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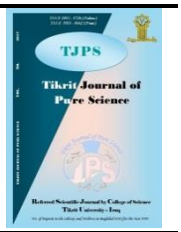

Detection some active Compounds in the Leaves and Stems of Local Coriander Plant - *Coriandrum sativum* L.

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Abstract

This research aimed at studying some of the chemical compounds of the leaves and stems of a local plant "Coriander". Inclusive chemical Detection for the most important active chemical compounds that exist in this plant were carried out. The most chemically effective groups of compounds were identified using the (FTIR) spectrophotometer. It was found that the leaves of this plant contain Glycosides, Saponins, Resins, Flavonieds, Alkaloids, Phenoles and Coumarines. The (pH) of leaves was found to be equal to (5.48). It was also found that the stems of this plant contain Flavonieds, Terpenes, Steroids, Glycosides, Coumarines, Saponins, Resins and Volatile Oils. The (pH) of stems was found to be equal to (5.46). The presence of these compounds in locally planted Coriander makes it one of the important medical herbs. The results of this research confirm the medical significance of this plant results from the existence of the active compounds. It is recommended to encourage planting Coriander in Iraq for medical purposes.

Introduction

The life of human, since ever, had been linked with the life of plants. Human, since his ancient life, had distinguished edible plants and other plants that were suitable to be used as fuel for fire while he avoided harmful plants. Coriander plant belongs to the Umbelliferae family having the scientific name of "*Coriandrum sativum* L.". It contains many important volatile oils such as Linalool, Camphor and Limonene. It also contains many important compounds like Coumarines, Tanninsand Glycosides, in addition to Flavinoids and Phenolic**[1]**. Furthermore, Coriander contains many important nutritious elements. It is considered as a good source of plant fibers, iron, manganese and magnesium especially its leaves. Because of the importance of Coriander as one of the medical plants that produce volatile oils and fatty acids, it was continually and intensively subjected to both biotechnical and tissue culture researches. The production of medical substances using tissue culturing proved to be a better alternative compared to using traditional agriculture in producing different necessary metabolism substances**[2]**.

Coriander is one of the herbs that are distinguished by its dark green leaves that have a strong distinctive taste. The most suitable season to start planting Coriander is at the late of spring in hot regions and perhaps it can also be successful at late summer where Coriander may starts blossoming producing flowers then seeds**[3]**.

Coriander is considered as one of the important medical plants. Its aromatic oils stimulate intestinal juices so it is used to treat indigestion, stomach and intestines cramps and anorexia. Coriander is also considered as an expeller to gases and worms. It also stimulates urine and sweat. It is useful to cure diarrhea and colic, oral ulcers, muscle spasms, bladder pain, fever and headache. Coriander tea reduces pain of menstruation or delivery. Furthermore, Coriander is externally used to cure rheumatism, arthritis and leprosy. It is used to heal breathing problems, laryngitis, coryza and influenza that are not accompanied by sweating**[4]**. Coriander is also useful to improve flavor of drugs and medications. It has an effect on the metabolism of lipid and fat which affect colon cancer**[5]**.

The identification of plants' benefits by the ancient man was completely dependent on his experience**[1].** The rapid improvement of lab techniques has enabled the employment of biochemistry to prove the genetic relations between different plant families and species. Such tests solely depend on detecting the presence of certain compounds such as Amino Acids, Carbohydrates, Lipids, Volatile Oils, Alkaline,

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Dyegranules, Flavonieds, Phenols, Resins and others**[6]**. It is believed that whenever genetic relations between plant families and species are strong, they will lead to more chemical similarity. Every plant is in fact a pharmacy that contains active compounds useful to mankind and nature**[7]**.

Coriander is naturally found all over Asia, North Africa and Europe before 2000 B.C. Archeologists in Egypt had found two baskets of Coriander fruits in the cemetery of Tut Ankh Amun. Coriander was presented as gifts in Pharaonic tombs**[3]**.

The aim of this research is to study the chemical properties of the leaves and stems of a local plant scientifically called "*Coriandrum sativum* L.". Comprehensive chemical investigations of the most important active compounds that exist in this plant were investigated. The most chemically effective groups of components were also identified using the Fourier Transform Infrared Spectrophotometer (FTIR).

Materials and Methods

Preparation of Raw Samples

Samples of leaves and stems of *Coriandrum sativum* L. were gathered from the plants that were planted in the green house of the College of Science in Tikrit University, show figure (1). FTIR spectrum of organic extract leaves of Coriandrum sativum L. After removing stuck soil from the samples and washing them using tap water, they were put in shade to dry at room temperature which ranged from (20°-32°C) so it takes more than (12) days to get dry enough to be grinded. Then the samples of leaves and stems were grinded separately by an electrical blender to get a powder of each. These two powders were kept into two separate sterilized glass vessels labeled by suitable signs showing its type and date of grinding. This procedure was carried out according to **[8]**.

Figure 1: ***Coriandrum sativum*** **L.**

Preparation of Extracts

The extracts of each of the powder samples were prepared using an organic solvent called Petroleum Ether and then polarity solvents namely water and Ethel Alcohol.

1. Preparation of Organic Extracts

The organic extract of the powder samples was prepared by taking (50) grams from each of the two types of powder and mixing each of them alone with (400 ml) of Petroleum Ether having a concentration of (40-60)% for (72) hours using magnetic mixer. Then the solution was filtered by filtering papers and the residue was dried at room temperature to get rid of organics. This procedure was carried out according to **[9]**.

2. Preparation of Alcoholic Extracts

The alcoholic extracts of the two aforementioned residues was prepared by taking the residue of each of the two types and mixed it with (400 ml) of Ethyl Alcohol having a concentration of (99%) for (72) hours using a magnetic mixer. Then the resulted mix was filtered by filtering papers and the solvent was evaporated under low pressure using a rotary evaporator at a temperature of (40°C). This procedure was carried out according to **[10]**.

3. Preparation of Watery Extracts

The cold watery extract of the two aforementioned residues was prepared by taking the residue of each of the two types and mix it with (400 ml) of distilled water for (72) hours using a magnetic mixer then the resulted mix was filtered by filtering papers. This solvent was evaporated under low pressure using a rotary evaporator at a temperature of (40°C). This procedure was also carried out according to **[10]**.

Preparation of Reagents

In order to detect the presence of chemical compounds in the extracts of each of the two powder samples (leaves and stems), the following reagents were prepared and used.

1. Preparation of Dragendroff's Reagent

Preparation of Dragendroff's reagent was carried out according to Harborne (1973) method to detect Alkaloids**[11]**. An amount of (0.6) grams of Bismuth Subnitratr and (2 ml) of concentrated Hydrochloric Acid (Hcl) were added to (10 ml) of distilled water. Another amount of (0.6) grams of Potassium Iodide (KI) were added to (10 ml) of distilled water separately. Then both solutions were mixed with (7 ml) of concentrated Hydrochloric Acid (Hcl) and (5 ml) of distilled water. Distilled water was added till the total mix quantity reaches (400 ml). This reagent gives an orange residue at the bottom as a proof that Alkaloids are present.

2. Preparation of Mayer's Reagent

Preparation of Mayer's reagent was carried out according to Somolenski *et al*. (1972) method to detect Alkaloids**[12]**. An amount of (1.58) grams of Mercury Chloride (HgCl2) were dissolved into (60 ml) of distilled water. Another amount of (5) grams of Potassium Iodide (KI) were dissolved into (10 ml) of distilled water separately. Then both solutions were mixed carefully while adding distilled water till the total mix quantity reaches (100 ml). This reagent gives a white residue at the bottom as a proof that Alkaloids are present.

3. Preparation of Wagner's Reagent

Preparation of Wagner's reagent was carried out according to Somolenski *et al*. (1972) method to detect Alkaloids**[12]**. An amount of (2) grams of Potassium Iodide (KI) was dissolved into (5 ml) of distilled water, then an amount of (1.27) grams of Iodine was added to the solution and mixed carefully. Distilled water was added till the total mix quantity reaches (100 ml) then kept in the refrigerator. This reagent gives a brown residue at the bottom as a proof that Alkaloids are present.

4. Preparation of Benedict's Reagent

Preparation of Benedict's reagent was carried out according to Al-Fayaad (2006) method to detect Glycosides**[13]**. An amount of (137) grams of Sodium Citrate and (100) grams of Monohydrate Sodium Carbonates were dissolved into (800 ml) of distilled water. This solution was filtered by filtering papers then (17.3) grams of Cupric Sulphate was dissolved into (100 ml) of distilled water and added to the leachate. Distilled water was added till the total mix quantity reaches (1000 ml). This reagent gives a red residue at the bottom as a proof that Glycosides compounds are present.

Detection of Active Compounds

These detection tests were carried out for both leaves and stems powder samples separately:

1. Detection of Alkaloids

This detection was made using (3 ml) of each of organic, alcoholic and watery extracts at a time mixed with (2 ml) of the following reagents each into a separate test tube:

i. When Dragendroff's reagent was used an orange residue appeared at the bottom as a proof that Alkaloids are present according to Harborne (1973)[11].

ii. When Mayer's reagent was used a white residue appeared as a proof that Alkaloids are present according to Somolenski et al. (1972)[12].

iii. When Wagner's reagent was used a brown residue appeared as a proof that Alkaloids are present according to Harborne (1973)[11].

2. Detection of Saponins

This detection was made according to Shihata (1951)[14]. Two methods were carried out as follows:

i. An amount of (1-3 ml) of Mercury Chloride (HgCl2) solution having a concentration of (1%) was added to (5 ml) of each of organic and alcoholic extracts into a separate test tube. A white residue appeared at the bottom and thick foam was formed as a proof that Saponins are present.

ii. One ml of watery solution of the plant powder samples was poured each into a separate test tube and then strongly shaken till it produces heavy foam

which remained for several minutes as a proof that Saponins are present.

3. Detection of Phenols

A solution of Ferric Chloride reagent was prepared by dissolving Ferric Chloride salt in distilled water at a concentration of (1%). Then (2 ml) of the Ferric Chloride solution was added to (3 ml) of each of organic, alcoholic and watery extracts each into a separate test tube. A bluish green color appeared as a proof that Phenols are present according to Harborne (1973)[11].

4. Detection of Resins

This detection was made by mixing (10 ml) of each of organic, alcoholic and watery extracts each time with (20 ml) of distilled water acidified by (4%) of Hydrochloric Acid (Hcl). The mix became turbulent as a proof that Resins are present according to Shihata (1951)[14].

5. Detection of Flavones

This detection was made by mixing (1 ml) of each of watery and alcoholic extracts separately with (1-4) drops of concentrated Sulfuric Acid (H2SO4) each into a separate test tube. A reddish brown color appeared as a proof that Flavones are present according to Cannell (1998)[15].

6. Detection of Terpenes and Steroids

This detection was made by mixing (1 ml) of each of watery, organic and alcoholic extracts with (5ml) Chloroform each into a separate test tube. Then a drop of Acetic Anhydrate substance and a drop of concentrated Sulfuric Acid were added to them. A brown color was formed as a proof that Terpenes are present, then after (1-3) minutes the color alter to dark blue as a proof that Steroids are present too, according to Al-Abid (1985)**[16]**.

7. Detection of Glycosides

This detection was made by mixing (1 ml) of watery, organic and alcoholic extracts with (2ml) of Benedict's reagent each into a separate test tube. Then each mix was subjected to a water bath where water was boiled for (5-10) minutes. A red residue appeared as a proof that Glycosides are present according to Al-Fayaad (2006)[13].

8. Detection of Tannins

This detection was made by boiling (10) grams of each of the two dry powders separately in (50 ml) of distilled water. The resulted solution was filtered by filtering papers and the leachate was left to cool and then be divided into two equal parts. One part of the resulted leachate was mixed with Lead Acetate having a concentration of (1%). A gelatinous residue was formed as a proof that Tannins are present according to Harborne (1984)[17]. On the other hand, the other part of the resulted leachate was mixed with Ferric Chloride having a concentration of (1%). A bluish green color appeared as a proof that Tannins are present according to Harborne (1984) too[17].

9. Detection of Volatile Oils

This detection was made by filtering (10 ml) of each of watery and alcoholic extracts separately. Filtering papers were saturated with these leachates separately and then they were exposed to Ultra Violet Ray. A shining pink color appeared as a proof that Volatile Oils are present according to Indian Herbal Pharmacopoeia (1998)[18].

10. Detection of Coumarines

One ml of each of organic, alcoholic and watery extracts was poured into test tubes separately. The test tubes were covered by filtering papers moist with diluted Sodium Hydroxide solution (NaOH). Each damped filtering paper was subjected to boiled water bath for several minutes then they were exposed to Ultra Violet Ray. A shining greenish yellow color appeared as a proof that Coumarines are present according to Geisman (1962)[19].

Measuring the pH of the Extracts

This test was made by blending (10) grams of the dry powder of each of the leaves and stems samples with (50 ml) of distilled water for (10) minutes using a magnetic stirrer. Then the blend was filtered by filtering papers and the pH was measured using a pH-meter device according to Shihata (1951)[14]. It was found that the pH of leaves was equal to (5.48) and the pH of stems was equal to (5.46).

Results and Discussion

Tables (1) and (2) shows the results of this research concerning the chemical detection of the active compounds found in the leaves and stems of Coriander Plant. One of the detected active compounds is Phenols. Phenols can help to protect plant against insects and fungus that may cause Damping off. Other detected active compounds are Tannins and Saponins. Tannins can be considered as a source of energy needed by the plant for biological metabolic processes. The leaves have shown the existence Saponins. Saponins can be used in large scale to reduce the incidence of heart disease, especially when extracted from the cortex of suitable plants**[20]**.It was also found that the leaves and stems of Coriander contain Flavinoids which are organic compounds that have the ability to dissolve in water. Flavinoids usually exist in the water solution of the plant cell**[21]**. They are found in superior plants and within young tissues either free or as Glycosides derivatives. Also Flavinoids are available in citrus fruits, onions, beans and others**[22]**. Furthermore, Flavinoids have many health benefits and participate in giving attractive colours to many types of fruits and vegetables in addition to distinguishing the taste**[23]**.

The stems of Coriander showed higher rates of Glycosides than the leaves. Glycosides are plant compounds that separate into two parts; Sugar part and Aglycon part when they are hydrated and become acids and enzymes. They play a vital role during the whole life of the plant for they regulate the growth of the plant, keep the plant water content and protect it against pests and insects attack.

The IR spectrum data for organic extract show bands at (3413–3477 cm-1) for (OH) Hydroxyl group for

carboxylic acid and band at (1743 cm-1) for (C=O) carbonyl group and band at (2854- 2923 cm-1) and this functional group found in structure of (Terpenes, Steroids, Tannins) The spectral data show in figure (2).

The extract of alcohol gives band at (3427- 3454 cm-1) for (OH) group and (2858-2929 cm-1) for (CH) aliphatic and band at (1751 cm-1) due to (C=O) group, band at (1637 cm-1) for (C-N) group this functional group found in structure of (alkaloids, flavones, coumarines) the spectral data show in figure (3), (5) .

The extract of distilled water show bands at (3352 cm-1) for (NH) group and (3122 cm-1) for (Ar-H) group band at (2955 cm-1) for (CH) group and band at (1606 cm-1) for (C=C). This functional group found in structure of (saponins, Tannins, coumarines, Terpenes) The spectral data show in figure (4), (6).

The results shown in Figures (2 to 6) indicate differences in the quality and quantity of the chemical compounds compared to those found in Tropical Plants (2008)**[25]**. These differences are due to the difference in the planting media, environmental conditions and methods of measurement and analysis. Physical and chemical properties of soil like porosity and acidity are regarded as significant factors that affect the quantity and quality of active components. Environmental conditions like light, humidity, heat, altitude, proximity to the equator, methods of harvesting and genetic coefficients such as mutation or hybridization are also regarded as significant factors**[26]**.

Through the discussion of the laboratory chemical detectors of the used plant in the research with its parts (leaves, stems), it is explained that there is a possibility of classification of a plan from the same family according to its chemical content[27]. Depending to the results, the chemical classification can be used with other plants [28].

Table 1: Chemical detection of *Coriandrumsativum* L. leaves

Extracts	Reagents or Devices	Active Compounds	Results
Organic	Mayer's + Dragendroff's+ Wagner's	Alkaloids	-
Alcoholic	Mayer's + Dragendroff's+ Wagner's	Alkaloids	+
Watery	Mayer's + Dragendroff's+ Wagner's	Alkaloids	-
Organic	Ferric Chloride	Phenols	-
Alcoholic	Ferric Chloride	Phenols	+
Watery	Ferric Chloride	Phenols	-
Organic	HgCl2	Saponins	-
Alcoholic	HgCl2	Saponins	-
Watery	HgCl2	Saponins	+
Organic	HCL 4%	Resins	-
Alcoholic	HCL 4%	Resins	+
Watery	HCL 4%	Resins	-
Organic	H2SO4	Flavones	-
Alcoholic	H2SO4	Flavones	+
Watery	H2SO4	Flavones	+
Organic	Acetic anhydrate + H2SO4	Terpenes	+
Alcoholic	Acetic anhydrate + H2SO4	Terpenes	+
Watery	Acetic anhydrate + H2SO4	Terpenes	+
Organic	Acetic anhydrate + H2SO4	Steroids	+
Alcoholic	Acetic anhydrate + H2SO4	Steroids	-
Watery	Acetic anhydrate + H2SO4	Steroids	+
Organic	Benedict	Glycosides	-
Alcoholic	Benedict	Glycosides	-
Watery	Benedict	Glycosides	+
Organic	Chloride Ferric + Lead acetate	Tannins	+
Alcoholic	Chloride Ferric + Lead acetate	Tannins	-
Watery	Chloride Ferric + Lead acetate	Tannins	-
Watery	pH-meter	pH	5.48
Organic	Ultra Violet Ray	Coumarines	+
Alcoholic	Ultra Violet Ray	Coumarines	++
Watery	Ultra Violet Ray	Coumarines	+
Organic	Ultra Violet Ray	Volatile Oils	+
Alcoholic	Ultra Violet Ray	Volatile Oils	++
Watery	Ultra Violet Ray	Volatile Oils	-

(-) means not present. (+) means slightly present. (++) means noticeably present.

Table 2: Chemical detection of *Coriandrumsativum* L. stems

Extracts	Reagents or Devices	Active Compounds	Results
Organic	Mayer's + Dragendroff's+ Wagner's	Alkaloids	-
Alcoholic	Mayer's + Dragendroff's+ Wagner's	Alkaloids	-
Watery	Mayer's + Dragendroff's+ Wagner's	Alkaloids	-
Organic	Ferric Chloride	Phenols	-
Alcoholic	Ferric Chloride	Phenols	-
Watery	Ferric Chloride	Phenols	-
Organic	HgCl2	Saponins	-
Alcoholic	HgCl2	Saponins	-
Watery	HgCl2	Saponins	+++
Organic	HCL 4%	Resins	-
Alcoholic	HCL 4%	Resins	+
Watery	HCL 4%	Resins	-
Organic	H2SO4	Flavones	-
Alcoholic	H2SO4	Flavones	+
Watery	H2SO4	Flavones	+
Organic	Acetic anhydrate + H2SO4	Terpenes	-
Alcoholic	Acetic anhydrate + H2SO4	Terpenes	+
Watery	Acetic anhydrate + H2SO4	Terpenes	-
Organic	Acetic anhydrate + H2SO4	Steroids	-
Alcoholic	Acetic anhydrate + H2SO4	Steroids	+
Watery	Acetic anhydrate + H2SO4	Steroids	-
Organic	Benedict	Glycosides	-
Alcoholic	Benedict	Glycosides	+++
Watery	Benedict	Glycosides	++
Organic	Chloride Ferric + Lead acetate	Tannins	-
Alcoholic	Chloride Ferric + Lead acetate	Tannins	-
Watery	Chloride Ferric + Lead acetate	Tannins	+
Watery	pH-meter	pH	5.46
Organic	Ultra Violet Ray	Coumarines	+
Alcoholic	Ultra Violet Ray	Coumarines	+
Watery	Ultra Violet Ray	Coumarines	+
Organic	Ultra Violet Ray	Volatile Oils	-
Alcoholic	Ultra Violet Ray	Volatile Oils	+
Watery	Ultra Violet Ray	Volatile Oils	-

(-) means not present. (+) means slightly present. (++) means noticeably present. (+++) means considerably present.

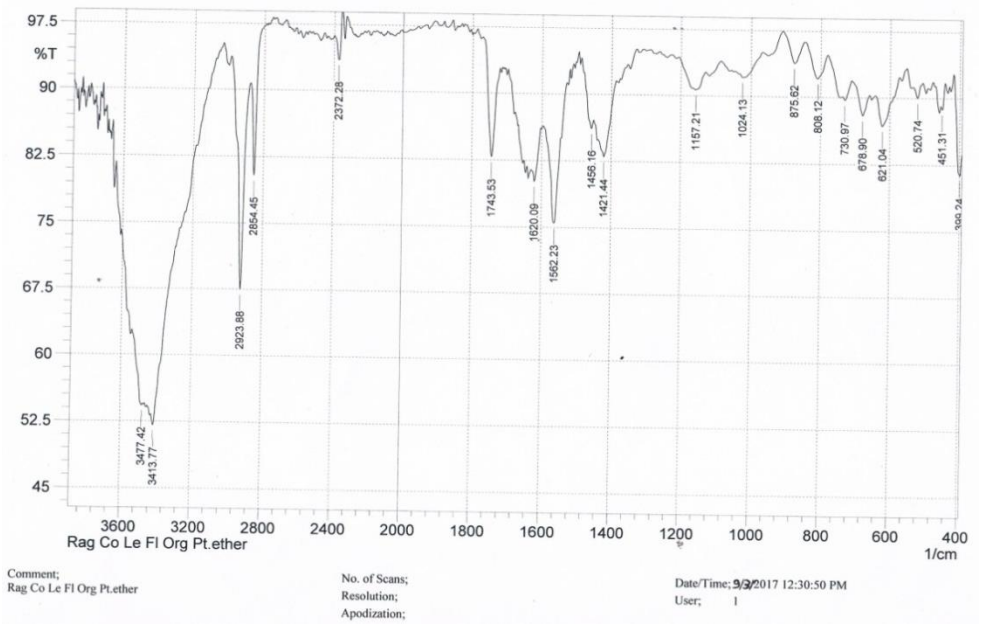

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Figure 2: FTIRspectrum of organic extract leaves of *Coriandrum sativum* L. (T% Transmittance)

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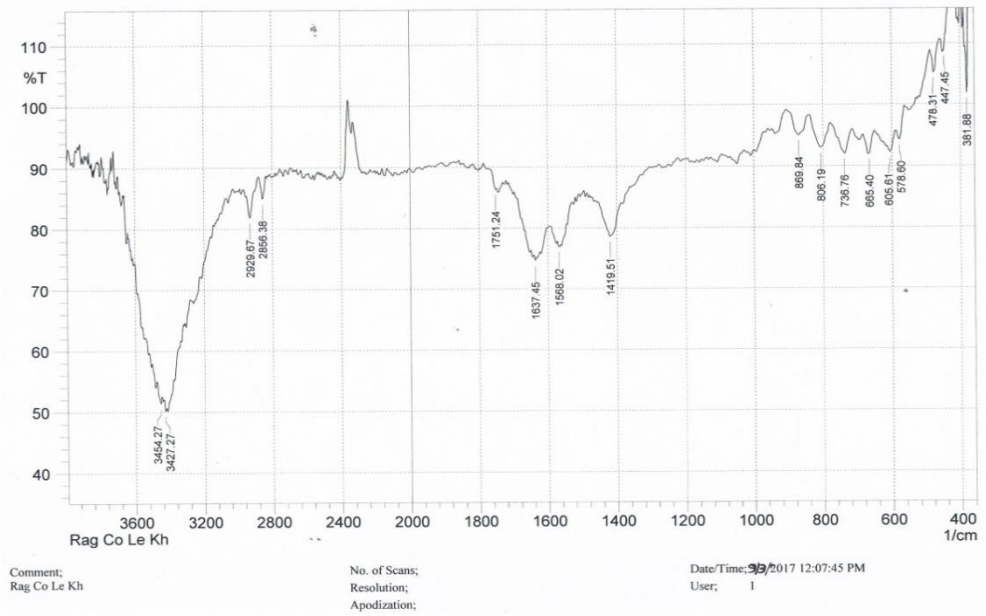

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Figure 3: FTIRspectrum of Alcoholic extract leaves of *Coriandrum sativum* L. (T% Transmittance)

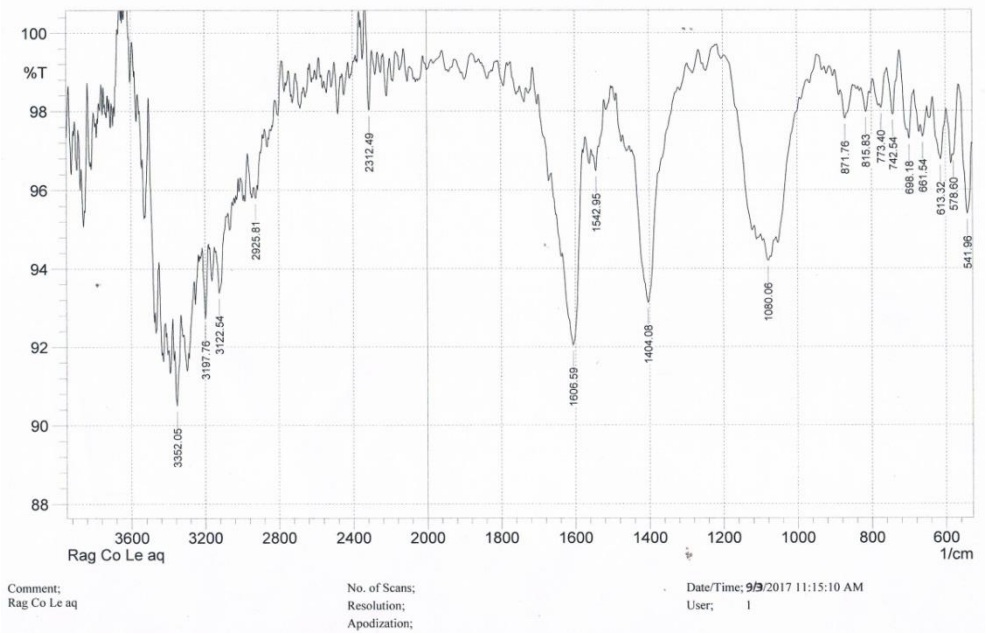

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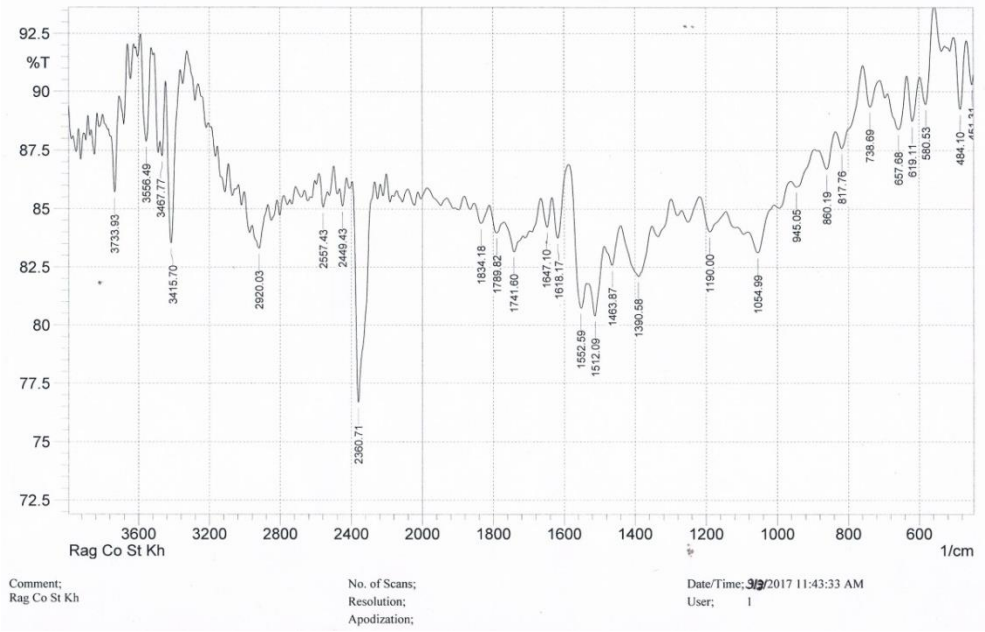
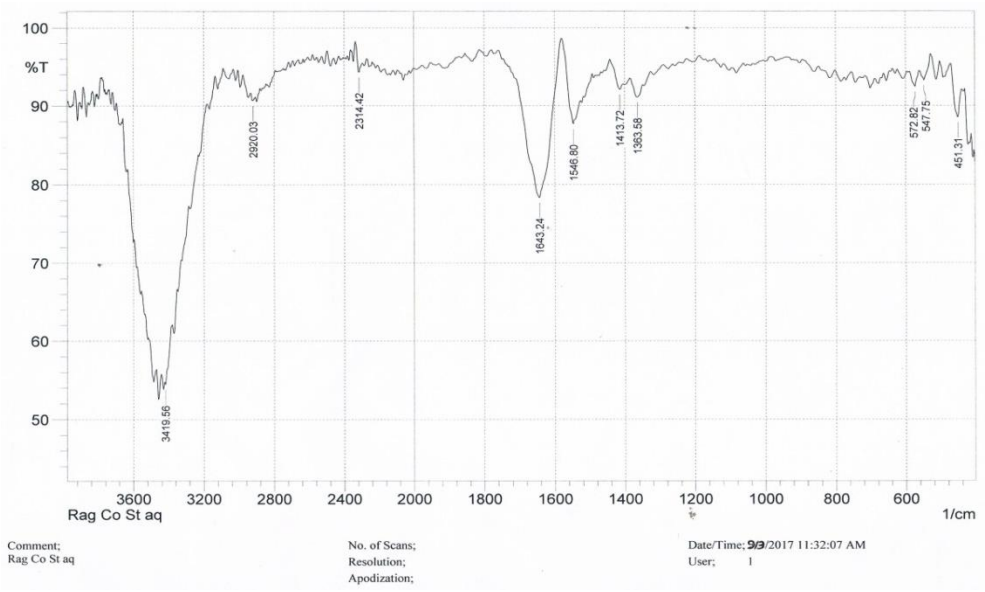
Figure 4:FTIRspectrum of Watery extract leaves of *Coriandrum sativum* L.(T% Transmittance)



(wave number cm)

Figure 5:FTIRspectrum of Alcoholic extract stems of *Coriandrum sativum* L. (T% Transmittance)



(wave number cm)

Figure 6: FTIRspectrum of Watery extract stems of *Coriandrum sativum* L.(T% Transmittance)

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الكشف عن بعض المركبات الفعالة في أوراق وسيقان نبات الكزبرة المحلي *Coriandrum sativum* L.

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الملخص

يهدف هذا البحث إلى دراسة بعض الخصائص الكيميائية لمحتويات أوراق وسيقان نبات الكزبرة المحلي ، إذ تم اجراء تحريات شاملة لأهم المركبات الكيميائية الفعالة الموجودة في النبات. كما تم تشخيص أهم المجاميع الفعالة كيميائياً باستخدام جهاز المطياف الضوئي (FTIR). فوجد بأن أوراق النبات تحتوي على الكلايكوسيدات (Glycosides)، والصابونينات (Saponins)، والراتنجات(Resins)، والفلافونات (Flavonieds)، والقلويدات (Alkaloids)، والفينولات (Phenoles)، والكومارينات (Coumarines). ووجد بأن الرقم الهيدروجيني لمستخلص الأوراق هو (pH=5.48). كما وجد بأن سيقان النبات تحتوي على الفلافونات (Flavonieds)، والتربينات (Terpenes)، والستيرويدات (Steroids)، والكلايكوسيدات (Glycosides)، والكومارينات (Coumarines)، والصابونينات (Saponins)، والراتنجات (Resins)، وزيوت طيارة (Volatile Oils). ووجد بأن الرقم الهيدروجيني لمستخلص السيقان هو (pH=5.46). إن وجود هذه المركبات في نبات الكزبرة المزروع محلياً (*Coriandrum sativum* L.) تجعل منه أحد أهم الأعشاب الطبية. وإن نتائج هذا البحث تؤكد على ان الاهمية الطبية للنبات ناتجة عن وجود المركبات الفعالة ، والتوصية بتشجيع زراعة نبات الكزبرة (*Coriandrum sativum* L.) في العراق للأغراض الطبية.