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# Quest

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It's a fact to laugh when we use a mosquito coil and find mosquitoes buzzing around. It's because they develop resistance against the coil effect. Now a day we are hearing a lot about diseases caused due to Multi-drug resistance viruses/bacterias. Kudos to recent research showing antibiotic azithromycin effectively kills many multidrug-resistant bacteria, a detailed report presented in the news article.

"A warm smile is the universal language of kindness". One of the most widespread problems faced is dental caries mostly occur due to the presence of microbial species in the mouth. Medical advancement has launched several drugs against the same but most of them are not successful in treating it. The reason behind this is the drug resistant shown by several microbial species. Recently, it has been known that plant extracts have been useful in curing the problem of dental caries. These plant extracts are now been used in oral products. Furthermore a plant product Brinjal is one of the most important crops of solanaceous family. Issues on BT Brinjal went viral and were the common headlines on every newspaper some year's back.

Random Amplified Polymorphic DNA (RAPD) analysis done for four local varieties showed several degrees of similarities and differences in the polymorphism. The data obtained by this analysis can be very useful for further crop improvement and cross breeding.

Here by all the students and faculty members are invited to read and contribute to "QUEST" to propagate the idea of knowledge gaining by sharing.

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Research News: About 400 words (1 page)

Research Article: About 2000 words (4 pages)

Common for all: -

Font: Calibri

Font Size: 14

Columns: 2

Line Spacing: 1

Margin: Narrow

References: 1) In text citing, S No, Superscript.

2) Author's name (s), *Journal name*, **Volume No**, Page No, (year).

3) Maximum number of references should not exceed than 25.

Article title	
Name of the author*	
Affiliation	
Abstract	
Article	
* e-mail of the corresponding author.	

## Single atoms become teeny data storage devices

The tiniest electronic gadgets have nothing on this new device to store data. It encodes each bit of data using the magnetic field of a single atom. This makes for extremely compact data storage. The rub: So far, researchers have stored only two bits of data this way.

A bit is the smallest unit of data, equal to a zero or one. “If you can make your bit smaller, you can store more information,” says Fabian Natterer. He’s a physicist at the École Polytechnique Fédérale de Lausanne in Switzerland. Natterer described his team’s achievement March 16 at a meeting, here, of the American Physical Society. His group also shared their results in the March 9 *Nature*.

The researchers created the super-tiny magnetic bits using atoms of the metal holmium. They placed the atoms onto a surface of magnesium oxide. The direction of each atom’s magnetic field served as a zero or one. Which it was depended on whether its north pole was pointing up or down.

Using a special microscope, the scientists could flip an atom’s magnetic orientation. This would switch a bit from 0 to 1 — or back again. To read out the data, the researchers measured the electric current running through the atom. That current will depend on the orientation of the magnetic field.

To ensure that such a change in current was due to a flipping of the atom’s magnetic field, the team added bystander atoms of iron. (This allowed the scientists to check how the holmium atoms’ magnetic fields had affected

the iron atoms.). The new system could lead to new hard drives that store data much more densely than has been possible. Today’s data systems need 10,000 atoms or more to store a single bit of information.

Natterer also hopes to use these mini magnets to construct materials with fine-tuned magnetic properties. They could be built up one atom at a time. “You can play with them,” he explains. He likened them to Lego blocks.

-contributed by Dipika Patel  
ARIBAS

Auto-focus eyeglasses rely on liquid lenses  
With round lenses set in super-thick frames, these new eyeglasses look like they belong on a cartoon character. But what they lack in style, they make up for in smart design. Their lenses are made of *glycerin* — a thick, colorless liquid — encased in clear rubber. And without effort, they will focus on whatever the wearer looks at.

Nazmul Hasan is the first to admit that the glasses he helped design may not be comfortable — or look cool. “They’re not very fashionable,” he concedes. “And they’re heavy,” notes this graduate student in engineering at the University of Utah in Salt Lake City. Still, these glasses are truly special. The lenses in normal glasses curve in a specific way to help a person’s eyes focus on something close or far away. Not everyone who needs glasses requires the same curvature. So one person’s glasses will not necessarily work for someone else. In contrast, the

glasses that Hasan and his team designed can be adjusted to meet anyone's visual needs. Consider, for example, someone who wants to read a *Science News for Students* story. With an app on her phone, the reader sends her lens prescription to the glasses. Now, when she puts the glasses on, a small *infra-red* (In-fruh-RED) light in the frames begins sending out light pulses. That light bounces off what's in front of the wearer — here, perhaps your smartphone — and back to the glasses. Those specs use the bounced light to calculate the distance from the glasses to the smartphone screen. Tiny motors in the frame respond by bending the lens so that its curvature matches the person's prescription. Voila! The article comes into focus.

Tunable, liquid lenses can be turned into "instant prescription eyewear," says Tracy Xu, who did not work on the new glasses. Xu is an engineer at the University of Central Florida in Orlando. She studies how new technologies that use light — like lasers and lenses — can be used to build devices that help people.

Tunable glasses could be useful in emergencies and in poor countries, she says. A whole family might use one pair as a backup for broken glasses. "Millions of people in developing countries cannot afford an eye exam or do not have access to *optometrists*," says Xu. "Low-cost, self-focusing liquid lenses can become a relatively cheap solution."

The new autofocus glasses would be useful to people who need glasses only sometimes — such when they read. Hasan credits the idea for them to the eyewear needs of his advisor at the University of Utah, Carlos Mastrangelo (who also worked on the glasses).

When he drives, he doesn't need eyeglasses," says Hasan. But they're a must when Mastrangelo reads. Hasan's mother has the same problem. Many people face such a situation as they get older. Just behind the *cornea* — the part of the eye covered with colorful patterns — the eye has a *lens*. Light rays from the world stream through it and into the eye. For the brain to make sense of the image being looked at, the lens must focus the incoming light. To do that, the lens changes shape. This redirects the light rays. But over the years, those lenses may not focus so well. People may become nearsighted, which means they can only see things in focus that are close. Or they may be farsighted, which means they only see distant objects in focus. Eyeglasses can correct for these problems. But Hasan points out that for people who suffer many problems, one pair of glasses often won't do the trick. People might need *bifocals*, which have two different kinds of lenses, or *trifocals*, which have three.

That's where the autofocus glasses can help, he says. When a person like Hasan's mother reads, the lenses would focus on the words on the page. But when she drives, the lenses would leave the view unchanged. They would adapt to different situations. The prototype, or model, that Hasan and his team have built can switch its focus from on one object to another in just 14 milliseconds. That's 14 one-thousandths of a second!

Someone who had auto-focus glasses might never have to buy another pair. That's because any prescription could be uploaded to the frames. Afterward, they would adjust as needed. But these glasses are not yet ready for the world outside the lab. The lenses only focus in one direction. That's a problem because people move their eyes around all the



# Digital Watermarking – A Key Tool to Secure Digital Data

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**Abstract:**In this technosavy world, due to high speed of the Internet today's communication becomes digital. Due to this advancement, anyone can access the digital data within the entire globe without the owner's permission. The digital data can be replaced and modified with great ease which has led to a need for effective data hiding tools. As a solution, digital watermarking is one of the data hiding technique which is used to provide authentication, security and ownership to the digital data. Digital watermarking is the general technique of embedding some information in the original file which can be altered on the user's requirement. So to focus on security and ownership of digital data, this research article presented various data hiding techniques, working principle of digital watermarking and classification of watermarking techniques.

## Introduction

### A. Data Hiding Technique

The augmentation of high speed Internet has assisted in amplifying the exploration of digital data. Ironically, the digital communication is terminated through sharing of digital media which in turn leads to the need for copyright protection tools. This is can be achieved by hiding data within digital media. Altogether,

there are three methods for hiding data as shown below in figure 1.

Cryptography, a word of Greek origin, means "secret writing". Cryptography is the process of sending messages in a distinct form such that only an authorized person can remove the disguise and read the message. The original message that the user demands to send is called the plaintext while the encrypted message which receiver receives is called the cipher text. During encryption and decryption two types of keys are used videlicet, public key and private key. A public key is used for encrypting and decrypting the data which is known to every communicator over the network. Every communicator has his or her own private key and public key which are only used for decrypting the encrypting data <sup>1</sup>. Thus, cryptography provides confidentiality, data integrity, authentication and non-repudiation of data. But, any unauthorized person can view the encrypted message as cryptography encrypts the message and transmits it. The encryption and decryption of cryptographic system is shown in below figure 2 <sup>1-5</sup>.



Figure 1: Data Hiding Techniques

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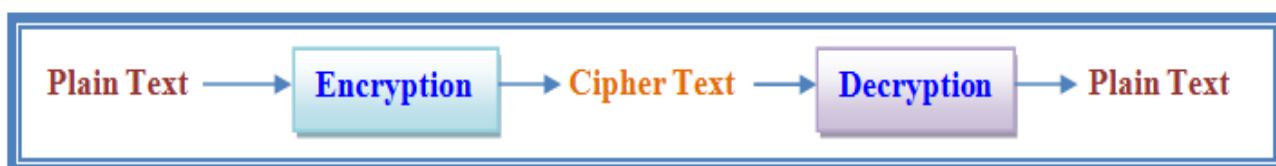


Figure 2 – Cryptography Model

**Steganography**, the most primitive art and science, hides information inside a different digital content in a way that it avoids chances of recognition of the hidden message. The existence of the word steganography is the resultant of Greek words steganos and graphein. The Greek words steganos means covered or protected, while graphein means to write. This finally sums up to “Covered Writing” or steganography which means “To hide in plain sight”.

the communication being exposed. Figure 3 shows a simple representation of the generic embedding and decoding process in steganography.

Digital watermarking is a technique for emphasizing an intellectual copyright in the electronic world. Digital watermarking is the skill of inserting information into digital data such as image, video, audio or text in such a way that the watermark can be perceived or extracted on the user’s requirement without impairing the object. The implanted information, known as a watermark, can be a digital signal or pattern or logo which is inserted into a multimedia object. Since, this signal or pattern or logo is present in each unaffected copy of the original data, the digital watermark may also work as a digital signature for the digital data. Digital Watermarking is the most ordinary yet one of the supreme techniques for protecting digital data<sup>6,7</sup>.

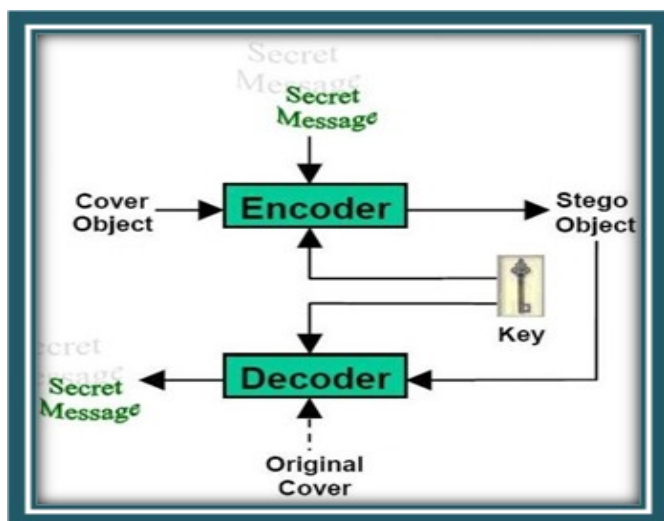


Figure 3: Model of Steganographic System

Steganography is a tool for communicating in such that the presence of a message cannot remain unrevealed. It is one of the data hiding techniques having an aspiration to transmit a message on a channel where some other sort of secret information is already being sent out. The premium advantage of steganography is that it can be hired to hideously convey messages, without the focus of

## B. The Working Principle of Digital Watermarking

Digital watermarking can be described as the procedure to embed a certain piece of information into multimedia content such as text, image, audio or video for the copyright protection. The embedded information is called watermark. Watermark can be any logo, icon, digital signature or biometric data. On the basis of user’s requirement this watermark can be detected or extracted to make an assertion about the data<sup>8</sup>.

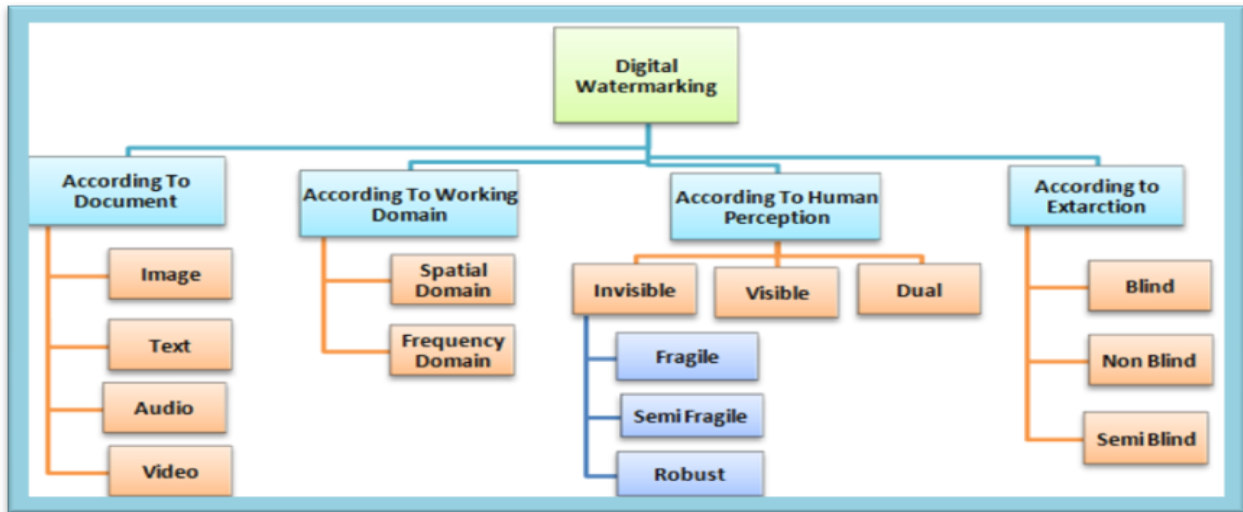


Figure 5: Classification of Digital Watermarking Techniques

Any digital watermarking system contains following two modules:

1. Watermark Embedding Module
2. Watermark Extracting Module

In Watermark Embedding module user has to input cover object and watermark. During embedding process watermark is embedded into cover object. The output of this process is watermarked data. The general model of digital watermarking system is shown in figure 4.

Now let us define cover object by  $C$ , watermark as  $W$  and watermarked data as  $C_w$ . Suppose  $F_E$  is an embedding function which takes cover object  $C$  and a watermark  $W$  and it generates a new watermarked image  $C_w$ . This is shown in below equation.

$$F_E(C, W) = C_w \quad \dots\dots\dots(1.1)$$

During watermark extraction, watermarked data is taken as an input and then extraction process is applied to retrieve original watermark. Suppose watermarked data is defined as  $C_w$  and retrieved watermark is declared by

$W'$ . Then watermark extraction function  $F_x$  takes  $C_w$  as an input and performs extraction on it and generate original watermark  $W'$  as an output.

This is shown in below equation.

$$W' = F_x(C_w, [C], [W]) \quad \dots\dots\dots(1.2)$$

Where  $W'$  is retrieved watermark,  $C$  and  $W$  enclosed in braces  $[ ]$  can be optional inputs for extraction function, which depends on the application. For example  $[C]$  is used when the watermarking system is non-blind, this system is suitable for the application where to extract the watermark original image is needed. If the watermarking system is blind the input to the extraction function is  $[W]$  only<sup>9</sup>

### C. Characteristics of Watermark

There are a number of important characteristics that a watermark can exhibit. The most important properties of watermarks are transparency, robustness, security, tamper resistance, fidelity, reliability, and computational cost, payload capacity of image, perceptibility and false positive rate. But in practice, it is probably impossible to design

watermarking system that excels at all of these. Thus, it is necessary to make tradeoffs between them, and those tradeoffs must be chosen with careful analysis of the application. In addition, the basic requirement of digital watermarking is closely related to its purpose of applications, different application has different demand.

#### **D. Classification of Digital Watermarking Techniques**

Watermarking techniques can be classified based on several criteria as shown in figure 5.

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# ***A review on Mode and DNA binding interaction of Oxine and its metal chelates***

***Ruby Khawar & Ritu Dixit\****

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**Abstract:** Metal based drugs received great attention after the landmark discovery of anti – cancer drug, Cis-platin. Metal based drugs or metal complexes gaining attention due to its structural diversity depending upon its coordination numbers, geometries, its redox-potential as well as its kinetics and thermodynamics characteristics which on the whole or individually favors the interaction of complex with negatively charged DNA, via- covalent, coordination interaction, non-coordinate interactions such as electrostatic attraction, groove binding and intercalation as well as combination of all. The potential of metal complexes is of great importance and has been proved with various marketed metal drugs. Including a variety of metal complexes of Oxine and mainly the binding modes, here a minor review has been presented on Oxine transition metal complexes and its interaction with DNA.

**Key words:** Oxine, Transition metal, chelates, DNA binding interaction

## **Introduction**

Modern lifestyle is accompanied with emerging infectious disease along with drug resistant infections and its number in human has been increased in past 2 decades and still a threatens matter to increase in near future. As a result synthesis of novel molecules has been of great interest in recent years. After the discovery of cisplatin "an anticancer drug", transition metal complexes have been found useful in pharmaceuticals as it offers possibilities to design new therapeutic agents due to its wide range of geometries and coordination number, its wide structural diversity, accessible redox state and adjustable ability of the thermodynamics and kinetics of ligand substitution. 8-hydroxyquinoline has been used before as fungicidal in agriculture, antibacterial and as preservatives. Among seven isomeric monohydroxyquinolines, only Oxine is capable of forming complex with divalent metal ions

through chelation. A series of oxines derivatives and its metal chelates has been reported as potent antimicrobial drugs like Anti-neurodegenerative, Anticancer, Antimicrobial, Antiviral, antimanic agent, anti-HIV, antiulcer agents, Anti-parasitic, Antioxidant, Anti-inflammatory, Anti-diabetic, etc. [1,2] Metal complexes exert their biological effect by inhibition of enzymes, interaction with intracellular biomolecules, enhanced lipophilicity and alteration of cell membrane functions etc. The present review describes that how metal based drugs interacts and binds with cellular DNA and exerts its effect.

Metal based drugs or metallo drugs, have shown promising results in the treatment of various diseases such as diabetes, ulcer, rheumatoid arthritis, inflammatory and cardiovascular diseases etc. in addition to cancer. In certain cases it was observed that the interaction between enzymes and heterocyclic

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compounds (ligands) was affected by the presence of metal ion in trace amount, since metal ions are required to form complexes between the ligand molecule and enzymes. Formation of metal complexes results into wide variety of coordination spheres, oxidation states and redox potential, will alter the kinetic and thermodynamic properties of the complexes towards biological receptors. Thus, metal complexes are responsible for drastic change in the biological properties of ligands. Metal complexes exert their biological effect by inhibition of enzymes, interaction with intracellular biomolecules, enhanced lipophilicity and alteration of cell membrane functions etc<sup>3-4</sup>.

**Oxines:** Oxine is trivial name of an organic compound; a derivative of Quinoline which is a class of nitrogen heterocyclic compounds. It is obtained from a large number of natural and synthetic compounds and possesses diverse biological activities. Commercially, Quinoline compounds are used as fungicides in agriculture and preservatives in textile, wood and paper industries. 8HQ in nature is a monoprotic bidentate chelating agent and it shows potent coordinating ability and good metal recognition properties, therefore, it is widely used for analytical and separation purpose, as well as for metal chelation. Amongst, all quinoline derivatives can only form complexes with bidentate metal ion through chelation. It has been used as potent metal chelators in order to restore metal balance that leads to the development of drugs for various diseases caused due to metal imbalance<sup>5</sup>.

DNA often refers as the molecule of heredity, as it is responsible for the genetic propagation of all traits.[6] DNA functions such as replication, transcription and regulation by specific protein interactions have been intensely in-

vestigated. There are some molecules that can induce or suppress cellular interactions related to DNA are of value as they manipulate the function of cells to produce a desired result, thereby allowing the diagnosis or treatment of disease. Transition metals are ideal for these purposes; as their unique properties allows specific interactions between DNA and other biomolecule while their spectroscopic characteristics facilitate use to study their biophysical properties. Structural Diversity of Metal Complexes and their degree of variability like oxidation state, coordinated ligands, overall size and shape of the complex allows a high degree of selectivity towards various biological target<sup>7-9</sup>.

Metal complexes bind to DNA by different modes like Covalent binding, Groove binding, Intercalation, etc,. B.Sreekanth *et al*, 2013 reported the DNA binding ability of the novel complexes of Zn and Mn with bioactive mixed ligand of 8-Hydroxyquinoline and 1,10-Phenanthroline, have been isolated and characterized by analytical and spectral methods. The intrinsic binding constant  $K_b$  has been estimated at room temperature. The absorption spectra indicate that the complexes intercalate between the base pairs of the CT-DNA tightly.[10]

H. Monsourie *et al* synthesized *Ethylenediamine 8-Hydroxyquinolinato Palladium (II) Chloride*[Pd(en)(8QO)]Cl and studied its DNA binding interaction by fluorescence, UV-Vis techniques and gel chromatography method. Experimental results indicate that the complex can bind non-cooperatively to CT-DNA most likely the mode of intercalation. This complex unexpectedly denatures CT-DNA at very low concentration. The wa-

ter soluble palladium complex breaks the CT-DNA into two unequal fractions and only binds to the fraction with lower molecular weight. This complex is especially active against chronic myelogenous leukemia cell line, K562<sup>11</sup>.

A.Y. Shaw *et al* showed possible mechanisms of DNA damage by Fe-8HQ complex. There they showed how complex binds at specific sites that break the phosphodiester backbone of DNA, acting as chemical nucleases, causing oxidative degradation at the deoxyribose moiety. Another possible mechanism is that the Fe-chelator complex induces membrane damage that leads to loss of calcium homeostasis, which triggers endonuclease to cleave DNA in an apoptotic-like manner. The binding mode here is intercalation<sup>12</sup>.

Toshihiro *et al* studied the 3 amino pyridine derivative of 8-hydroxyquinoline linked at 5<sup>th</sup> position by azo coupling and its copper complex binds to DNA via groove binding due to its the non-planer coordination, intercalation is hardly conceivable. The study for elucidating the orientation of the dimer in the groove of double-stranded DNA remains to be solved. So the binding of dimer to DNA is possible through groove binding<sup>13</sup>.

Dixit *et al* synthesized transition metal complexes of sulfonamides substituted 8-hydroxyquinoline derivatives (AHQMBSH) and studied DNA binding interaction with Ni<sup>2+</sup>, Cu<sup>2+</sup> and Zn<sup>2+</sup> complexes where the maximum DNA cleavage ability was given by Copper complex compared to all the compounds. All metal complexes showed moderate binding with DNA. The relative binding efficacy of the complexes to DNA was much higher than the

ligands. Among, the tested compounds, Cu-AHQMBSH was found to have excellent binding ability for DNA

**Conclusion:** Metal complex-DNA interactions have been extensively researched in scrupulous and here we have reviewed very few examples of transition metal complexes that interact with DNA in its various structural forms, using a variety of different binding modes. From this we conclude that by modifying the structure of drug by complexation with transition metals we can improve the binding affinity and selectivity of drugs. The flexibility to design such drugs afforded by transition metals due to their inherent physiochemical variety and almost there is limitless range of ligands for coordination, makes metal complexes potent therapeutic and diagnostic agents.

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# ESTIMATION OF TOTAL PHENOL AND FLAVONOIDS CONTENT IN CRUDE LEAVES

## EXTRACTS OF *RANDIA DUMETORUM* LAMK

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**Abstract:** The present study was undertaken to estimate the total phenolic and total flavanoids contents in crude leaves extracts of *Randia dumetorum* Lamk using petroleum ether, chloroform, ethyl acetate and methanol for extraction. The amount of total phenols and flavanoids content has been studied. Major amount of phenols was determined in methanolic leaves extract (98.6 µg/ml dry weight) while minimum content was reported in petroleum ether leaves extract (60.71 µg/ml dry weight basis). Moreover, maximum flavonoid content was found to be present in methanol leaves extracts (37.64 µg/ml dry weight basis) and minimum content was reported in ethyl acetate extract (13.44 µg/ml dry weight basis).

**Key words:** Flavanoid, Phenolics and *Randia dumetorum* Lamk.

### Introduction

Medicinal plants are generally used for treating various disorders in human beings from the time immemorial. There are many different types of phytochemicals are present in medicinal plants and they attributed for its medicinal properties. Phenolic and flavonoids compounds are also widely distributed in plants which have been reported to exert multiple biological effects, including antioxidant, free radical scavenging abilities, anti-inflammatory, anticarcinogenic etc <sup>1</sup>. *Randia dumetorum* Lamk. is one of the important medicinal plant belonging to family Rubiaceae.

This is large deciduous thorny tree which is also known as a *Catunaregam spinosa* (Thumb.) Tirveng. Commonly called madanphal or mindhal and emetic nut in English.

Large deciduous thorny shrub grows up to 5 meters of height. Leaves are simple, obovate, wrinkled, shiny and pubescent. Fruit, 1.8-4.5 cm long, globose or broadly ovoid, longitudinally ribbed or smooth yellowish-brown, crowned with persistent calyx-limb, fruit, contains numerous seeds, 0.4-0.6 cm long, compressed, smooth, brown and very hard <sup>2</sup>. This plant has many therapeutic uses which are mention in Ayurveda. Fruit has mainly uses for cures cough, piles, asthma, jaundices, abscess, ulcers, inflammation, wounds, tumours, skin diseases and have antibacterial activity. The pulp of fruit is believed by many practitioners to also have anthelmintic properties, and also used as an abortifacient as folklore remedy <sup>3</sup>. However, the bark is astringent and is given in cases of diarrhea and dysentery <sup>4</sup>. It is administered internally and applied externally

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in the form of paste in rheumatism and to relieve pain of bruises and boneaches during fevers and to disperse abscesses. The aqueous extract of the root bark of the tree is used as an active insecticide <sup>5</sup>.

*Randia dumetorum* contains glycosides, triterpenoid glycosides and randianin. Saponins named as dumetoronins A, B, C, D, E and F etc. It has rasa, guna, virya, vipaka like Ayurvedic property. It has anti-bacterial, anti-allergic, anti-inflammatory, analgesic and immunomodulatory activity<sup>2</sup>.

Root bark contains triterpene, 1-keto-3-hydroxyoleanane, mannitol, saponins and coumarin glycosides. Leaves contain an iridoid-10-methylxoside <sup>6</sup>. Ripe fruit contains glycosides, randioside A, mollisidial triterpenoid glycosides and randianin, six saponins- dumetoronins A to F <sup>3</sup>. The objectives of this study were to extract and determine the total phenolics and flavanoids contents in different solvent extracts of *Randia dumetorum* leaves. This plant is believed to contain high phenolic and flavanoids compounds but limited research on phytochemical compounds of this plant has been reported. This research may lead to further investigation on the potential of this particular plant as herbal drug products.

## Materials and methods

### Plants materials:

The plant selected in the present study was *Randia dumetorum* Lamk. This plant was collected from DMAPR (Directorate for Medicinal and Aromatic Plants Research, Boriavi, Anand). Fresh and mature leaves were used for estimation of total phenolic and flavonoid contents.

## Preparation of Plant Extract

For the preparation of crude leaves extracts in different solvents, *Randia dumetorum* leaves were air dried at room temperature (27°C) for one week, after that it was ground to form uniform powder. The following four different extracting solvents were used for preparing leaves extracts i.e. petroleum ether, chloroform, ethyl acetate and methanol. By soaking 10 g dry leaves powdered material in 200 ml of respective solvent at their respective boiling temperature for 48 hrs. in distillation assembly. The filtrates obtained were concentrated under vacuum on a rotary evaporator at 40°C. The extracts were kept in sterile bottles under refrigerated condition until use.

## Determination of total phenolics

Total phenolic content was determined by Folin Ciocalteu reagent method <sup>7</sup>. 0.5 ml of different plant extracts were taken and Folin ciocalteu reagent (2.5 ml 1:10 diluted with distilled water) was added, then 2 ml of 20% solution of Na<sub>2</sub>CO<sub>3</sub> was added. The mixture was allowed to stand for 15 minutes at room temperature (37°C) and absorbance was measured at 765 nm. For standard reading Gallic acid (standard phenolic compound 20 mg/ml) was used. Standard graph was compared with samples reading. Total phenolic content of extracts were expressed in µg /ml on dry weight basis. All samples were analyzed in triplicates.

## Determination of total flavanoids

The aluminum chloride colorimetric method was used to measure the flavonoid content of extract samples <sup>8</sup>. 0.5 ml of plant extracts were taken, in that 1.5 ml methanol, 0.1 ml 10% aluminium chloride, 0.1 M sodium ace-

and 7.8 ml distilled water were added. The mixture was allowed to stand for 30 minutes at room temperature. The absorbance of reaction mixture was measured at 415 nm. Quercetin (Standard flavonoid compound 0.2mg/ml) was used as standard for the calibration curve. Standard graph was compared with samples reading. Total flavonoid content of samples was expressed in  $\mu\text{g/ml}$  on dry weight basis.

## RESULT AND DISCUSSION

In the present investigation results for total phenolic content in crude leaves extracts of *Randia dumetorum* in different solvents are

presented in Table no: 1.1 . Result revealed that the maximum phenolic content was observed in case of methanol extract in which  $98.6 \mu\text{g/ml}$  dry weight basis was present. This was followed by ethyl acetate extract in which  $88.46 \mu\text{g/ml}$  dry weight basis of total phenolic content was reported. However, minimum total phenolic content was found in petroleum ether extract (  $60.71 \mu\text{g/ml}$  dry weight basis).

**TABLE NO 1.1: TOTAL PHENOLIC AND FLAVANOIDS CONTENTS OF *Randia dumetorum* LEAVES EXTRACTS**

Plant name	Crude Leaves Extracts	Total phenolic content ( $\mu\text{g/ml}$ dry weight basis)	Total flavanoids content ( $\mu\text{g/ml}$ dry weight basis)
<i>Randia dumetorum</i>	Petroleum ether leaves extract	60.71	36.14
	Ethyl acetate leaves extract	88.46	13.44
	Chloroform leaves extract	66.75	21.71
	Methanol leaves extract	98.60	37.64

These results are also in agreement with Movalia *et al.*, (2010) who investigated on *Randia dumetorum* fruits extracts where  $0.132 \text{ mg/ml}$  total phenolic content was present and showed good amount of total phenolic content was present in methanolic leaf extract [9]. It has also reported that this poly-

phenolic compounds with known properties which include free radical scavenging, inhibition of hydrolytic and oxidative enzymes, anti-inflammatory action [10].The beneficial effects derived from phenolics compounds have been attributed to their antioxidant activity<sup>11</sup>.

Similarly for flavanoids contents, the results of crude leaves extracts of *Randia dumetorum* in different solvents showed variability in total flavonoid content. Maximum result was reported in methanolic crude leaves extract that was 37.64 µg/ml with compare to other. This was followed by petroleum ether in which 36.14µg/ml was reported. However, minimum amount of total flavonoid content was found in ethyl acetate extract where 13.44 ug/ml was noted (Table no: 1.1).

Similar line of research work was also carried out by Ghante *et al.*, (2012)<sup>12</sup> on *Randia dumetorum* fruit (methanolic and ethanolic extract). They found that in methanolic fruit extract, total flavonoid content was 8.02mg/g and in ethanolic fruit extract 3.32mg/g total flavonoid content was present. Flavonoids are a group of polyphenolic compounds, it has properties like free radical scavenging, inhibition of hydrolytic and oxidative enzymes; anti-inflammatory action<sup>10</sup>.

### Conclusion

It could be concluded from present study that different crude leaves extract of *Randia dumetorum* Lamk in different solvents showed difference in phytochemical constituents. Due to presence of good amount of total phenolic and flavonoid content in crude leaves extracts may provide a good source of antioxidant.

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