Studies on the seed oils of citrus cultivars, Shamber grapefruit and Minneola tangelo

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ABSTRACT

The seed oils of citrus cultivars Shamber grapefruit and Minneola tangelo were analysed for their physico-chemical properties. The yield of oils on dry seed basis were 25.01% and 40.08% respectively. The GLC analysis of methyl esters derived from the seed oils of Shamber grapefruit and Minneola tangelo revealed the presence of lauric (0.9%, 0.74%), myristic (2.1%, 4.38%), palmitic (54.65%, 35.38%), stearic (5.2%, 0.33%), oleic (24.37%, 39.47%), linoleic (4.67%, 14.63%) and linolenic acid (5.96%, 3.97%).

Key words: Shamber grapefruit, minneola tangelo, fatty acid

INTRODUCTION

The taxonomic classification of citrus species has been the subject of considerable controversy (Hodgson et al., 1967) but within the past two decades chemo-systematic studies on secondary plant constituents has become an important tool in defining and differentiating the complex genus. Shamber grapefruit is a variety of Citrus paradisi, the commonly known grapefruit. They are largely globose with a slightly bitter acid pulp like other members of this genus. Minneola tangelo belongs to group that includes which consist of hybrids of tangerine and grapefruit (Ali 1987) and Seminole, Orlando, Minneola, San Jacinto, Sunshine and Shampson. There are attractive because of high colour and smooth rind.

Although the production of citrus seed oils is of minor importance yet it is a non-conventional source of oils in some citrus growing countries where citrus fruit is processed in large quantities for juices and jams. The citrus seed oils can be used for edible as well as soap and cosmetic preparations. Extensive studies (Kelford and Chandler 1970) have been carried out on the fatty acid composition of the seed oils of various citrus fruits. Many seed oils of indigenous varieties have also been analysed (Saleem et al. 1977; Sattar et al. 1987) but the fatty acid composition of seed oils of Shamber grapefruit and Minneola tangelo have not been reported earlier. The present research work thus describes the fatty acid composition of these seed oils in continuation of a research programme to explore the indigenous and non-conventional source of vegetable oils (Saleem et al. 1977, Sattar et al. 1987).

MATERIALS AND METHODS

Selection of seeds

Fresh, mature and virus-free fruits of Shamber grapefruit and Minneola tangelo varieties were collected from Horticulture Research Institute, Sahiwal. The fruits were cut in halves and seeds were handpicked and transferred to petri-dishes. The seeds were then washed with distilled water and dried in the shade for further study and analysis.

Extraction of oil

The seeds of the two varieties were ground to a fine powder and extracted with distilled hexane a Soxhlet apparatus for 12 hours (AACC 2000). The hexane extracts were dried over anhydrous sodium sulphate and after removal of solvent gave pale yellow oils. The percentage yield of the oils of both varieties was noted as 25.01% and 40.08% respectively.

Seed oil analysis

The physical and chemical properties Table 1 of the oils were determined according to standard procedure (AOCS, 1998 and AOAC, 1990).

Table 1. Physico-Chemical Properties of Shamber grapefruit and Minneola tangelo seed oils

<table>
<thead>
<tr>
<th>Physicochemical properties of seed oils</th>
<th>Shamber grapefruit Seed Oil</th>
<th>Minneola tangelo Seed Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Yield (%)</td>
<td>25.01</td>
<td>40.08</td>
</tr>
<tr>
<td>2. Colour</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>3. Refractive index at 30°C</td>
<td>1.4645</td>
<td>1.4637</td>
</tr>
<tr>
<td>4. Specific gravity</td>
<td>0.8879</td>
<td>0.8906</td>
</tr>
<tr>
<td>5. Acid value</td>
<td>0.7941</td>
<td>0.8085</td>
</tr>
<tr>
<td>6. Saponification value</td>
<td>191</td>
<td>187</td>
</tr>
<tr>
<td>7. Free fatty acid</td>
<td>0.413</td>
<td>0.419</td>
</tr>
</tbody>
</table>
Preparation of fatty acid methyl esters

Weighed amounts of oils (1.0 g) were transferred to a Teflon test tube. Methanolic potassium hydroxide (0.5 N, 10 ml) was then added to the oil samples. The mixture was refluxed until the globules of oil got into solution (90 minutes). Sulphuric acid (2 N) was then added to the cooled mixture to liberate the fatty acids. Esterification of the liberated fatty acids was carried out in the presence of catalytic amount of methanol BF3 reagent (10 ML) and boiled for about 20 minutes. The esterified mixture was cooled and extracted with hexane. Separated hexane layers were washed with water and dried over anhydrous sodium sulphate (Wahed et al. 2001).

Table 2. Percentage Fatty Acids Composition of Shamber grapefruit and Minneola tangelo Seed Oils

<table>
<thead>
<tr>
<th>Fatty acids</th>
<th>C12:0</th>
<th>C14:0</th>
<th>C16:0</th>
<th>C16:1</th>
<th>C18:0</th>
<th>C18:1</th>
<th>C18:2</th>
<th>C18:3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shamber grapefruit</td>
<td>0.91</td>
<td>2.1</td>
<td>54.65</td>
<td>0.53</td>
<td>5.2</td>
<td>24.37</td>
<td>4.67</td>
<td>5.96</td>
</tr>
<tr>
<td>Minneola tangelo</td>
<td>0.74</td>
<td>4.38</td>
<td>35.38</td>
<td>-</td>
<td>0.33</td>
<td>39.47</td>
<td>14.63</td>
<td>3.97</td>
</tr>
</tbody>
</table>

Table 3. Saturated and Unsaturated fatty Acids composition of Shamber grape fruit and Minneola tangelo Seed Oils

<table>
<thead>
<tr>
<th></th>
<th>Saturated Fatty Acid (%)</th>
<th>Unsaturated Fatty Acid (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shamber grapefruit</td>
<td>62.86</td>
<td>35.53</td>
</tr>
<tr>
<td>Minneola tangelo</td>
<td>40.83</td>
<td>58.07</td>
</tr>
</tbody>
</table>

Determination of fatty acids methyl esters

The fatty acids composition of the oils was determined by gas liquid chromatography (GC-14A, Shimadzu) using a column (1.5 m x 4 mm i.d.) packed with celite coated with 10% DEGS. The GLC operating conditions were: column temperature 200°C, FID temperature 250°C, injector temperature 220°C and carrier gas nitrogen with flow rate of 40 ml/min. The determined percentage fatty acid composition is given in Table 2.

Saponification values of the oils indicated that the mean molecular weight of the combined fatty acids is normal showing the presence of predominantly C16 and C18 fatty acids. The physico-chemical characteristics of the oils from the two varieties (as listed in Table 1) are also normal. Because of this property the extracted oils can be used for edible purposes.

RESULTS AND DISCUSSION

The seeds of Shamber grapefruit and Minneola tangelo were found to be a valuable, non-conventional source of fixed oils. In order to evaluate the oils with respect to their suitability both for industrial and edible purposes, the oils were subjected to physico-chemical characterization and determination of chemical composition. The percentage yield of oil from dry seeds of shamber grapefruit and Minneola tangelo were 25.01% and 40.06% respectively. The physico-chemical constants and chemical composition of the oils are reported in Table 1, 2, 3.

The chemical compositions of the oils were determined by GLC. Apart from the solvent peak, chromatograms of methyl esters of the species indicated the presence of lauric, myristic, palmitic, stearic, oleic, linoleic and linolenic acids respectively in varying proportions. The presence of these acids were further confirmed by running standard methyl fatty esters mixtures under the same set of conditions and comparing the chromatograms. According to table-3 the Shamber grapefruit seed oil contained higher saturated fatty acids (62.86%) as compared to Minneola tangelo seed oil (40.83%), which had more a unsaturated fatty acids (58.07%). Shamber grapefruit oil contained palmitic acid (54.65%) and oleic acid (24.37%) as major fatty acids while lauric acid (0.91%) and palmitoleic acid (0.53%) were the minor fatty acids. In Minneola tangelo seed oil palmitic acid (35.38%) Oleic (39.47%) and Linoleic (14.63%) were as the major fatty acid while lauric acid (0.74%) and stearic acid (0.33%) were present as minor fatty acids. It is interesting that the fatty acid profile of the oils from the two cultivars resemble each other and is close to that of Palm Oil (Lerinner 1981). It is concluded from our investigations that these oils can find application both for edible and industrial purposes.
REFERENCES


