Evaluation of Antimicrobial Activity, Antioxidant Activity and Extraction of Essential Oil from Coriander Seed

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***Abstract*: Coriander (*Coriandrium sativum*) is an annual herb belonging to the family Apiaceae. The coriander seeds were collected from local market, Mandalay region. Phytochemical screening was performed with standard procedures. The elemental analysis of coriander seed were analyzed by using Energy Dispersive X-ray Fluorescence (EDXRF) spectrometer. From elemental analysis, the coriander seed contains potassium, magnesium, calcium and phosphous. Potassium and magnesium are higher than the other element in the coriander seed. Antimicrobial activities of the selected sample in various solvent systems were determined by Agar-well diffusion method on six selected organisms such as *Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeroginosa, Bacillus pumilus, Escherichia coli* and *Candida albicans*. The antioxidant activity of ethanol extracts of coriander seed was determined by DPPH (1, 1-Diphenyl-2-picryl-hydrazyl) assay. The essential oil was extracted from coriander seeds by steam distillation method.**

Keywords: Agar-well, DPPH, EDXRF, Steam distillation

I. INTRODUCTION

Coriander (*Coriandrium sativum*) which is commonly known as an annual herb belongs to family Apiaceae. Coriander fruits are a common spice in many countries of Europe, Northern Africa, West, Central and South Asia due to its distinct aromatic properties. Coriander seeds are also used in perfumery and pharmacologically to disguise the taste of medicines, and to flavour gin and liqueurs. Leaves and seeds are used as flavouring in salads, soups, curries and many dishes. Traditionally, coriander seeds are used as a diuretic, dyspepsia and indigestion, seeds lotion for rheumatic pain. The flavour of coriander seed is mainly due to its essential oil content which having petroselinic acid (68.8%) and linoleic acid (16.6 %) as major constituents. An essential oil from the seed is used as food flavouring, in perfumery and soap making, etc.

Steam distillation is a traditional method of extraction of an essential oil from coriander seeds. The alteration of chemical constituents of essential oils is a major problem associated with hydro-distillation methods this leads to destruction of the heat-sensitive compounds. Therefore, the quality of the essential oil extracts is extremely impaired. Solvent extraction is an alternative to steam distillation method but the method also has problem of destruction of thermally liable constituents due to application of high temperatures [4].

Essential oils may be an alternative to synthetic pesticides for the control of food fungi and pests. The interest in their use has been increasing because they present lower risks for human health and the environment and do not leave residues in food, another growing concern of the population [1]. The aim of the study was to determine antimicrobial activity, antioxidant activity and extraction of essential oil from Coriander seed.

II. MATERIALS AND METHODS

Sample Collection

The coriander seeds were purchased from local market, Mandalay Region in Myanmar.

Preliminary Phytochemical Screening

Preliminary phytochemical tests were carried out on according to the reported methods [2].

Antimicrobial Activities of Coriander Seed

Antimicrobial activities of coriander seed by using n-hexane, ethyl acetate and ethanol were investigated against *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeroginosa*, *Bacillus pumilus*, *Escherichia coli* and *Candida albicans* species of microorganisms by employing Agar well diffusion method at PFRD (Pharmaceutical Food Research Department), Insein, Yangon [5].

Antioxidant Activity of Coriander Seed

The antioxidant activity of coriander seed was done by using DPPH Radical Scavenging Assay. In this experiment, 1, 1-diphenyl-2-picryl hydrazyl (DPPH) powder was used as stable free radical. Ascorbic acid was used as standard antioxidant. Ethanol (Analar grade) was also used as solvent. The absorbance was determined at 517 nm wavelength. [3]

Elemental Analysis of Coriander Seed

The elemental composition of **coriander seed** were examined by the Energy Dispersive X-ray Fluorescence (EDXRF) spectrophotometer (SPECTRO XEPOS EDXRF Spectrometer, Germany)

Extraction of Essential Oil from Coriander Seed by Steam Distillation

The dried sample 300 g was placed in a container and distilled water (2 L) was poured into the still body. It was heated carefully without decomposition of oil. The volume of essential oil was collected in the receiver flask. After the steam distillation process. The product was collected and separated two layers of immiscible liquids such as water and oil by using of separating funnel. The oil was the partitioned with pet-ether in a separating funnel. The pet-ether extract was dried anhydrous sodium sulphate, filtered and evaporated to get the essential oil which has then weight until to the constant and kept in air tight bottle.

Figure (1) Steam distillation apparatus

Figure (2) The extracted oil by using separating funnel

III. RESULTS AND DISCUSSION

In this section, the results obtained from the experimental works such as phytochemical constituent, antimicrobial activities, antioxidant activity, elemental analysis and percent of essential oil in coriander seed were discussed.

Preliminary Phytochemical Tests

Preliminary phytochemical tests were done to investigate the presence or absence of chemical constituents in coriander seed. According to the phytochemical examinations alkaloids, flavonoids, glycoside, polyphenol, saponins, reducing sugar, steroids and terpene were found to be present in the sample.

Table (1) Results of Phytochemical Screening

No.	Test	Reagent	Observation	Bark
1.	Alkaloid	Wagner's solution	Orange ppt	+
2.	Flavonoid	Conc: HCl, Mg turning	Yellow color solution	+
3.	Glycoside	10 % lead acetate	Yellow ppt	+
4.	Phenolic	10 % $FeCl_3$	Greenish blue color solution	+
5.	Polyphenol	1 % $FeCl_3$ and 1 % K_3 $[Fe(CN)_6]$	Greenish blue color solution	+
6.	Reducing Sugar	Benedict's solution	Red ppt	+
7.	Saponin	$NaHCO_3$	Forth	+
8.	Steroid	Pet ether, $CHCl_3$,, acetic anhydride, Conc: H_2SO_4	Reddish brown ppt	+
9.	Terpene	Acetic anhydride, $CHCl_3$, conc: H_2SO_4	Brown ppt	+

(+) = presence
(-) = absence
ppt = precipitate

Antimicrobial Activities of Coriander Seed

The antimicrobial activities of coriander seed were determined by Agar well diffusion method on six tested organisms. The results are tabulated in Figure 3.

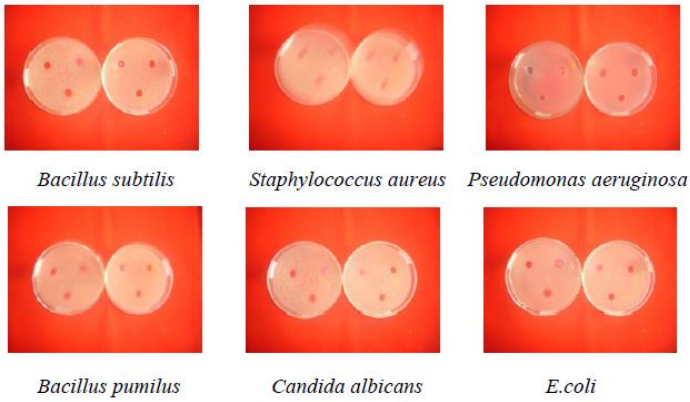


Figure (3) Antimicrobial activities of various solvent extracts of coriander seed

In accordance with these results, the ethyl acetate extract of this selected sample gave medium activities on *E-coli* and low activities on remaining five organisms. The ethanol extract of this selected sample gave low activities on six tested organisms. Moreover, n-hexane extract of coriander seed responds low activities on *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Candida albicans* and *E-coli*.

Antioxidant Activity of Coriander Seed

The antioxidant activity of coriander seed was determined by DPPH free radical scavenging assay. In DPPH screening assy that IC_{50} value of coriander seed was found to be 60.19 µg/mL. It was much higher than that of standard ascorbic acid (IC_{50} 17.99 µg/mL). So the sample extract has lower antioxidant activity than standard ascorbic acid.

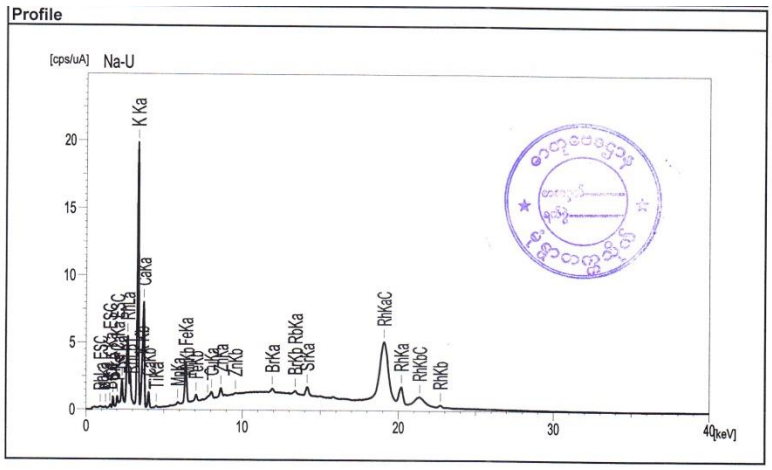
Elemental Analysis of Coriander Seed

The results of elemental analysis of coriander seed are recorded in table (2).

Table (2) Elemental Analysis of Coriander Seed

No.	Symbol	Element	Relative Abundance (%)
1.	K	potassium	1.231
2.	Mg	magnesium	1.175
3.	Ca	Calcium	0.322
4.	S	Sulphur	0.166
5.	P	Phosphorous	0.139
6.	Fe	Iron	0.020
7.	Ti	Vanadium	0.002
8.	Zi	Zinc	0.002

According to EDXRF results, potassium content of sample is higher than the others.



Extraction of Essential Oil by Steam Distillation Method

Table (3) The Yield (%) of Essential Oil by Steam Distillation Method

No. of Experiment	Weight of Sample (g)	Weight of extracted essential oil	% of essential oil
1	300	0.650	0.216
2	300	0.648	0.216
3	300	0.643	0.214

According to this table, the average yield percent of essential oil is 0.2% based on the weight of coriander seed.

IV. CONCLUSION

In this research work, the coriander seed were collected from Local Market, Mandalay Region in Myanmar. According to phytochemical screening which gave positive tests for alkaloids, flavonoids, glycosides, phenolic, polyphenol, reducing sugars, saponins, steroids and terpenes compound respectively. The antimicrobial activities of various solvent systems were tested by Agar well diffusion method on six selected organisms. ethyl acetate extract of this selected sample gave medium activities on *E-coli* and low activities on remaining five organisms. The ethanol extract of this selected sample gave low activities on six tested organisms.

Moreover, n-hexane extract of coriander seed responds low activities on *Staphylococcus aureus, Pseudomonas aeruginosa*, *Candida albicans* and *E-coli.* In DPPH screening assy that IC_{50} value of coriander seed was found to be 60.19 µg/mL. It was much higher than that of standard ascorbic acid (IC_{50} 17.99 µg/mL). So the sample extract has lower antioxidant activity than standard ascorbic acid. The mineral contents of coriander seed the highest amount of potassium and magnesium were found. Potassium is important for supports blood pressure, cardiovascular health, bone strength, and muscle strength. In addition, the essential oil was isolated by steam distillation method. The yield percent of essential oil was found to be 0.2% based in crude sample.

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