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Extraction and Characterization of Tobacco Seed Oil

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The present study describes the extraction and characterization of tobacco seed oil. The oil was extracted using soxhlet apparatus and it was found that tobacco seeds were rich in oil content, which was 40.6% by weight. Some of the physical and chemical characteristics of the oil such as specific gravity, iodine value, drying index, saponification value, acid value and unsaponifiable matter were also determined. The values of these parameters were found to be 0.917, 140.27, 53–67, 189.3 mg KOH/g, 6.8 mg KOH/g and 1.2, respectively. The results showed that tobacco seed oil was comparable to the other commonly used vegetable oils.

Key Words:: Extraction, Tobacco seed oil.

INTRODUCTION

Pakistan being an agricultural country is well known for the cultivation of tobacco crop. Although a native of tropical America, its two species, *viz.*, *Nicotiana tabacum* and *Nicotiana resticum* (Family Solanaceae) are commonly grown in various regions of Pakistan. The tobacco plant is a handsome, unbranched annual growing to a height of 3-6 ft with large oval leaves. It bears pink flowers and its fruit is a 2-celled capsule. The fruit splits lengthwise and produces numerous very small seeds, which come in an extremely large quantity per plant[1]. The seeds are more or less ovate in shape, about 0.75 mm long, 0.53 mm broad and 0.47 mm thick. They are long lived and can be stored for a long period in dry conditions at ordinary temperature. The average weight of 1000 seeds falls in the range of 0.08–0.09[2] g.

The leaves of the tobacco plant are used to make the popular blends of tobacco and also contain alkaloids, which are used as insecticide. As the leaves are products of choice, so the plants are usually not allowed to produce seeds. However, enlightening the farmers about the application and economic importance of the tobacco seed oil can result in the enhanced production of tobacco

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seeds. The tobacco seed endosperm contains thin-walled cells, rich in oil. About 38% of the seeds is oil and the remaining parts are protein, crude fabric, carbohydrates and inorganic material[3]. The percentage composition of the meals obtained from tobacco seeds shows fat, raw protein and ash content similar to the meals obtained from other common oil bearing seeds. Also the high fibre content makes these meals similar to those obtained from other crops with little dimension seeds[4]. The oilcake produced after extraction of oil makes good manure[5].

The nutritional value of tobacco seed oil is also better than groundnut and cottonseed oils and comparable to safflower oil and is used as edible oil in some European countries[6]. It has been found that the oil is unusually high in contents of linoleic acid and has usually less than 12 per cent saturated acids. The proportions of individual fatty acids in *Nicotiana tabacum* seed oil are linoleic acid 70.6%, oleic acid 17.1%, palmitic acid 7.9%, stearic acid 3.1% and others[7]. The high degree of unsaturation of the seed oil could render the oil to be susceptible to autoxidation and polymerization, resulting in cross-linked and tough films upon exposure to air. Hence, the oil could find some uses in industrial applications such as in paint industries[2]. It can either alone or blended with linseed oil be used in the synthesis of modified alkyd resins for air-drying glossy paints[8]. The oil obtained from the seeds is also used for burning purpose[5]. Studies have also suggested that tobacco oil may be used as an appropriate substitute for diesel fuel[3].

The present study was carried out to investigate some of the physical and chemical properties of tobacco seed oil and its potential applications.

EXPERIMENTAL

The seeds of tobacc were especially procured from farmers in a village near District Sheikhupura, Pakistan. For the extraction of oil, the tobacco seeds of known weight were taken and dried for 15 h at 60–70°C in an oven. After drying, the seeds were ground well by using an electrical grinder. The ground seeds were placed in a soxhlet apparatus and the tobacco seed oil was extracted by heating the soxhlet apparatus in a water bath at 80–90°C. The solvent used in the soxhlet apparatus was *n*-hexane. The oil-rich solvent was distilled off under reduced pressure to remove the bulk of the solvent. After distillation of the solvent, pure tobacco seed oil was obtained. The oil was weighed and the yield was calculated on dry weight basis[9]. The oil was stored for further use in the present study.

Characterization of oil

Some of the physical and chemical characteristics of tobacco seed oil were determined. These include specific gravity, iodine value, drying index, saponification value, acid value and unsaponifiable matter. All the characteristics were determined by using the standard Association of Official Analytical Chemists (AOAC) methods.

RESULTS AND DISCUSSION

It was found that the oil was of brown colour and had a characteristic smell of tobacco seeds. The same colour and smell of tobacco seed oil was reported by El-Hamid *et al.*[10].

Oil content of seeds: The contents of oil in the tobacco seeds were found to be relatively high, ranging up to 40.6% by weight. This value is close to those obtained from the other common oil-bearing seeds[11] but it is different from the reports made by Giannelos[3] according to which the oil content of tobacco seed is 38%. So it is evident from the results that the species and varieties grown in Pakistan are rich in oil content than others.

Specific gravity: The specific gravity of tobacco seed oil was determined by specific gravity bottle and it was found to be 0.917 at 15°C. The specific gravity of tobacco seed oil was also similar to those of the other vegetable oils[3] as shown in Table-1.

Iodine value: The iodine value of tobacco seed oil was found to be 140.27, which was higher than those of the other oils but lower than that of linseed oil (180–190). The iodine value of most of the vegetable oils is within the range of 104–132 except coconut oil and palm-kernel oil which has much lower iodine value, *i.e.*, 8.8 and 14.5, respectively (Table-1)[12].

Spectroscopic measurements have shown that tobacco seed oil is practically free from acids more unsaturated than linoleic acid. The degree of unsaturation and fatty acid composition of tobacco oil make it especially suitable for the manufacture of non-yellowing, oil modified alkyd resins[7], which are good for the production of white paints. The unsaturation of oil can be removed by hydrogenation but it leads to a worsening of cold flow properties[13].

Drying index: The drying index of tobacco seeds was found to be in the range of 53–67. This value of drying index was close to the range of 55–75 as reported by Eshetu[2]. This value is also close to the soybeans oil (65–70) but is lower than that of linseed oil (100–130)[4] (Table-1).

Saponification value

The saponification value of tobacco seed oil was found to be 189.3 mg KOH/g. This value was within the saponification value range of most of the other vegetable oils[12], which is approximately 190–196 mg KOH/g. However, the saponification values of coconut and palm-kernel oil are 257 and 246 respectively, which are higher than tobacco seed oil and other common vegetable oils (Table-2).

Acid value

The acid value of tobacco seed oil was found to be 6.8 mg KOH/g. This value was near to the acid values of other vegetable oils[12] (Table-2).

The vegetable oil from fresh seeds contains only a small amount of free fatty acids but their quantity increases due to hydrolytic changes. Thus, they impart a

sharp and unpleasant flavour to edible oils and their action is especially injurious in the oil used for pharmaceutical or medicinal purposes[14].

Unsaponifiable matter: The unsaponifiable fraction of tobacco seed oil was found to be 1.2, which was almost close to other vegetable oils (Table-2). Unsaponifiable matter includes those substances which are frequently found dissolved in fats and oils and cannot be saponified by the caustic alkalis but are soluble in ordinary fat solvents. Most of the vegetable oils have unsaponifiable oil fraction less than 2.0[12].

TABLE-1
SPECIFIC GRAVITY, IODINE VALUE AND DRYING INDEX OF SOME IMPORTANT OILS

Oil seed	Specific gravity at 15°C	Iodine value	Drying index
Tobacco	0.917	140.27	53–67
Linseed	0.938	180–190	100–130
Soybeans	0.936	120–135	65–70
Cotton	0.923	110	—
Coconut	—	8.8	—
Palm-kernel	—	14.5	—

TABLE-2
SAPONIFICATION VALUES, ACID VALUES AND UNSAPONIFIABLE MATTER OF SOME IMPORTANT OILS

Oil seed	Saponification value (mg KOH/g)	Acid value (mg KOH/g)	Unsaponifiable matter
Tobacco	189.3	6.8	1.2
Linseed	196	5.9	1.3
Soybeans	192	6.2	1.5
Cotton	193	6.4	1.3
Coconut	257	—	—
Palm-kernel	246	—	—

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