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Chemistry

EXTRACTION AND CHARACTERIZATION OF BLACK SEEDS OIL (NIGELLA SATIVA LINN)

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ABSTRACT Black seed oil is an essential oil extracted from the seeds, *Nigella sativa Linn*. Black seeds oil extracts from seeds via extraction with cyclohexane. The resulted oil was subjected to some characteristic tests. A positive test with the disappearance of the purple KMnO4 indicated the presence of double bond. The reddish brown color appeared from reaction of oil with H₹SO4 which confirm the presence of unsaturated bond. Also some physichemicals properties were examined: the color of the oil is yellowish brown color, the density is 0.7 g/mL, peroxide value is 0.22 Meq/K, acid number is 7.9 mg/g and saponification value is 144.45 mg/g. The IR-spectroscopy indicates the presences of some expected functional groups.

KEYWORDS : Black seeds, essential oil and Thymoquinone

Introduction

The Arabic name of Nigella sativa Linn is (Habbatus Sauda or Habbat al Baraka). It is also known around the world by many other names because of its ancient popular history and medicinal value. [1] Essential oils are aromatic oily liquids extracted from different parts of plants, for example, leaves, peels, barks, flowers, buds, seeds, and so on. Black seeds contain over 100 chemical compounds and some of the ingredients are yet to be discovered and identified. The main active ingredient in black seeds is crystalline nigellone. The seeds also contain thymoquinone, myristic acid, palmitic acid, stearic acid, palmitoleic acid, oleic acid, linoleic acid, arachidonic acid, proteins and vitamins B1, B2 and B3. They also contain calcium, folic acid, iron, copper, zinc and phosphorous. [2-4] Thymoquinone is an antioxidant compound and is derived from the medical plant Nigella sativa (Fig.1). This medical plant has been used for over 2000 years for a number of purposes including the eradication of most cancers. Thymoquinone inhibits the formation of undesirable prostaglandins, is anti-inflammatory, antibacterial and has a pain killing effect. It has a choleretic effect (stimulates the production of bile) and is good for fat metabolism, deworming and detoxification.

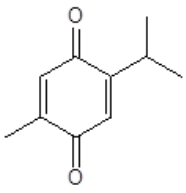


Fig.1: Thymoquinone

Nigellon The active ingredient in Nigella sativa is nigellon. Its purpose is to support the immune and respiratory functions, such as in the treatment of asthma, whooping cough and respiratory disorders. Nigellon also has antihistamine properties as compared to thymoquinone. [5]

Materials and Methods

Nigella sativa seeds: The seeds were purchased from a local herbal shop in Riyadh. Seeds were washed, dried and stored in dark at room temperature until use.

Extraction of oil:

70 g of black seed was weighted and placed in Soxhlet apparatus; 140 ml of cyclohexane was added. The mixture was refluxed for 5 h and then allowed to cool to room temperature. The oil product was collected and used for the characteristic test.

Acid value:

5 g of black seed oil was weighted by using digital balance in conical flack. 20 mL of ethanol added to conical flack, the flack content was heated on water bath for 3 min, then allowed to cool to room temperature and titrated with 0.1 N alcoholic potassium hydroxide using phenolphthalein as an indicator until end point. The experiment was repeated three times.

Acid value = V*M of KOH * 56.1/ W

Where
V: volume of alcoholic potassium hydroxide used.
M: concentration alcoholic potassium hydroxide.
W: weight of oil.

Number of peroxide:

5 g of oil black seed oil was weighted in clean conical flack. 12 ml of chloroform was added to conical flack then shack well. 18 ml of Acetic acid (CH_3COOH) was added and followed by o.5 mL of potassium iodide (Kl) the flack content shake well and titrated against sodium thiosulfate ($Na_2S_2O_3$) until the end point. The experiment repeated three times.

Number of peroxide = V*M of Sodium thiosulfate ($Na_2S_2O_3$)/W
Where
V: volume of Sodium thiosulfate ($Na_2S_2O_3$) used.
M: molarity of Sodium thiosulfate ($Na_2S_2O_3$).
W: weight of oil.

Saponification value:

2 g of black seed oil was weighted and placed in conical flack. 25 mL of 0.5N alcoholic potassium hydroxide (KOH) was added to conical flack. The mixture was refluxed on water bath for 30 min then titrated against Hydrochloric acid (0.5 M) by using phenolphthalein as an indicator, until the end point. The blank test was conducted by repeated the same experiment without the addition of the oil.

Saponification value = M*(V 1 – V 2)*56.1/W
Where
M: concentration of alcoholic potassium hydroxide (KOH).
V1: volume of blank used.
V2: volume of alcoholic potassium hydroxide (KOH) used.
W: weight of oil.

Density of oil:

1 mL of oil was measured by measurement cylinder and the weight of this amount was taken.

D=M/V
Where
M: weight of sample in gram.
V: volume of sample in mL.

Reaction with potassium permanganate

Few drops of potassium permanganate (KMnO4) were added to 1 mL of oil and shake well. The potassium permanganate color disappeared.

Reaction with sulfuric acid:

Few drops of sulfuric acid (H_2SO_4) were added to 1 mL of oil, the color of the solution became dark.

Results and Discussion

Yellowish brown colour of black seed oil was evaluated for physiochemical properties and listed in table 1, chemicals properties are listed in table 1 and IR-spectrum of oil in Fig. 2. All the obtained results are in agree with the published data. [6]

Table 1: Characterization of black seed oil

	Analytical parameter	Values
1	Oil percent (% v/w)	3.29%
2	Colour	Yellowish brown
3	Odour	Disagreeable
4	Acid number (mg KOH/g)	7.9
5	Peroxide value (Meq/Kg)	0.22
6	Saponification value (mg/g)	144.45
7	Density of oil	0.7 g/ml

Table 2: Chemical properties of black seed oil

Test	Result	
Reaction with potassium permanganate (KMnO4)	+Ve	Oxidation of double bond and diol.
Reaction with sulfuric acid (H2SO4)	+Ve	Oxidation of double bond with sulfuric acid.

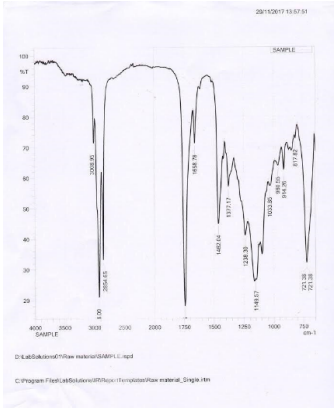
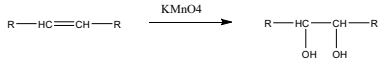


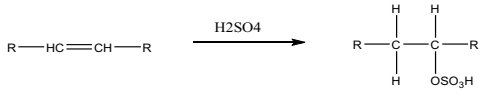
Fig 2. IR-spectroscopy of black seed oil

The oil present in black seeds was found to be 3.29% and the density 0.7 g/ml. The saponification value of black seeds oil was found to be 144.45 mg/g, the peroxide value 0.22 Meq/Kg and the acid value is 7.9 mg KOH/g.

A potassium permanganate ($KMnO_4$) Solution can oxidize a double bond at room temperature to form a 1,2-diol with the simultaneous reduction of Mn^{+7} in ($KMnO_4$) To Mn^{+4} in manganese oxide (MnO_2). A positive test is the disappearance of the purple KMnO4 and the appearance of MnO2 as brown precipitate.



Reaction of black seeds oil with concentrated (H_2SO_4) gives a brown color which confirms the presence of unsaturated bond.



Conclusion

In conclusion, on the basis of the above mentioned data, the black seed contains moderate percentage of oil, the study shows that its composition is rich of unsaturated oil.

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