3)

Compound-B

Elemental Composition Calculated: C(62.98%),H(5.02%),N(11.02%),O(12.58%), S (8.40)%

IR(KBr)cm^{-1}: IR spectrum of the respective compound code III has shown characteristic peak of 3618(Ar-OH stretching),1710(C=O),1624(NO_2),3289(N-H stretching for 2^{nd} amines), 1522 (C=S), 1058(C-N stretching), 1340(OH bending), 755(N-H wagging)

^{1}HNMR($CDCl_3$)δ:13.11(s,1H,NH),8.11(d,1H,NH),9.90(d,1H,NH-Pyrazoline ring),2.3(d, 1H,CH,Pyrazoline ring),3.7(dd,1H,CH,Pyrazoline ring),5.14(s,1H,CH),9.61(s,1H,Ar-OH),8.01,8.04,7.05(M,3H,ArH),6.79,7.03,6.91,7.22(M,4H,ArH),7.31,7.27,7.23,7.27,7.31(M,5H, Ar-H),3.65(S,3H,CH_3)

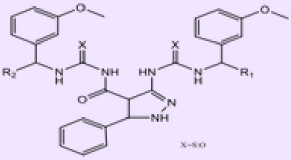
^{13}CNMR ($CDCl_3$) δ: 50.1 (1C,CH of Pyrazoline ring), 46.1(1C,CH of Pyrazoline ring), 169.2(1C,C=O), 183.0(1C,C=S), 153,132,133,118,125(6C-C_6H_5), 127(6C- C_6H_5), 56.0(1C,CH), 55.5(1C,OCH_3)

MS(Relative abundance%)m/z: 762

ANTI-FUNGAL ELUCIDATION

ANTI-MICROBIAL ELUCIDATION- The well diffusion method was used to screening compounds A, B and C for antimicrobials..

ADOPTED METHODOLOGY- The antibacterial activity of compounds B, C and D was investigated based on their structural characteristics.

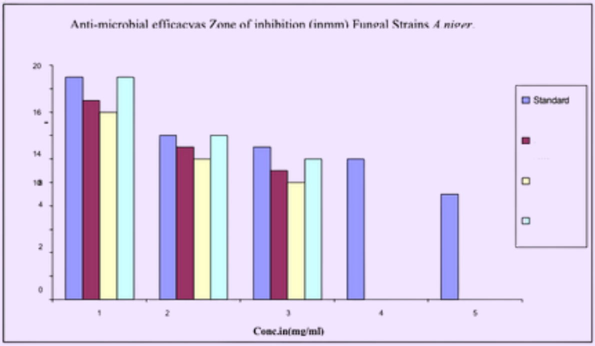


Entry	C	D	B
R_1	p-nitro phenol	Phenol	Hydroquinone
R_2	β- Naphthol	Hydroquinone	β - Naphthol

Table N0 - 1

Anti- fungal activity of synthesized compounds N-substituted-3-substituted-5-phenyl-4,5-dihydro-1H-pyrazole-4-carboxamide compounds code B, C, and D compared with the standard drug against fungal strains *A. Niger.*

Conc.in (mg\ml)	Antimicrobial efficacy as Zone of inhibition (in mm) Fungal Strains *A. Niger.*			
	Standard	Comp.B	Comp.C	Comp.D
100	19	17	16	19
50	14	13	12	14
25	13	11	10	12
12.5	12	0	0	0
6.25	9	0	0	0



Graph no -1

Graphical representation of synthesized compounds N-substituted-3-substituted-5-phenyl-4,5-dihydro-1H-pyrazole-4-carboxamide compounds code B, C, and D compared with the standard drug against fungal strains A. Niger.

Conclusion :

In the study we have successfully synthesized new pyrazolines derivatives compounds . The proper analysis of the synthesis of new pyrazolines derivatives has been systematically evaluated by FT-IR, 1HNMR, CNMR, and Mass spectrometry. In conclusion, the review highlights the synthesis of pyrazolines with their potency as antifungal agents. It will benefit the researchers by developing novel molecules with more potency, better selectivity, and minimum side effects. Thus, this article is a useful supplement and will contribute to the further development and synthesis of medicinally important pyrazolines derivatives.

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An Analytical Study of Bacterial Growth and Reproduction

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Abstract

BBacteria are among the most primitive yet highly adaptable living organisms on Earth. Their remarkable ability to grow and reproduce rapidly allows them to survive in diverse and extreme environments. Understanding bacterial growth and reproduction is fundamental to microbiology, medicine, agriculture, and biotechnology. This research paper presents an analytical study of bacterial growth patterns, phases of growth curve, and mechanisms of reproduction, primarily focusing on binary fission. The paper also examines environmental factors influencing bacterial multiplication and highlights the significance of bacterial growth studies in health, industry, and environmental sciences.

Keywords : acteria, Growth Curve, Binary Fission, Reproduction, Microbiology

Introduction:

Bacteria are unicellular prokaryotic organisms lacking a true nucleus and membrane-bound organelles. Despite their simple structure, bacteria exhibit complex physiological processes that enable rapid growth and reproduction. Bacterial growth refers to an increase in the number of bacterial cells rather than an increase in cell size. Under favorable conditions, bacteria can multiply exponentially, making them significant both as beneficial organisms and as disease-causing agents.

The study of bacterial growth and reproduction is essential for controlling infectious diseases, improving industrial fermentation processes, and understanding ecological nutrient cycles.

Concept of Bacterial Growth

Bacterial growth is defined as the orderly increase in the number of bacterial cells over time. It is usually measured by cell count, cell mass, or turbidity of the culture medium. Unlike multicellular organisms, bacterial growth occurs through cell division rather than enlargement.

Bacterial Growth Curve

When bacteria are grown in a closed system (batch culture), their growth follows a characteristic pattern known as the bacterial growth curve, which consists of four distinct phases:

a) Lag Phase

- Cells adapt to the new environment.
- No immediate increase in cell number.
- Enzyme synthesis and metabolic activity increase.

b) Log (Exponential) Phase

- Rapid cell division occurs.
- Population doubles at a constant rate.

Discussion

Bacterial growth and reproduction demonstrate the efficiency of prokaryotic life forms. Their ability to reproduce rapidly allows adaptation to environmental changes, but also poses challenges in controlling pathogenic bacteria. Analytical approaches to growth patterns help scientists predict bacterial behavior under various conditions, enabling effective control and utilization.

Conclusion

Bacterial growth and reproduction are fundamental biological processes that influence ecosystems, human health, and industrial applications. Binary fission allows rapid population expansion, while growth phases reflect the dynamic interaction between bacteria and their environment. An analytical understanding of these processes is essential for advancements in microbiology, medicine, and biotechnology.

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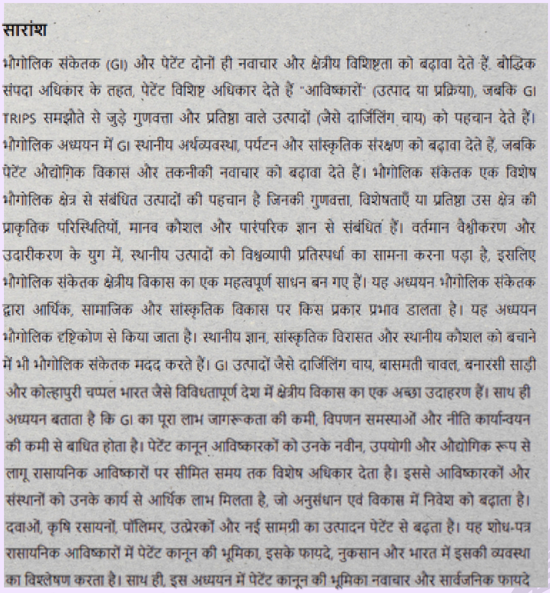

सारांश

भौगोलिक संकेतक (GI) और पेटेंट दोनों ही नवाचार और क्षेत्रीय विशिष्टता को बढ़ावा देते हैं. बौद्धिक संपदा अधिकार के तहत, पेटेंट विशिष्ट अधिकार देते हैं "आविष्कारों" (उत्पाद या प्रक्रिया), जबकि GI TRIPS समझौते से जुड़े गुणवत्ता और प्रतिष्ठा वाले उत्पादों (जैसे दार्जिलिंग चाय) को पहचान देते हैं। भौगोलिक अध्ययन में GI स्थानीय अर्थव्यवस्था, पर्यटन और सांस्कृतिक संरक्षण को बढ़ावा देते हैं, जबकि पेटेंट औद्योगिक विकास और तकनीकी नवाचार को बढ़ावा देते हैं। भौगोलिक संकेतक एक विशेष भौगोलिक क्षेत्र से संबंधित उत्पादों की पहचान है जिनकी गुणवत्ता, विशेषताएँ या प्रतिष्ठा उस क्षेत्र की प्राकृतिक परिस्थितियों, मानव कौशल और पारंपरिक ज्ञान से संबंधित हैं। वर्तमान वैश्वीकरण और उदारीकरण के युग में, स्थानीय उत्पादों को विश्वव्यापी प्रतिस्पर्धा का सामना करना पड़ा है, इसलिए भौगोलिक संकेतक क्षेत्रीय विकास का एक महत्वपूर्ण साधन बन गए हैं। यह अध्ययन भौगोलिक संकेतक द्वारा आर्थिक, सामाजिक और सांस्कृतिक विकास पर किस प्रकार प्रभाव डालता है। यह अध्ययन भौगोलिक दृष्टिकोण से किया जाता है। स्थानीय ज्ञान, सांस्कृतिक विरासत और स्थानीय कौशल को बचाने में भी भौगोलिक संकेतक मदद करते हैं। GI उत्पादों जैसे दार्जिलिंग चाय, बासमती चावल, बनारसी साड़ी और कोल्हापुरी चप्पल भारत जैसे विविधतापूर्ण देश में क्षेत्रीय विकास का एक अच्छा उदाहरण हैं। साथ ही अध्ययन बताता है कि GI का पूरा लाभ जागरूकता की कमी, विपणन समस्याओं और नीति कार्यान्वयन की कमी से बाधित होता है। पेटेंट कानून आविष्कारकों को उनके नवीन, उपयोगी और औद्योगिक रूप से लागू रासायनिक आविष्कारों पर सीमित समय तक विशेष अधिकार देता है। इससे आविष्कारकों और संस्थानों को उनके कार्य से आर्थिक लाभ मिलता है, जो अनुसंधान एवं विकास में निवेश को बढ़ाता है। दवाओं, कृषि रसायनों, पॉलिमर, उत्प्रेरकों और नई सामग्री का उत्पादन पेटेंट से बढ़ता है। यह शोध-पत्र रासायनिक आविष्कारों में पेटेंट कानून की भूमिका, इसके फायदे, नुकसान और भारत में इसकी व्यवस्था का विश्लेषण करता है। साथ ही, इस अध्ययन में पेटेंट कानून की भूमिका नवाचार और सार्वजनिक फायदे के बीच संतुलन बनाने में है। यह अध्ययन भौगोलिक संकेतकों के माध्यम से होने वाले क्षेत्रीय विकास की प्रक्रिया को समझने के लिए है। अध्ययन से पता चला कि GI टैग वाले उत्पादों की मांग और मूल्य दोनों बढ़ा है। यह स्थानीय कारीगरों, किसानों और उत्पादकों को सीधा लाभ देता है, जिससे उनकी आय बढ़ती है और रोजगार के नए अवसर पैदा होते हैं।

मुख्यबिंदु बौद्धिक संपदा अधिकार, भौगोलिक संकेतक, क्षेत्रीय विकास, स्थानीय अर्थव्यवस्था, ग्रामीण रोजगार, सतत विकास

प्रस्तावना

मानव बुद्धि की अमूर्त रचनाएँ बौद्धिक संपदा की श्रेणी में आते हैं। बौद्धिक संपदा के कई प्रकार हैं, और कुछ देशों ने दूसरों की तुलना में अधिक प्रकारों को मान्यता दी है[1-2]। व्यापार रहस्य, पेटेंट, कॉपीराइट और ट्रेडमार्क सबसे लोकप्रिय प्रकार हैं[3-5]। 17वीं और 18वीं शताब्दी में इंग्लैंड में बौद्धिक संपदा की आधुनिक अवधारणा विकसित हुई। 19वीं शताब्दी में "बौद्धिक संपदा" शब्द का प्रयोग शुरू हुआ, लेकिन 20वीं शताब्दी के उत्तरार्ध तक विश्व की अधिकांश कानूनी प्रणालियों में ऐसा नहीं था[6]।

वैश्वीकरण के इस युग में, बौद्धिक संपदा अधिकार किसी भी देश की आर्थिक, सामाजिक और सांस्कृतिक वृद्धि में महत्वपूर्ण योगदान दे रहे हैं। विशेष क्षेत्रों में निर्मित उत्पादों की विशिष्ट पहचान, गुणवत्ता और प्रतिष्ठा को बचाने के लिए, भौगोलिक संकेतक (GI) बौद्धिक संपदा अधिकारों का एक प्रभावी माध्यम है। ये संकेतक बहुत संबंधित हैं उस क्षेत्र के प्राकृतिक संसाधनों, जलवायु, भौगोलिक परिस्थितियों और स्थानीय समुदाय के पारंपरिक ज्ञान और कौशल से। उत्पादों पर भौगोलिक संकेत (जीआई) नाम या चिह्न जो किसी विशिष्ट भौगोलिक स्थान या उत्पत्ति से संबंधित है, जैसे एक शहर या क्षेत्र 'उत्पाद के स्रोत के संकेत के रूप में भौगोलिक संकेत का उपयोग इस बात का प्रमाणीकरण करने के लिए किया जाता है कि उत्पाद में कुछ विशेषताएं हैं, इसे पारंपरिक तरीकों से बनाया गया है, पारंपरिक तरीकों से बनाया गया है, या इसकी भौगोलिक उत्पत्ति के कारण इसकी अच्छी प्रतिष्ठा है। ट्रिप्स समझौते का अनुच्छेद 22.1 भौगोलिक संकेतों को परिभाषित करता है: ऐसे संकेत जो किसी वस्तु को विश्व व्यापार संगठन के सदस्य देश के क्षेत्र या उस क्षेत्र के किसी क्षेत्र से उत्पन्न होने के रूप में पहचानते हैं, जहाँ वस्तु की कोई विशिष्ट गुणवत्ता, प्रतिष्ठा या अन्य विशेषता अनिवार्य रूप से उसके भौगोलिक मूल से जुड़े हुए हैं[8]।

दवा उद्योग में पेटेंट बौद्धिक संपदा अधिकार (आईपीआर) का एक रूप है। 1995 में व्यापार संबंधी बौद्धिक संपदा अधिकारों (TRIPS) समझौते पर हस्ताक्षर करने से भारत की पेटेंट व्यवस्था में महत्वपूर्ण परिवर्तन हुआ। भारत टीआरआईपीएस समझौते पर हस्ताक्षरकर्ता था, इसलिए उसने अपने पेटेंट कानून को संशोधित करना था ताकि यह समझौते के प्रावधानों को पूरा कर सके। इसलिए 1999 के पेटेंट संशोधन अधिनियम ने देश को औषधीय आविष्कारों के लिए उत्पादों को पेटेंट देना शुरू करने तक पाइपलाइन संरक्षण देना शुरू कर दिया [9]। इसमें 1 जनवरी 1995 से दवाओं और कृषि रसायनों के क्षेत्र में उत्पाद पेटेंट के लिए आवेदन दाखिल करने के प्रावधान निर्धारित किए गए, जिन्हें मेलबॉक्स आवेदन के रूप में लागू किया गया और इन पेटेंटों पर अनन्य विपणन अधिकार (ईएमआर) प्रदान करने की शुरुआत की गई। भारत ने पेटेंट अधिनियम, 1970 को पेटेंट (संशोधन) अधिनियम, 2002 द्वारा आगे संशोधित कर ट्रिप्स दायित्वों के दूसरे सेट को लागू किया। इस संशोधन ने सभी श्रेणियों के आविष्कार के लिए पेटेंट की दो दशक की एक समान अवधि का प्रस्ताव किया, यानी पेटेंट आवेदन की तारीख से दो दशक [10]।

पेटेंट एक अधिकार है जो सरकार द्वारा किसी आविष्कारक या उसके उत्तराधिकारी को दिया जाता है. यह अधिकार एक सीमित अवधि के लिए आविष्कार को सार्वजनिक प्रकटीकरण के बदले में दूसरों को बनाने, इस्तेमाल करने, बेचने, बेचने या आयात करने से रोकता है[11]। उत्पाद या प्रक्रिया हो सकता है, आविष्कार तीन मुख्य आवश्यकताओं को पूरा करने के साथ एक विशिष्ट तकनीकी समस्या का समाधान है: यह नया होना चाहिए, औद्योगिक प्रयोज्यता होनी चाहिए और स्पष्ट नहीं होना चाहिए। पेटेंट धारकों को अपने आविष्कारों के बारे में जनता को बताना चाहिए, क्योंकि यह ज्ञान के भंडार को समृद्ध करने और नवाचार को प्रोत्साहित करने के लिए आवश्यक है[12]।

Ravindran Sudhir (2016) ने अपने अध्ययन में पाया कि भौगोलिक संकेत (जीआई) की सुरक्षा पिछले कुछ वर्षों में सबसे विवादास्पद आईपीआर (बौद्धिक संपदा) में से एक बन गई है। साथ ही, विश्व व्यापार संगठन (ट्रिप्स) के समझौते में बौद्धिक संपदा अधिकारों के व्यापार संबंधी मुद्दों पर प्रावधान किए गए हैं। जीआई एक संकेत है जो किसी उत्पाद को किसी विशेष स्थान से निकलने के रूप में पहचानता है, जहां उत्पाद की गुणवत्ता, प्रतिष्ठा या अन्य विशेषताएं अनिवार्य रूप से इसके भौगोलिक मूल के कारण हैं।

दास कस्तूरी (2015) ने अपने अध्ययन में पाया कि जीआई की सफलता, प्रासंगिक बाजारों (घरेलू और निर्यात) में अधिकारों के प्रभावी प्रवर्तन के अलावा, उत्पादों के प्रभावी विपणन और प्रचार पर निर्भर करती है। भारत जैसे विकासशील देश से कई हितधारकों के लिए निष्पादित करने के लिए ऐसे कार्य, जो न केवल खर्चीले हैं बल्कि चुनौतीपूर्ण भी हैं।

भारत में भौगोलिक संकेतक की शुरुआत

भारत विश्व व्यापार संगठन का सदस्य है, विश्व व्यापार संगठन विश्व भर में बौद्धिक सम्पदा अधिकारों का संरक्षण करता है। इसलिए भारत में भौगोलिक संकेतक की शुरुआत 1999 में हुई थी और 2004 में दार्जिलिंग की चाय को पहला भौगोलिक संकेतक (GI) मिला। 10 वर्षों तक भौगोलिक संकेतक जीआई टैग मान्य रहता है। मान्यता समाप्त होने पर उन्हें अगले दस वर्षों के लिए फिर से जीआई टैग मिलता है। भारत में बौद्धिक संपदा अधिकार के लिए भौगोलिक संकेत (जीआई) एक महत्वपूर्ण मुद्दा बन गए हैं।15 सितंबर 2003 से, जब से जीआई अधिनियम लागू हुआ, देश के भौगोलिक संकेतक लगातार बढ़ रहे हैं। भारत में कर्नाटक ने सबसे ज्यादा जीआई टैग पाया है। कर्नाटक में 48 उत्पादों पर GI टैग लगाया गया है। वर्तमान कर्नाटक भौगोलिक संकेतक सिरसी सुपारी है। भारत ने अब तक 370 उत्पादों को जीआई चिह्नित किया है। जैसे तेलिया रूमाल, वायनाड रोबस्टा कॉफी और कश्मीर केसर को जीआई टैग मिला है।

- पेटेंट कानून की अवधारणा

पेटेंट एक कानूनिक अधिकार है जो किसी आविष्कारक को सीमित समय (भारत में अक्सर दो दशक) तक आविष्कार करने का अधिकार देता है। पेटेंट देने से आविष्कारक को यह अधिकार मिलता है कि बिना अनुमति के किसी अन्य व्यक्ति को किसी आविष्कार को बनाने, इस्तेमाल करने, बेचने या आयात करने से रोक सके। पेटेंट कानून का मुख्य उद्देश्य नवाचार को बढ़ावा देना, आविष्कारक के अधिकारों की रक्षा करना और तकनीकी ज्ञान को सार्वजनिक रूप से उपलब्ध कराना है।

भौगोलिक संकेतक प्राप्त करने कि प्रक्रिया

औद्योगिक संपत्ति की सुरक्षा के लिए पेरिस कन्वेंशन के तहत भौगोलिक संकेतक बौद्धिक संपदा अधिकारों (आईपीआर) का एक हिस्सा हैं।

1. अंतरराष्ट्रीय स्तर पर, भौगोलिक संकेतक विश्व व्यापार संगठन (डब्ल्यूटीओ) के बौद्धिक संपदा अधिकार (ट्रिप्स) के व्यापार-संबंधित पहलुओं पर सहमति से नियंत्रित है।
2. भारत में भौगोलिक संकेतक 1999 के पंजीकरण माल के भौगोलिक संकेत (पंजीकरण और संरक्षण) अधिनियम से नियंत्रित हैं, जो सितंबर 2003 से लागू हो गया।
3. भारत में पहला उत्पाद जिसे भौगोलिक संभावना के साथ जोड़ा गया था वह वर्ष 2004-05 में दार्जिलिंग चाय थी।

मध्यप्रदेश को प्राप्त भौगोलिक संकेतक

विभिन्न भौगोलिक संकेतक के अनुसार, मध्यप्रदेश देश का हृदय प्रदेश माना जाता है, और कई क्षेत्रों में अलग है। भौगोलिक संकेतक वाले उत्पादों में कृषि, भौतिक संपदा, हस्तशिल्प, काष्ठकला आदि शामिल हैं।

मध्यप्रदेश के भौगोलिक संकेतक कि सूची: **तालिका न. 01**

क्रमांक	भौगोलिक संकेतक	प्रकार
1	चिन्नौर चावल जीआई टैग	चावल\भोजन
2	मध्य प्रदेश के बाघ प्रिंट	हस्तशिल्प
3	चंदेरी साड़ी	हस्तशिल्प
4	दतिया एवं टीकमगढ़ के कांस्य बर्तन	हस्तशिल्प
5	महेश्वर सारी	हस्तशिल्
6	इंदौर के चमड़े के खिलौने	हस्तशिल्प
7	झाबुआ कड़कनाथ ब्लेक चिकन मांस	खाद्य सामग्री
8	चंदेरी वस्त्र	हस्तशिल्प
9	रतलामी सेव	खाद्य सामग्री

भौगोलिक संकेतक और ग्रामीण विकास के प्रभाव

पर्यावरण संरक्षण, आर्थिक विकास और सामाजिक कल्याण के संदर्भ में, भौगोलिक संकेतकों से ग्रामीण विकास पर निम्नलिखित प्रभाव पड़ सकते हैं-

1. कच्चे माल के उत्पादकों को बेहतर वितरण और खुदरा मूल्य लाभ प्रतिशत में वृद्धि के लिए अधिक सौदेबाजी की शक्ति प्रदान करना।
2. स्थानीय स्तर पर टिकाऊ खाद्य उत्पादन और आपूर्ति को मजबूत करना (हस्तशिल्प जैसे गैर-कृषि खाद्य पदार्थों को छोड़कर), उत्पाद की उत्पत्ति से जुड़ी एक सामान्य प्रतिष्ठा के आधार पर आपूर्ति श्रृंखला को बनाना।
3. उच्च गुणवत्ता वाले उत्पादों में आर्थिक लाभों को निवेश करने की क्षमता, जिससे विशिष्ट बाजारों तक पहुंच, चक्रीय अर्थव्यवस्था के साधनों में सुधार, अवैध उत्पादकों द्वारा मुफ्तखोरी जैसे उल्लंघनों से सुरक्षा आदि।

निष्कर्ष

बौद्धिक संपदा अधिकार (IPR) में भौगोलिक संकेतक (GI) और पेटेंट दोनों महत्वपूर्ण हैं. जहां GI भौगोलिक पहचान और गुणवत्ता की रक्षा करता है (जैसे दार्जिलिंग चाय), यह स्थानीय अर्थव्यवस्था और संस्कृति को बढ़ावा देता है; वहीं, विकसित देशों अक्सर पेटेंट देते हैं, जो नवाचार को बढ़ावा देते हैं और नए तकनीकी आविष्कारों पर एकाधिकार अधिकार देते हैं। यह निष्कर्ष निकलता है कि GI स्थानीय समुदायों के लिए महत्वपूर्ण है, जबकि पेटेंट तकनीकी प्रगति और दोनों के बीच संतुलन बनाने के लिए भारत जैसे देशों में जागरूकता बढ़ाना और इनका प्रभावी क्रियान्वयन करना (जैसे 2016 IPR नीति) राष्ट्रीय विकास और सांस्कृतिक विरासत के संरक्षण के लिए आवश्यक है।

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अजातशत्रु और प्राचीन भारतीय राज्य व्यवस्था: एक ऐतिहासिक एवं विश्लेषणात्मक अध्ययन

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Abstract

यह शोधपत्र प्राचीन भारत के शक्तिशाली शासक अजातशत्रु के राजनीतिक, सैन्य, धार्मिक एवं नैतिक योगदान का समग्र अध्ययन प्रस्तुत करता है। अजातशत्रु न केवल मगध साम्राज्य के विस्तार का प्रमुख सूत्रधार था, बल्कि वह बौद्ध धर्म के इतिहास में भी एक निर्णायक पात्र रहा। इस अध्ययन में ऐतिहासिक ग्रंथों, बौद्ध साहित्य तथा आधुनिक इतिहासकारों के दृष्टिकोण के आधार पर अजातशत्रु के व्यक्तित्व का आलोचनात्मक विश्लेषण किया गया है।

Keywords: Ajatashatru, Magadha, Buddhism, Ancient Indian Polity, State Formation

Introduction

अजातशत्रु प्राचीन भारत के उन शासकों में से एक था, जिनका शासन काल गंगा घाटी में राजनीतिक, सामाजिक एवं धार्मिक परिवर्तनों का निर्णायक चरण माना जाता है। ईसा-पूर्व छठी–पाँचवीं शताब्दी का यह काल गणराज्यों के पतन और शक्तिशाली राजतंत्रों के उदय का समय था, जिसमें मगध सबसे प्रभावशाली राज्य के रूप में उभरा। इस ऐतिहासिक प्रक्रिया में अजातशत्रु की भूमिका अत्यंत महत्वपूर्ण रही, जिसने मगध को एक सुदृढ़ और विस्तारित साम्राज्य के रूप में स्थापित किया।

अजातशत्रु का सिंहासनारूढ़ होना अपने पिता बिंबिसार की हत्या के कारण नैतिक विवादों से घिरा रहा है। ब्राह्मण और बौद्ध दोनों परंपराओं में उसे प्रारंभ में एक क्रूर और महत्वाकांक्षी शासक के रूप में चित्रित किया गया है। किंतु इस नैतिक आलोचना के परे, उसका शासन राजनीतिक यथार्थवाद, सैन्य कौशल और प्रशासनिक दूरदृष्टि का उत्कृष्ट उदाहरण प्रस्तुत करता है। उसने वैशाली के लिच्छवियों जैसे शक्तिशाली गणराज्यों को पराजित कर मगध की सर्वोच्चता स्थापित की और नवीन युद्ध तकनीकों का प्रयोग किया। साथ ही, अजातशत्रु का बौद्ध धर्म से संबंध उसके व्यक्तित्व को और अधिक जटिल बनाता है। पश्चाताप की भावना से प्रेरित होकर उसने भगवान बुद्ध से संपर्क किया और प्रथम बौद्ध संगीति के आयोजन में सहयोग दिया। इस प्रकार अजातशत्रु का जीवन सत्ता, नैतिकता और धर्म के अंतर्संबंधों को समझने के लिए एक महत्वपूर्ण ऐतिहासिक अध्ययन प्रस्तुत करता है।

Historical Background of Ajatashatru

अजातशत्रु का शासन लगभग 492–460 ई.पू. माना जाता है। पितृहंता राजा के रूप में उसकी छवि नकारात्मक रही, किंतु प्रशासनिक दक्षता और सामरिक दृष्टि से वह अत्यंत दूरदर्शी शासक था। उसने राजगृह (गिरिव्रज) को अपनी राजधानी बनाए रखा और बाद में पाटलिग्राम (पाटलिपुत्र) को सुदृढ़ किया।

Military Innovations and Expansion Policy

अजातशत्रु को प्राचीन भारत का पहला “तकनीकी युद्ध रणनीतिकार” कहा जा सकता है।

उसकी प्रमुख उपलब्धियाँ थीं:

- महाशिलाकंटक (Stone-throwing war machine)
- रथमूसल (scythed chariot जैसी युद्ध प्रणाली)
- वैशाली के लिच्छवियों पर विजय

इन युद्धों ने मगध को गंगा घाटी की सबसे बड़ी शक्ति बना दिया।

अजातशत्रु और बौद्ध धर्म:

अजातशत्रु का बौद्ध धर्म से संबंध प्राचीन भारतीय इतिहास में एक गहन नैतिक, धार्मिक और राजनीतिक परिवर्तन का महत्वपूर्ण उदाहरण प्रस्तुत करता है। यद्यपि अजातशत्रु का प्रारंभिक जीवन सत्ता-लोलुपता, हिंसा और पितृहंसा जैसे गंभीर आरोपों से जुड़ा रहा, फिर भी उसका उत्तरवर्ती जीवन बौद्ध धर्म की करुणा, पश्चाताप और आत्मपरिवर्तन की शिक्षाओं से गहराई से प्रभावित दिखाई देता है।

बौद्ध ग्रंथों, विशेषतः दीघ निकाय और महावग्ग में वर्णित है कि पिता बिंबिसार की हत्या के बाद अजातशत्रु गहरे मानसिक द्वंद्व और अपराधबोध से ग्रस्त हो गया था। इसी अवस्था में उसने भगवान बुद्ध से भेंट की और अपने कृत्य के लिए पश्चाताप व्यक्त किया। बुद्ध ने उसे कर्म और उसके फल का सिद्धांत समझाते हुए यह स्पष्ट किया कि पापकर्म का परिणाम अवश्य भोगना पड़ता है, किंतु आत्मबोध और सदाचार के मार्ग पर चलकर व्यक्ति आध्यात्मिक उन्नति कर सकता है। इस उपदेश ने अजातशत्रु के जीवन की दिशा बदल दी।

अजातशत्रु ने बौद्ध संघ को राजनीतिक संरक्षण प्रदान किया और राजगृह में आयोजित प्रथम बौद्ध संगीति के आयोजन में महत्वपूर्ण भूमिका निभाई। यह संगीति भगवान बुद्ध के महापरिनिर्वाण के पश्चात बौद्ध शिक्षाओं के संकलन और संरक्षण के लिए अत्यंत आवश्यक थी। इस प्रकार अजातशत्रु बौद्ध धर्म के संस्थागत विकास में एक प्रमुख संरक्षक के रूप में उभरा।

हालाँकि बौद्ध परंपरा उसे आनंतरिक पापकर्म (अनंतर कर्म) का दोषी मानती है, फिर भी उसके पश्चाताप और धर्मानुकरण को विशेष महत्व दिया गया है। इससे बौद्ध धर्म का यह मूल सिद्धांत स्पष्ट होता है कि कोई भी व्यक्ति, चाहे वह कितना ही पतित क्यों न रहा हो, आत्मबोध और नैतिक परिवर्तन के माध्यम से धर्म के मार्ग पर अग्रसर हो सकता है।

इस प्रकार अजातशत्रु और बौद्ध धर्म का संबंध केवल शासक-धर्म संरक्षक का नहीं, बल्कि सत्ता, अपराधबोध, करुणा और नैतिक पुनर्जन्म के जटिल अंतर्संबंधों का सशक्त ऐतिहासिक उदाहरण है।

निष्कर्ष:

अजातशत्रु का ऐतिहासिक मूल्यांकन यह स्पष्ट करता है कि वह केवल एक क्रूर या पितृहंता शासक तक सीमित व्यक्तित्व नहीं था, बल्कि प्राचीन भारत के राजनीतिक, धार्मिक और नैतिक विकास की जटिल प्रक्रियाओं का प्रतिनिधि पात्र था। उसके जीवन और शासन में सत्ता की आकांक्षा, हिंसा, पश्चाताप तथा आध्यात्मिक परिवर्तन—ये सभी तत्व एक साथ विद्यमान रहे, जो उसे भारतीय इतिहास के सबसे विरोधाभासी किंतु महत्वपूर्ण शासकों में स्थान दिलाते हैं।

राजनीतिक दृष्टि से अजातशत्रु ने मगध राज्य को सुदृढ़ आधार प्रदान किया। गणराज्यों के विरुद्ध उसकी सफल सैन्य रणनीतियों और नवीन युद्ध तकनीकों ने यह सिद्ध किया कि वह केवल बल प्रयोग करने वाला राजा नहीं, बल्कि संगठित राज्य शक्ति का निर्माता था। उसकी नीतियों ने मगध को उत्तर भारत की सर्वप्रमुख शक्ति के रूप में स्थापित किया, जिससे आगे चलकर मौर्य साम्राज्य के उदय का मार्ग प्रशस्त हुआ। इस दृष्टि से अजातशत्रु भारतीय राज्य-निर्माण की परंपरा में एक केंद्रीय कड़ी के रूप में उभरता है।

धार्मिक और नैतिक स्तर पर अजातशत्रु का बौद्ध धर्म से संबंध विशेष महत्व रखता है। पिता की हत्या जैसे गंभीर पापकर्म के बाद उसका पश्चाताप और भगवान बुद्ध के प्रति श्रद्धा बौद्ध दर्शन की करुणा और आत्मपरिवर्तन की अवधारणा को मूर्त रूप में प्रस्तुत करती है। बौद्ध परंपरा में उसे अनंतर कर्म का दोषी माना गया, किंतु साथ ही उसके पश्चाताप को इस बात के प्रमाण के रूप में देखा गया कि नैतिक बोध और आत्मचिंतन व्यक्ति के जीवन में परिवर्तन ला सकता है।

अजातशत्रु द्वारा प्रथम बौद्ध संगीति को संरक्षण दिया जाना यह दर्शाता है कि उसने बौद्ध धर्म को केवल व्यक्तिगत शांति का साधन नहीं, बल्कि सामाजिक और संस्थागत स्थिरता का माध्यम भी माना। इस संरक्षण ने बौद्ध शिक्षाओं के संरक्षण और प्रसार में निर्णायक भूमिका निभाई, जिससे बौद्ध धर्म एक संगठित और वैश्विक धर्म के रूप में विकसित हो सका।

अंततः यह कहा जा सकता है कि अजातशत्रु का जीवन सत्ता और धर्म, हिंसा और करुणा, अपराध और पश्चाताप के बीच संतुलन की खोज का प्रतीक है। उसका अध्ययन हमें यह समझने में सहायता करता है कि प्राचीन भारतीय इतिहास में शासक केवल राजनीतिक पात्र नहीं थे, बल्कि वे नैतिक और आध्यात्मिक विमर्श के भी महत्वपूर्ण केंद्र थे। इस प्रकार अजातशत्रु न केवल मगध का शक्तिशाली राजा था, बल्कि बौद्ध धर्म के इतिहास में एक निर्णायक और विचारोत्तेजक व्यक्तित्व भी था।

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AN INTRODUCTION TO CHEMICAL PARAMETERS ANALYSIS OF WATER QUALITY

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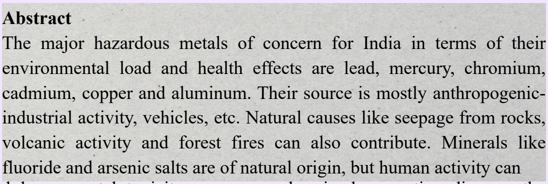


Abstract

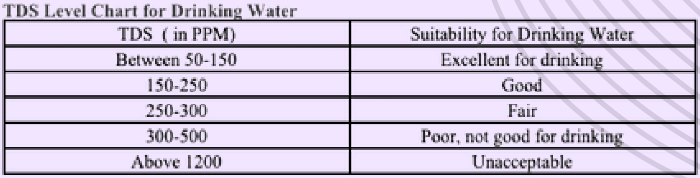
The major hazardous metals of concern for India in terms of their environmental load and health effects are lead, mercury, chromium, cadmium, copper and aluminum. Their source is mostly anthropogenic- industrial activity, vehicles, etc. Natural causes like seepage from rocks, volcanic activity and forest fires can also contribute. Minerals like fluoride and arsenic salts are of natural origin, but human activity can also aggravate the situation. In general heavy metal toxicity can cause chronic degenerative diseases the symptoms being mental disorders, pain in muscle and joints, gastro intestinal disorders, vision problems, chronic fatigue, and susceptibility to fungal infections. Sometimes the symptoms are vague and difficult to diagnose at early stage.

Keywords: TDS,Alkalinity,Hardness,Organics, PH, PPM, DO, BOD, RO

Introduction

Water is the second most important need for life to exist after air. There are three water quality parameters that help to measure the quality of water, which include physical parameters, chemical parameters, and biological parameters. The physical parameters include color, taste, odor, temperature, turbidity, solids, and electrical conductivity. Chemical parameters can include pH, alkalinity, chlorine, hardness, dissolved oxygen, and biological oxygen demand. The third type of parameter involves biological parameters, which include bacteria, algae, and viruses.In this chapter we will discuss about chemical parameters of water quality The major chemical parameters in water treatment are – 1.Total dissolved solids (TDS) 2. Alkalinity 3. Hardness 4. Fluorides 5. Metals 6. Organics 7. Nutrients 8. pH 9. Chlorides.

(1). Total dissolved solids (TDS): Solids in water occur either in solution or in suspension. The solids in the water that remain after filtration and evaporation as residue are called total dissolved solids, or TDS. Total Dissolved Solids and refers to the total concentration of dissolved substances in drinking water. TDS comprises inorganic salts and a small amount of organic matter as well. Inorganic salts are made up of the positively charged cations (calcium, magnesium, potassium and sodium) and negatively charged anions (carbonates, nitrates, bicarbonates, chlorides and sulfates). Dissolved solids can be removed from water by filtration and evaporation, and also by electrodialysis, reverse osmosis, or ion exchange. Dissolved solids may be organic or inorganic, and come from water's contact with substances in soil, on surfaces, and in the atmosphere. Organic dissolved constituents come from decayed vegetation, and from organic chemicals and gases. These dissolved minerals, gases, and organic constituents may cause physiological effects, as well as color, taste, and odor problems.

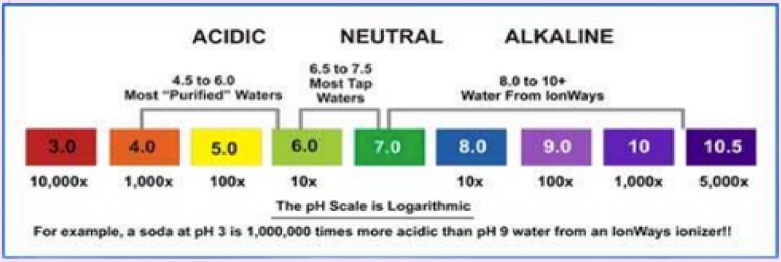


TDS Level Chart for Drinking Water

TDS (in PPM)	Suitability for Drinking Water
Between 50-150	Excellent for drinking
150-250	Good
250-300	Fair
300-500	Poor, not good for drinking
Above 1200	Unacceptable

2. ALKALINITY :

Alkalinity is an important water quality parameter, because it measures the water's ability to neutralize acids. Alkalinity constituents in natural water supplies are bicarbonate, carbonate, and hydroxyl ions-mostly the carbonates and bicarbonates of sodium, potassium, magnesium, and calcium. Alkalinity also occurs naturally from carbon dioxide (from the atmosphere and as a by-product of microbial decomposition of organic material) and from mineral origins (primarily from chemical compounds dissolved from rocks and soil). While highly alkaline waters do not seriously affect human health, elevated alkalinity can cause an objectionable bitter taste. In treatment, alkaline water can cause problems with the reactions that occur between alkalinity and certain substances in the water that can foul water system appurtenances.



3. HARDNESS

The hardness of water is due to the presence of soluble bicarbonates, chlorides and sulfates of calcium and magnesium. Water which does not give lather with soap is hard water. These problems make hard water generally unacceptable to the public, though advantages to hard water do exist. Hard water helps tooth and bone growth and hard water scaling reduces toxicity of lead oxide in pipelines made of lead.
water's hardness based on these concentrations of calcium carbonate:

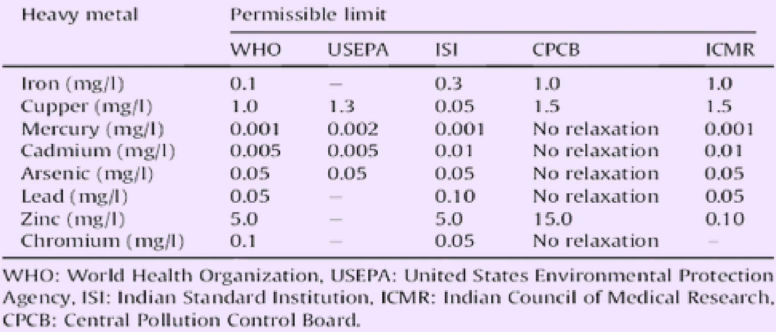
- below 75 mg/L - is generally considered soft
- 76 to 150 mg/L - moderately hard
- 151 to 300 mg/L - hard
- more than 300 mg/ - very hard

4. FLUORIDES

Fluoride is toxic to humans in large quantities, and to some animals, though moderate amounts of fluoride ions (F-) in drinking water contribute to good dental health. Fluoride appears in groundwater in only a few geographical reg6. ORGANICS6. ORGANICSions, and in a few types of igneous or sedimentary rocks. It is seldom found in appreciable quantities in surface water. Fluoride is a common addition to drinking water in many communities. safety levels of fluoride in drinking water in India should be fixed at 0.5 ppm

5. METALS

Metals in water that are harmful in relatively small amounts are classified as toxic; other metals are classified as nontoxic. In natural waters other than groundwater, metal sources include dissolution from natural deposits and discharges of domestic, agricultural, or industrial wastes. Leachate from improperly designed, constructed, or managed landfills is another common source. Some metals [iron (Fe) and manganese (Mn), for example] impart a bitter taste to drinking water even at low concentrations, though they do not cause health problems. These metals usually occur in groundwater in solution.



Heavy metal	Permissible limit				
	WHO	USEPA	ISI	CPCB	ICMR
Iron (mg/l)	0.1	–	0.3	1.0	1.0
Cupper (mg/l)	1.0	1.3	0.05	1.5	1.5
Mercury (mg/l)	0.001	0.002	0.001	No relaxation	0.001
Cadmium (mg/l)	0.005	0.005	0.01	No relaxation	0.01
Arsenic (mg/l)	0.05	0.05	0.05	No relaxation	0.05
Lead (mg/l)	0.05	–	0.10	No relaxation	0.05
Zinc (mg/l)	5.0	–	5.0	15.0	0.10
Chromium (mg/l)	0.1	–	0.05	No relaxation	–

WHO: World Health Organization, USEPA: United States Environmental Protection Agency, ISI: Indian Standard Institution, ICMR: Indian Council of Medical Research, CPCB: Central Pollution Control Board.

6. ORGANICS

Organic matter in water can cause color problems as well as taste and odor problems. Organic matter can contribute to the formation of halogenated compounds in water undergoing chlorine disinfection. Organic matter can also create problems with oxygen depletion in streams, because as microbes metabolize organic material, they consume oxygen. Oxygen depletion from organic matter interferes with water treatment processes. The oxygen microbes consume is dissolved oxygen (DO). This demand for oxygen is called the biochemical oxygen demand (BOD), the amount of dissolved oxygen aerobic decomposers require to decay organic materials in a given volume of water over a five-day incubation period at 68°F (20°C). If the oxygen is not continually replaced, the DO level decreases as the microbes decompose the organics, until the cycle fails from lack of available oxygen. Generally, organic matter in water comes from natural sources--decaying leaves, weeds, and trees. Man-made sources include pesticides and other synthetic organic compounds.

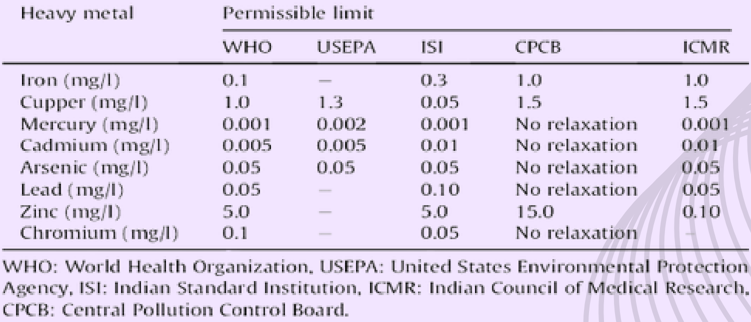
Many organic compounds are soluble in water, and surface waters are more prone to contamination by natural organic compounds than are groundwaters. Dissolved organics are usually divided into biodegradable and nonbiodegradable. Nonbiodegradable organics resist biological degradation. For example, the refractory (resistant to biodegradation) constituents of woody plants (tannin and lignin acids, phenols, and cellulose) are found in natural water systems. Other essentially nonbiodegradable constituents include some polysaccharides with exceptionally strong bonds, and benzene with its ringed structure.

7. INORGANICS

Natural water can possess several common inorganic constituents (pH, chlorides, alkalinity, nitrogen, phosphorous, sulfur, toxic inorganic compounds, and heavy metals) that are important to treatment processes. Water's inorganic load is affected by wastewater discharges, geologic conditions and formations, and inorganics that remain in water after evaporation. Natural waters dissolve rocks and minerals, adding inorganics to water, and these constituents can also enter water through human use. Inorganic contaminants are often removed by corrosion control methods or by removal techniques. Corrosion controls reduce corrosion by-products (lead, for example) in potable water. Removal technologies, including coagulation filtration, reverse osmosis (RO), and ion exchange, are used to treat source water contaminated with metals or radioactive substances.

Nutrients

The nutrients of greatest concern in water supplies are nitrogen and phosphorous. Other nutrients include carbon, sulfur, calcium, iron, potassium, manganese, cobalt, and boron-all essential to the growth and reproduction of plants and animals. Nitrogen (NZ) is an extremely stable gas. As the primary component of the earth's atmosphere, it occurs in many forms in the environment and takes part in many biochemical reactions. Nitrogen enters water from runoff from animal feedlots, fertilizer runoff, municipal wastewater discharges, and from certain bacteria and blue-green algae that directly obtain atmospheric nitrogen. Some types of acid rain also add nitrogen to surface waters. In water, nitrogen in the form of nitrate (NO3) indicates contamination with sewage. An immediate health threat to both human and animal infants, excessive nitrate concentrations in drinking water can even cause death. Though the presence of phosphorous (P) in drinking water has little effect on health, too much phosphorus in water supplies causes problems. While essential for growth, excess amounts of this nutrient contribute to algae bloom and lake eutrophication. Phosphorous sources include phosphates from detergents, fertilizer and feedlot runoff, as well as municipal wastewater discharges.



Heavy metal	Permissible limit				
	WHO	USEPA	ISI	CPCB	ICMR
Iron (mg/l)	0.1	–	0.3	1.0	1.0
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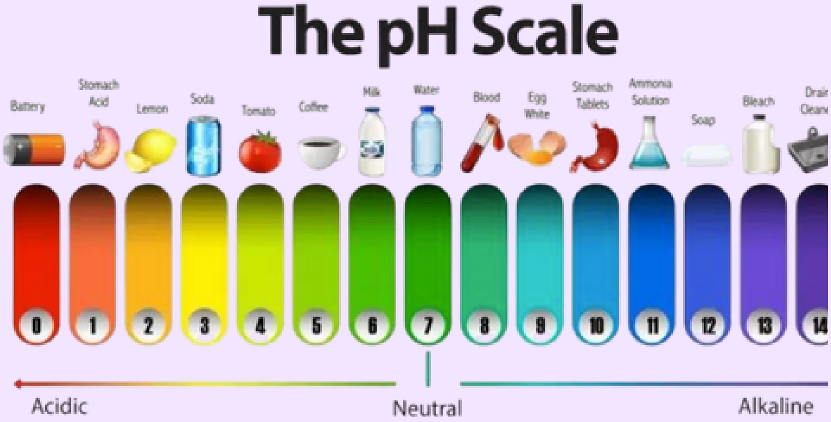
Arsenic (mg/l)	0.05	0.05	0.05	No relaxation	0.05
Lead (mg/l)	0.05	–	0.10	No relaxation	0.05
Zinc (mg/l)	5.0	–	5.0	15.0	0.10
Chromium (mg/l)	0.1	–	0.05	No relaxation	–

WHO: World Health Organization, USEPA: United States Environmental Protection Agency, ISI: Indian Standard Institution, ICMR: Indian Council of Medical Research, CPCB: Central Pollution Control Board.

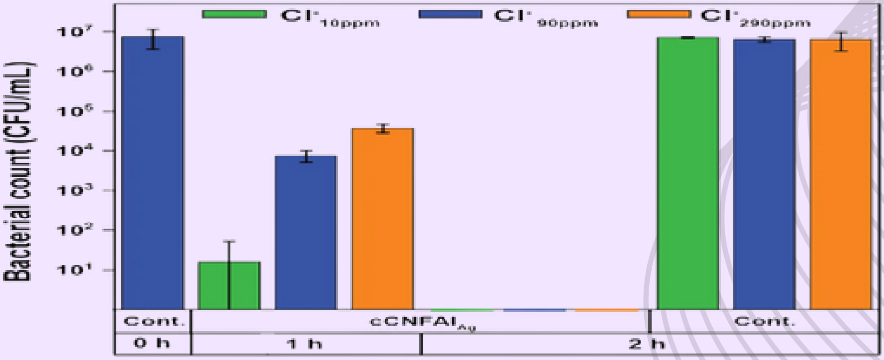
8. pH

pH (hydrogen ion concentration) indicates the intensity of acidity or alkalinity in water, and affects biological and chemical reactions. Water's chemical balance (equilibrium relationships) is strongly influenced by pH. For example, water's pH levels directly affect certain unit processes, including disinfection with chlorine. Increased pH increases the contact time needed for chlorine disinfection.



9.Chlorides

Chloride (a major inorganic constituent in water) generally does not cause any harmful effects to public health, though a high enough concentration can cause an objectionable salty taste. Chlorides occur naturally in groundwater, streams, and lakes, but concentrations in fresh water of 500 mg/L or more may indicate sewage contamination.



SUMMARY

Taking wastewater influent to accepted standards is the foundational task of wastewater treatment. The parameters and testing

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Extraction, Synthesis and Spectral Characterization of Quercetin–Sr (II) Complexes

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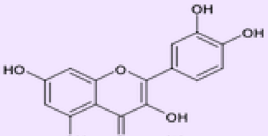
Abstract

Due to its numerous hydroxyl and carbonyl functional groups quercetin [1] a naturally occurring flavonoid that is widely found in fruits and vegetables [2] has a significant chelating capacity. In this work, a quercetin–strontium (II) [Qu–Sr (II)] complex was synthesized after quercetin was isolated from plant material of or Sophora japonica buds using solvent extraction [3]. Quercetin and strontium chloride were reacted under carefully regulated pH and temperature conditions to synthesized the complex. UV–visible spectroscopy, Fourier Transform Infrared (FTIR) spectroscopy, NMR spectroscopy, and elemental analysis were used to analyze the extracted ligand and the synthesized complex. Spectral analyses verified that quercetin and Sr (II) were coordinated by the 3-hydroxyl and 4-carbonyl groups. Bathochromic shifts in UV-visible spectra and distinctive modifications in FTIR bands demonstrated the establishment of a stable metal-ligand combination [4]. According to the findings, quercetin forms a stable coordination complex with potential uses in bioinorganic and medicinal chemistry by acting as a bidentate chelating ligand [5] toward Sr (II).

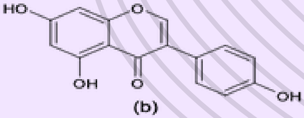
Keywords: Extraction, Synthesis, Quercetin, Strontium (II), Metal complex, FTIR, UV–Visible, 1HNMR spectroscopy.

Introduction: A class of polyphenolic chemicals found in many plants, quercetin is well-known for its antibacterial, anti-inflammatory, antioxidant, and metal-chelating qualities. Among these, quercetin (3,3′,4′,5,7-pentahydroxyflavone) has garnered significant interest because of its potent biological activity and capacity to form compounds with metal ions. Because metal coordination can dramatically alter the physicochemical and biological characteristics of quercetin, metal-quercetin complexes have been thoroughly investigated. Chelation influences antioxidant and pharmacological activities and frequently improves stability, lipophilicity, and bioavailability. Strontium (II) is an alkaline earth metal ion that has been used in biomaterials, radiopharmaceuticals, and bone metabolism. Because Sr (II) compounds have a dual effect on bone production and resorption, they have been employed in the treatment of osteoporosis and bone regeneration. But studies on the coordination behavior of Sr (II) with natural flavonoids remain limited.



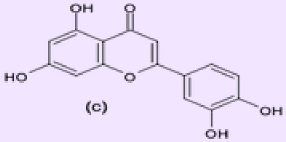
(a)

2-(3,4-dihydroxyphenyl)-3,5,7-trihydroxy-4*H*-1-benzopyran-4-one



(b)

5,7-dihydroxy-3-(4-hydroxyphenyl)-4*H*-1-benzopyran-4-one



2-(3,4-dihydroxyphenyl)-5,7-dihydroxy-4*H*-1-benzopyran-4-one

Fig: - (a) Quercetin, (b) Genistein, (c) Luteolin

2. Experimental

2.1 Extraction of Quercetin

The substance was finely powdered and then extracted from the dried Sophora japonica buds using a solvent. For three hours, 200 mL of 70% ethanol was refluxed with around 20 g of the powdered material . Lower pressure was used to filter and concentrate the extract. Crude quercetin precipitated when the concentrated solution was left to stand. To obtain pure quercetin as a yellow crystalline solid, the precipitate was filtered, cleaned with cold distilled water, separated by column chromatography, and then recrystallized from ethanol.

2.2. Reagents and chemicals

Chemically pure or equivalent quality reagents were utilized. MeONa was produced by adding small, freshly cut pieces of Na (2.5 g) to dry MeOH (100 cm3), an analytical reagent.an. After solvents had been redistilled according to standard protocols, the mixture was refracted. Aldrich Chemical Co. supplied quercetin, SrCl2.6H2O, methanol, KBr, THF (tetra hydrofuran), Me2CO,. Every reagent was precisely weighed to within ±0.0001 g.

2.3. Stoichiometric ratio of the metal and ligand in the complex

Job's method (continual variation method) was used to determine the stoichiometric ratio between the quercetin and the metal ion SrCl2.6H2O for their complexation in methanol; the solutions were prepared by mixing of equimolar concentration solutions of both components in different ratios varying from 1:9 to 9:1 [16] Then the absorbance was measured at 427 nm.

2.4 Synthesis of Quercetin–Sr (II) Complex

Solid quercetin was added to a 100 cm3 round-bottomed flask with two necks, an electromagnetic stirrer, and a thermometer. HPLC-grade methanol (20 ml) and 2H2O (0.17 g, 0.01 M). Continue gazing until the quercetin solidifies. 2H2O was fully dissolved, and the solution had a golden [17]. After about five minutes of adding MeONa (150 ml) to deprotonate the ligand, solid strontium chloride hexahydrate (SrCl2·6H2O) (0.24 g, 0.02 M) was swiftly added. The solution's color changed to dark yellow, and it was agitated for one and a half hours at room temperature [18]. The reaction mixture was filtered after being stirred, and the filtrate was allowed to gently evaporate at room temperature. The dark yellow product was then collected and cleaned with t-butanol.to remove the uncreative part of the reagent, dried the product in vacuum desiccator, yielded the brown yellowish product (0.32 g, 79%).

2.5. Instrumentation:

UV–visible spectra of the quercetin and its metal complex [Qu2–Sr (II,)] were obtained by Perkin Elmer Lambda 35 UV–visible double beam Spectrophotometer using standard 1.00 cm quartz cells and methanol as a solvent. Bruker 400 MHz spectrometer was used for recording the 1H NMR spectra employing TMS as internal reference and DMSO as a solvent. Elemental analyses were performed using a CHNS instrument model Flash EA 1112 elemental analyzer. Infrared spectra were recorded using KBr pellets in the spectral range 4000–400 on a Nicolet 5700 FTIR spectrophotometer.

2.6. Elemental analysis

Elemental analysis found C (52.22%) H (2.63%) O (32.46%) Sr (12.70%) Calculated for Qu2–Sr (II), Molecular Mass 596.658, Molecular Formula: $C_{30}H_{18}O_{14}Sr$ Formula Weight: 690.0800,
M+: 689.974724 Da

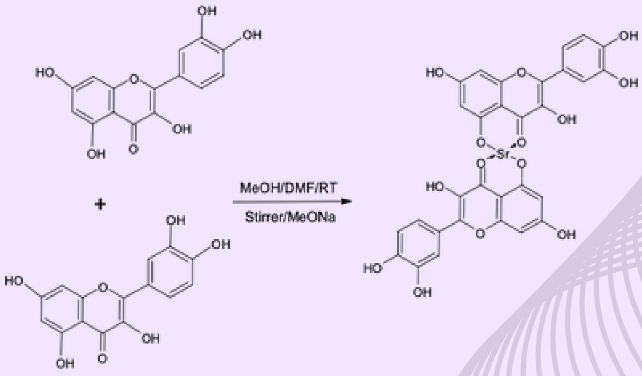


Fig: - (d) Synthesis of Qu–Sr (II) complex

3. Results and Discussion

3.1 Physical Properties

The extracted quercetin appeared as a yellow crystalline solid, while the synthesized Qu2–Sr (II) complex was obtained as a pale yellow to light brown solid. The complex showed higher thermal stability and lower solubility in common organic solvents compared to free quercetin. Qu2–Sr (II) complex melting point is 327 oC.

3.2 UV–Visible Spectral Analysis

Two distinctive absorption bands were seen in quercetin: Band I (cinnamoyl system) at about 370 nm and Band II (benzoyl system) at around 255 nm. These bands demonstrated observable bathochromic shifts and intensity variations in the Qu–Sr (II) complex, suggesting coordination between quercetin and Sr (II). The Band I shift indicated that the 3-OH and 4-C=O groups were involved in the production of complexes

3.3 FTIR Spectral Analysis

3.4. Spectral analysis of infrared IR spectroscopy was used to identify quercetin's coordination sites and binding characteristics. The IR spectra of quercetin and the Sr (II)–quercetin complex can be compared to acquire important information. The key bands with tentative assignment are listed in. The complex's synthesis has moved the -1 -1 free quercetin's C-O stretching mode from 1664 cm to 1636 cm . This change implies that the metal ion and carbonyl oxygen are coordinated. The decrease in bond order of C=O and 3-OH when connected with the metal in the complex may give rise to a coupling of the vibrations of these two bonds. The new bands at approximately 1507 and 1412 cm-1 can be considered as associated with the anti symmetric and symmetric stretching modes of the C–O group at the chelating site, respectively. The band situated at 1615 and 1268 cm-1 (C = C) and (C–O–C) frequencies, which are slightly shifted by complex. The m(C–O–H) deformation mode observed at 1321 cm-1 in the ligand, is shifted to 1363 cm-1 in the complex, indicating an increase in bond order, which is normally observed when metal coordination involves with the ortho-phenolic (OH) group on the quercetin B ring. Furthermore, the creation of a metal complex is indicated by the existence of a (M–O) stretching vibration at 413 cm-1 whereas the ligand does not display this band. The complex's (O–H) and (OH) bends -1 in aqueous solution appear at 3389 and 595 cm , respectively, indicating the existence of water of crystallization in the complex. This is also consistent with the findings of thermal analysis.

Free quercetin's FTIR spectra showed a broad O–H stretching band at around 3400 cm−1, a strong C=O stretching band at about 1660 cm−1, and C–O stretching vibrations in the 1200–1300 cm−1 range.

In the Qu–Sr (II) complex: The O–H stretching band showed reduced intensity, indicating deprotonation and C=O stretching frequency shifted to lower wave numbers new bands appeared in the 501–605 cm−1 region, attributed to Sr–O vibrations. These changes confirm coordination of Sr (II) through oxygen atoms of quercetin.

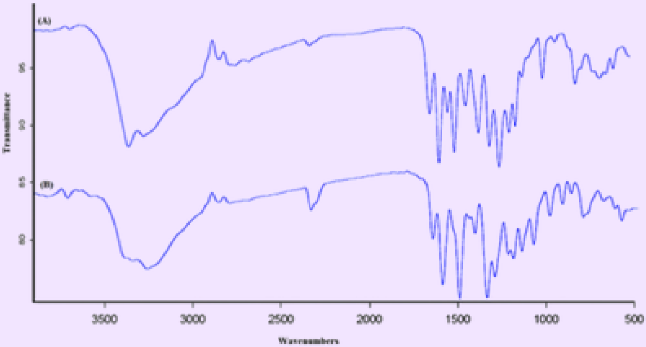


Fig IR spectra of Quercetin–Sr(II)

3.3. NMR spectra

1H NMR (DMSO) data of quercetin and its complex with Sr (II) are listed below: 3.3.1. Quercetin 12.51 (s, 1H, 5-OH), 10.72 (s, 1H, 7-OH), 9.54 (s,1H, 3-OH), 9.29 (s, 1H, 40-OH), 9.34 (s, 1H, 3-OH), 7.68 (d, JH20/H60 = 1.7 Hz, 1H, 20-H), 7.54 (dd, 1H, 6'-H), 6.79 (d, JH50/H60 = 8.5 Hz, 1H, 5'-H), 6.45 (d, JH8/H6 = 1.5 Hz, 1H, 8- H), 6.26 (d, 1H, 6-H).

3**.3.2. Quercetin:**–

Sr(II) d 12.45 (s, 1H, 5-OH), 10.76 (s, 1H, 7-OH), 9.23(s, 1H, 30- OH or 40-OH), 7.55 (d, JH2'/H6' = 2.0 Hz, 1H, 2'-H), 7.42 (dd, 1H, 6'-H), 6.83 (d, JH5'/H6' = 8.0 Hz, 1H, 5'-H), 6.29 (d, JH8/H6 = 1.9Hz, 1H, 8 H), 6.27 (d, 1H, 6-H). 1H NMR studies of the quercetin and its Sr (II) complex show that the quercetin is able to chelate metal ions via 3' or 4' phenolic groups. Upon complexation, the metal ion removes one hydrogen from quercetin. In solution, the quercetin is in a relatively rapid equilibrium between structures.

The 1H NMR spectra of the quercetin–Sr (II) complex reveal the absence of hydrogen of the 3-OH group. The other proton signals of the complex are slightly shifted as compared to the free quercetin, and the signals appeared at downfield, as expected; this is probably due to the increase of the conjugation caused by the effect of coordination when the complex is formed. The complex is diamagnetic in nature due to the unavailability of the unpaired electron. This information clearly indicates that during complex formation, two protons of free ligand are deprotonated and ligand behaves in a dibasic tetra dentate fashion.

Conclusion

New quercetin Sr (II) combination was created by successfully extracting quercetin from plant material. The creation of a stable coordination molecule in which quercetin binds to Sr (II) via oxygen donor was verified by spectral analysis. The study emphasizes quercetin's significant metal-chelating capacity and offers possible uses for these in the field of bioinorganic chemistry, medicine, and biomaterial research.

5. Acknowledgements

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Chemistry and Bioactivity of Flavonoids in some Vegetables and Fruits: An Overview

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Abstract

Flavonoids are widely distributed in vegetables and fruits. The common vegetables and fruits containing flavonoids are used as food. In this review the chemical structure, classification, source and bioactivity activity are described. The important biological activity of flavonoids such as anticancer, anti-microbial, antioxidant, anti-inflammatory, anti-fungal, anti-ulcer are described. The majority of plants shows antioxidant activity by protecting the body against free radicals. The pharmacological activities of flavonoids from the various sources reviewed in this study show that the secondary metabolites provide health benefits to human.

Keywords: flavonoids, bioactivity, health benefits

Introduction:

Flavonoids are natural products responsible for the various colours in the flowers and fruits. Flavonoids are a large class of natural aromatic compounds found in plants [1]. It has been reported that more than 10,000 different classes of flavonoids have been found in kingdom Plantae [2,3]. Flavonoids are secondary metabolites found the plants shows varieties of pharmacological activity [4]. Flavonoids have been reported from sources such as vegetables and fruits [5]. The chemical structures of flavonoids consist of C6-C3-C6 [6] rings which correspond to two aromatic rings A and B linked by three carbon atoms, which may lead to the formation of a third ring C. Variations in this basic structure give the various subclasses of flavonoid compounds. These are flavanones, isoflavones, flavones, flavanols, flavonols, and anthocyanins [7]. Recent research have focused on the health benefits of these secondary metabolites because of their preventive activity against diseases and antioxidative activity, anticancer activities, antimicrobial activities, and anti-inflammatory [8]. Aside from the antioxidant activity of flavonoids, chelating properties [9], their usage as anti-aging substances [10], and inflammatory response, anti-bacterial11], gastroprotective, and anti-diabetic activity [3] of these phenolics have been reported. The protective effects such as the anti-inflammatory, antioxidant, antimicrobial, and anti-tumour activity of flavonoids from natural sources are well documented [12]. The anti-carcinogenic activity of flavonoids has been linked to their antioxidant properties [13] which is due to the hydroxyl groups on the structure of the flavonoids. Because of the importance of these phytochemicals, this review summarizes the isolation, characterization, and health benefits of these flavonoids taking into consideration those phytochemicals responsible for these activities. The health benefits reviewed were anti-cancer, anti-microbial, antioxidant, anti-inflammatory, anti-fungal, and anti-ulcer activities.

Methods:

In this review the search of literature was done by using keywords such as flavonoids, plant names on in valid scientific data base. The keywords are searched in "science direct," "google scholar," "Scopus" database, and many journal sites. Other search engines used as well as papers published between 2000 and 2025.The articles were evaluated and the references in the articles were evaluated in this study

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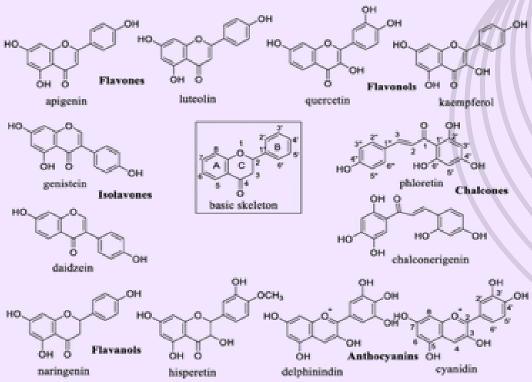
Table 1 Sources of flavonoids [13]

SNo	Flavonoids	Sources
1	Flavonols	Onion, ginger, broccoli, green leafy
2	Flavanols	Tea, apples, plums, apricots
3	Flavones	Parsley, celery, red pepper.
4	Flavanones	Lemon, orange, Citrus fruits
5	Anthocyanidins	Grapes, red cabbage, berries, cherries
6	Isoflavonones	Soya, small amount in many fruits and vegetables

Table 2 Classification of flavonoids [14]

SNo	Flavonoids	Subclasses
1	Flavonols	Quercetin,rutin,myricetin,kaempferol, morin,fisetin,isorhamnetin
2	Flavanols	Gallocatechin, epigallocatechin gallate
3	Flavones	Luteolin,galangin,apigenin, chrysin,rpoifolin,baicalein,nobiletin,tangeretin
4	Flavanones	Hesperidin, naringenin, naringin,,eriodityol,
5	Anthocyanidins	Catechin,cyanidin,epicatechin,pelargonidin, malvidin,delphinidin,
6	Isoflavonones	Genistin,glycitein,daidzin,genistein

Fig.1 Classification of Flavonoids



3.2 Isolation of flavonoids Various techniques are available to natural products researchers for the isolation of Flavonoids. These techniques have simplified their isolation from crude extracts. These techniques are column chromatography (CC), high-performance liquid chromatography (HPLC), high-speed counter-current chromatography (HSCCC), counter-current chromatography (CCC), centrifugal preparative thin layer chromatography (CPTLC), preparative thin-layer chromatography (PTLC), medium pressure liquid chromatography (MPLC) [14, 15]. The details of the extraction, steps, and the solvents used for the structural elucidation and characterization of the flavonoids summarized in this review are shown in Table 3.

3.3 Techniques used to elucidate the structure of flavonoids.

The different spectroscopic techniques are used by researchers to elucidate the structure of flavonoids. These spectroscopic methods are infrared spectroscopy (IR), nuclear magnetic resonance (NMR), ultraviolet spectrophotometry (UV), mass spectrometry (MS), and physical properties as electronic circular dichroism (ECD), melting point, and specific rotation for flavonoids [α]D. Flavonoids have unique chemical shifts. These characteristic chemical shifts make it easier to characterize them.

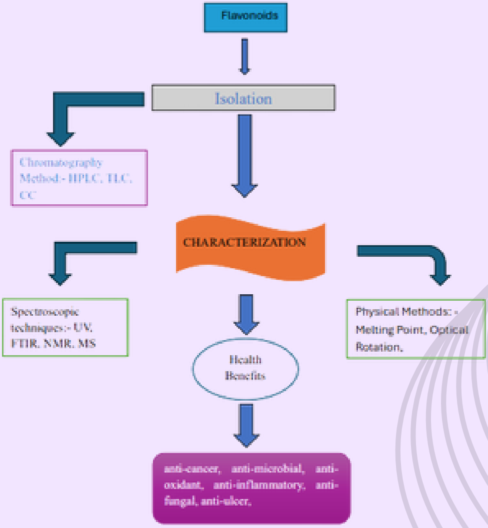


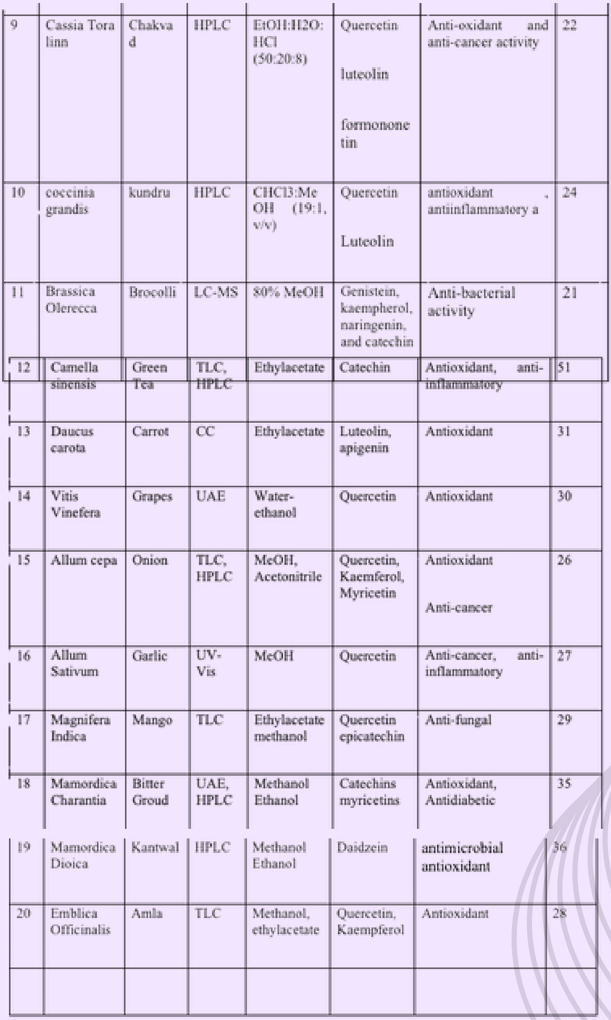
Fig. 2- The isolation, characterization, and health benefits of flavonoids are represented

4 Discussion Health benefits of flavonoids The study of bio activity of flavonoids have revealed their health benefits and their importance in the prevention of diseases [2, 39]. They have exhibited anti-oxidant, anti-inflammatory, antibacterial, and anti-viral activities [40], anti-oxidant [41], anti-allergic anti-carcinogenic properties [42]. The protective effects of flavonoids have been reported as they help to reduce oxidative stress in the body. The cholesterol-lowering activity, anti-cancer, antioxidant of myricetin, tricin, apigenin, luteolin, quercetin, and isorhamnetin has been reported [12]. The anti-viral, antibacterial, anti-cancer, cardioprotective, and anti-inflammatory activity [43], as chelating agents and, are strong topoisomerase inhibitors [12] anti-aggregational, anti-atherosclerotic, and detoxification activities [44] of various flavonoids have been reported. These biological activities depend to a larger extent on the hydroxyl group in the flavonoids [45]. Quercetin has reduced the risk of cancer, and allergic disorders [5]. The decreased risk of cardiovascular disease by proanthocyanins and flavone-3-ols has been reported [11].The techniques used for the isolation, characterization, and the health benefits of these flavonoids are as summarized in this review are shown in Table 3.

Table 3

Table 3 Isolation, characterization, and health benefits of flavonoids

S. No	Source of Flavonoids	Common Name	Isolation/Characterization	Solvent used for Extraction	Flavonoids	Bioactivity	Ref.
1	Citrus Sinensis	Orange	HPLC	MeOH	Hesperidin	Antiulcer	25
2	Citrus Limon	Lemon	HPLC	EtOH	Eriocitrin, Naringin, Hesperidin	Antioxidant, Antibacterial, Anti-inflammatory,	34
3	Malus Pumila	Apple	HPLC	MeOH	Quercetin, catechins	Antioxidant	17
4	Zingiber spectabile Griff	Zinger	NMR	DCM, EtOAc	Kaempferol	Antioxidant, antibacterial	16
5	Psidium Guajava	Guava	Column Chromatography	MeOH	Quercetin	Antimicrobial-antibacterial	18
6	C Angustifolia	Turmeric	HPCL-MS, NMR	MeOH, EtOH, acetone, and EtOAc	Quercimeritrin, scutellarein, and rutin	Antioxidant Anticancer Antimicrobial	23
7	Artocarpus lowii king	Jackfruit	TLC and NMR	n-hex:MeOH: DCM	Catechin	Antimicrobial	20
8	Spinacia oleracea	Spinach	HPLC	Ethanol	Spinacetin, luteolin, quercetin	Antifungal, antioxidant	33



9	Cassia Tora linn	Chakvad	HPLC	EtOH:H_2O: HCl (50:20:8)	Quercetin luteolin formononetin	Anti-oxidant and anti-cancer activity	22
10	coccinia grandis	kundru	HPLC	$CHCl_3$:MeOH (19:1, v/v)	Quercetin Luteolin	antioxidant , antiinflammatory a	24
11	Brassica Olerecca	Brocolli	LC-MS	80% MeOH	Genistein, kaempherol, naringenin, and catechin	Anti-bacterial activity	21
12	Camella sinensis	Green Tea	TLC, HPLC	Ethylacetate	Catechin	Antioxidant, anti-inflammatory	51
13	Daucus carota	Carrot	CC	Ethylacetate	Luteolin, apigenin	Antioxidant	31
14	Vitis Vinefera	Grapes	UAE	Water-ethanol	Quercetin	Antioxidant	30
15	Allum cepa	Onion	TLC, HPLC	MeOH, Acetonitrile	Quercetin, Kaemferol, Myricetin	Antioxidant Anti-cancer	26
16	Allum Sativum	Garlic	UV-Vis	MeOH	Quercetin	Anti-cancer, anti-inflammatory	27
17	Magnifera Indica	Mango	TLC	Ethylacetate methanol	Quercetin epicatechin	Anti-fungal	29
18	Mamordica Charantia	Bitter Groud	UAE, HPLC	Methanol Ethanol	Catechins myricetins	Antioxidant, Antidiabetic	35
19	Mamordica Dioica	Kantwal	HPLC	Methanol Ethanol	Daidzein	antimicrobial antioxidant	36
20	Emblica Officinalis	Amla	TLC	Methanol, ethylacetate	Quercetin, Kaempferol	Antioxidant	28

The pharmacological activities of the flavonoids from 20 plant families reported in the literature represented in Fig. 2. Out of the references cited, majority of the flavonoids showed antioxidant activity. Because of this vast antioxidant activity, flavonoids reduce aging by protecting the body against free radicals oxidation [46,47].

4.1 Antioxidant Activity :

Antioxidants are compounds that slow or prevent oxidation in living cells. They act against the effects of free radicals. Flavonoids protect the body against reactive oxygen species. Chemically, flavonoids have hydroxyl groups and a highly conjugated π-electron system, which allows them to act as free radical scavengers [48]. Antioxidant activity of flavonoids [8, 9,], chelating properties [9], makes them acts as protective agents against free radicals [47 46]. In the body, anti-oxidants protect the human body from free radicals oxidation [49] thereby retarding the progress of many chronic diseases. Naringenin has shown anti-oxidant, anti-diabetic, anti-atherogenic, antidepressant, immunomodulatory, antitumor, anti-inflammatory, and hypolipidaemic, activity [7]. Catechin, epicatechin, rutin, quercetin, and naringin have been reported for anti-oxidant activity against free radicals [50].Quercimeritrin, scutellarein, and rutin isolated from C. angustifolia showed strong anti-oxidant activity against oxidative stress [23]. Catechins have been reported for its protection against oxidative stress, cancer, and cardiovascular disorder [51].

4.2 Antimicrobial Genistein,
kaempferol, naringenin, and catechin isolated from Brassica oleracea var. Capitata L. possessed anti-bacterial activity against E. coli and S. aureus [21]. The 2′,4′-dihydroxy-4methoxy-3′-prenyldihydrochalcone, 4-hydroxyonchocarpin, isobavachalcone, 2′,4′-dihydroxy-3,4-(2″,2′′dimethylchromeno)-3′-prenyldihydrochalcone, 5,7- dihydroxy4′-methoxy-6-prenylflavanone, 5-hydroxy-6,7-(2,2dimethylchromano)-4′- methoxyflavanone, 4′,5-dihydroxy-6,7(2,2-dimethylchromeno)-2′-methoxy-8-γ,γdimethylallylflavone, artocarpin, pyranocycloartobiloxanthone A, and cycloheterophyllin isolated from Artocarpus lowii King and Artocarpus anisophyllus Miq showed activity against S. aureus, P. putida, B. cereus, E. coli, C. albicans, and C. glabrata [20].

4.3 Anti-cancer

In cancer the cells of a tissue undergo uncontrolled and often rapid proliferation [52]. The pharmacological properties of flavonoids have made them useful alternatives to inhibit cell damage [40]. Flavonoids have been reported to be good anti-cancer therapeutics [53]. Quercetin particularly has been reported to be effective in the treatment of stomach, lung, prostate, and breast cancers [13]. The anti-tumour activity of quercetin without toxicity on the breast cancer cell, MCF7 had been reported [54]. The anti-cancer activity of quercetin has been linked to the inhibition of the enzyme (DNA gyrase) [55].Quercetin has been reported to induce cytotoxicity in cancer cells[56]. Quercitin, morin, and myricetin have shown protective effects in the prevention of liver, cardiovascular diseases and cancer[8].

4.4 Anti-inflammatory:

Inflammation is a normal biological process in response to pathogen infection, tissue injury, or chemical irritation [8]. Daidzein, quercetin, genistein, and kaempferol have inhibited the production of both STAT-1 and NF-κB [57]. At higher doses, flavonoids have shown a decrease in proliferation, CD14 surface marker, and NO production [58].

4.5 Antifungal Quercetin-3-O-a-glucopyranosyl-(1 2)-b-D-glucopyranoside isolated from Mangifera indica L exhibited anti-fungal activity [59]. The flavonoid, baicalein, showed anti-candidal activity against C. tropicalis 170.06, C. albicans ATCC 64550, and C. parapsilosis 153.07 with the MIC50 of 2.6, 26, and 13 μg ml−1, respectively [60].

4.6 Antiulcer :

n ulcer is a disease of the alimentary tract caused by an inflamed break in the mucus lining membrane [61]. The anti-ulcer activity of quercetin in animals has been reported [39]. The hesperidin isolated from Citrus sinensis showed anti-ulcer activity [25].

5. Conclusions

Twenty members of the different plant families containing flavonoids studied for their health benefits. The study confirmed the medicinal importance of the flavonoids from these sources. The pharmacological pieces of evidence reported in the literature has proven that these flavonoids have shown anti-cancer, anti-microbial, antioxidant, anti-inflammatory, anti-fungal, and anti-ulcer activity. Out of the references cited, the antioxidant activity of flavonoids is found in almost fruits and vegetables, protecting the body against free radicals and oxidative stress. Also, the references showed anti-microbial and anti-cancer activities. Further literature reports indicated that flavonoids from these families exhibited anti-inflammatory, anti-ulcer, anti-fungal, and antiallergic activity . The pharmacological activities of flavonoids from the various sources reviewed in this study will be helpful for human health benefit.

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Juvenile Justice for Teenage Offenders: A Critical and Analytical Study

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Abstract

Juvenile justice is a specialized legal framework designed to address crimes committed by children and adolescents, emphasizing reform rather than punishment. Teenagers, due to their psychological immaturity and social vulnerability, require a justice system that balances accountability with rehabilitation. This research paper examines the concept of juvenile justice for teenagers, its objectives, legal principles, causes of juvenile delinquency, international standards, and challenges faced by juvenile justice systems. Special focus is given to the need for a child-centric, rights-based, and reformative approach to ensure social reintegration of juveniles and long-term crime prevention..

Keywords: Juvenile Justice, Teenagers, Juvenile Delinquency, Rehabilitation, Child Rights

Introduction

Juvenile justice refers to the system of laws, institutions, and policies developed to deal with minors who come into conflict with the law. Teenagers, generally between the ages of 13 and 18 years, form the most sensitive group within the juvenile justice system due to their ongoing physical, emotional, and cognitive development. Unlike adults, teenagers are more susceptible to peer pressure, emotional impulses, and environmental influences.

The primary objective of juvenile justice is not retribution but reformation. Modern legal systems recognize that teenage offenders possess the capacity for change and rehabilitation. Therefore, juvenile justice aims to protect society while simultaneously safeguarding the rights and future of the child offender.

2. Concept and Meaning of Juvenile Justice

Juvenile justice is based on the principle that children who violate the law should be treated differently from adults. The system focuses on:

- Care and protection
- Rehabilitation and reintegration
- Psychological and social development
- Prevention of repeat offending

3. Objectives of Juvenile Justice System

The objectives of the Juvenile Justice System are rooted in the principle that children and adolescents who come into conflict with the law require care, protection, and guidance rather than punitive treatment. The foremost objective of the system is rehabilitation, aiming to reform juvenile offenders through education, counseling, skill development, and psychological support so that they may reintegrate into society as responsible individuals. Another significant objective is the protection of the rights and dignity of juveniles, ensuring that they are treated in a child-friendly manner and safeguarded from abuse, exploitation, and stigma. The system also seeks to promote the best interests of the child by addressing the underlying social, economic, and familial factors that contribute to juvenile delinquency. Prevention of recidivism is a key objective, achieved through corrective and restorative measures rather than harsh punishment. Additionally, the juvenile justice system aims to maintain a balance between social safety and child welfare, ensuring accountability while avoiding exposure of juveniles to

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The adult criminal justice system. Ultimately, the system strives to foster social reintegration, moral development, and positive behavioral change, thereby contributing to long-term crime prevention and a more humane justice framework.

Causes of Juvenile Delinquency Among Teenagers

Teenage delinquency is influenced by multiple factors, including:

4.1 Family Factors

- Broken families
- Domestic violence
- Lack of parental supervision

4.2 Social Factors

- Peer pressure
- Exposure to crime and substance abuse
- Poverty and unemployment

4.3 Psychological Factors

- Emotional instability
- Identity crisis during adolescence
- Mental health issues

4.4 Educational Factors

- School dropout
- Lack of moral and value-based education

Legal Framework for Juvenile Justice

Most countries have enacted special legislation for juveniles, guided by international standards. These laws generally provide:

- Separate juvenile courts or boards
- Observation homes and rehabilitation centers
- Probation and counseling services
- Protection from adult criminal procedures

Conclusion

Juvenile justice for teenagers is a crucial component of a humane and progressive legal system. Teenagers are at a formative stage of life, and their interaction with the justice system can either reform or permanently damage them. A balanced juvenile justice system must protect society while ensuring that teenage offenders receive opportunities for correction and reintegration. Strengthening rehabilitation mechanisms, improving institutional care, and adopting a child-centric approach are essential for achieving the true objectives of juvenile justice.

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