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# Fatty Acids and Unsaponifiable Composition of *Cucumis amaris* Seeds Oil

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**Abstract:** Seeds obtained from *Cucumis amaris* were analysed for their lipid composition. The seeds contained high level of lipids (40%). Freshly extracted oil gave acid and peroxide values of 6.06 and 34.44 , respectively. The iodine and saponification values were 117.20 and 192.30, respectively. The oil contained various fatty acids. Linoleic, oleic, palmitic and steraric acids were the principal fatty acids present. Unsaponifiable components study of the seed oil revealed β-sitosterol and Δ-5, 24-stigmastadienol as the most prominent. The minor compounds included Chlerosterol, Δ-7, stigmastenol, Δ-7-avenasterol, Δ-7-campesterol, cholesterol, 2, 4-methylencholesterol and Campesterol.

**Key words:** *Cucurbitaceous*, *Cucumis amaris*, seeds oil, fatty acids, unsaponifiable

## INTRODUCTION

Seeds belonging to *Cucurbitaceous* family are known to be rich in oils (Badifu, 1993). Cucurbitaceous oils contain high percentage of mono- and polyunsaturated fatty acids (not produced by a human being) which play an important role in prevention of cardiovascular, cardiac and coronary sickness. Studies from different countries have shown that *Cucumis melo* seeds, apart from is medicinal properties (Lal and Lata, 1980; Woo *et al*., 1981; Bellakhdat *et al*., 1991), are also rich in oil (37.67%) and protein (53.90%) (Rashwan *et al*., 1993; Maria *et al*., 2001). Reports are also available on the amino acids composition of the proteins of the melon seeds grown in Egypt, India, Vietnam and Brazil (Rashwan *et al*., 1993; Hemavatahy, 1992; Ibms and Pham, 1995; Maria *et al*., 2001). Most studies indicate the dependence of the oil quality on the country and type of soil, where the seeds are obtained.

No report is available on the *Cucumis amaris* seeds oil and its physico-chemical characteristics. This study aims to give information on the physico-chemical characteristics of this oil in comparison to the melon seeds oil.

## MATERIALS AND METHODS

**Sample and sampling:** *Cucumis amaris* (Identified by botanists of National Polytechnic Institute) fruit belongs to the family of *cucurbitaceous* and is cultivated in the savanna region in the North of Côte d, Ivoire. The fruit (Fig. 1) contains large quantities of seeds like cucumber ones. The pulp is not edible because of its sourness and the seeds are used in the cuisine.

Fig. 1: Fruit and plant development of *Cucumis amaris*

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*Cucumis amaris* seeds were obtained from a farm located in Korhogo, a city in the North of Côte d, Ivoire.

**Sample preparation:** The seeds were cleaned and dried at 50°C in a drying oven for 48 h. Dried seeds were triturated in a mill and screened through a mesh of 0.5 mm diameter. The triturated seeds were directly extracted by maceration using n-hexane as a solvent.

**Methods:** At room temperature, 2500.0 g of powdered *Cucumis amaris* seeds were macerated in equal volume of n-hexane for four times. A 8.0 g portion of the hexane soluble fat was hydrolysed by refluxing it with 50 mL of 1.0 M solution of potassium hydroxide in 95% ethanol for 1 h. To the cooled solution, 100 mL of water were added and the mixture was extracted thrice with 50 mL portions of diethyl ether.

The organic layer was washed three times with water and the aqueous layers were combined and acidified in slight excess with 6.0 M hydrochloric acid. This mixture was extracted three times with 50 mL portions of diethyl ether. The free fatty acids were recovered after washing the extract with water, drying it over anhydrous sodium sulfate (10.0 g) and evaporating off the solvent.

**Chromatographic analysis of the fatty acids obtained:** A Shimadzu GC-7AG gas chromatograph equipped with a Flame Ionisation Detector (FID) was used for GC analysis of the fatty acids and the unsaponifiable components.

Fatty acids were transformed to their methyl esters (FAME) following the method of Hartman and Lago (1973). GC separations were performed on a DB capillary column (30×0.32 mm ID) (SEG Company). The temperature was programmed from 170 to 280°C at the rate of 2°C $min^{-1}$ increment, while the temperature at the injector and detector was kept constant at 280°C. The carrier gas was helium.

**Physico-chemical properties of the seed oil:** Specific density and refractive index were determined at room temperature (30EC) using a specific density bottle and a refractometer, respectively (NFT 60-214, NFT 60-206 and NFT 60-203). For determination of acid, peroxide, iodine and saponification values, NF EN ISO 5555, NFT 60-220, NFT 60 C ISO 3961 and NI ISO 3657 methods were used.

**Isolation of unsaponifiable components of the seed oil:** The aqueous solution of the seed oil was extracted three times with 50 mL of dichloromethane. The organic layer was dried over anhydrous sodium sulfate and the solvent was evaporated off. The white powder obtained was analysed by GC. The GC separations were performed on a COV 1701 capillary column (30×0.25 mm ID) (SEG Company). The temperature was programmed from 150 to 280°C at 2°C $min^{-1}$ increment, while the temperature at the injector and detector was kept constant at 280°C. The carrier gas was hydrogen and air. All analyses were performed in duplicate.

## RESULTS AND DISCUSSION

*Cucumis amaris* seeds contained high percentage (40%) of oil. Similar quantities, 32.3 and 33% of oil were, respectively reported by Maria *et al.* (2001) and Teotia and Ramakrishna (1984) in seeds *Cucumis melo* hybrid.

The oil from *Cucumis amaris* seeds had a specific density of 0.90±002 and refractive index of 1.47±0.002, (Table 1), which were slightly lower than the value reported by Ramakrishna *et al.* (1970) and Maria *et al.* (2001) from melon seed oil. The saponification value of the oil in this study was 192.3±0.95, (Table 1) This compared favourably with values reported from other studies on melon oil. Similarly the iodine value of 117.2±0.71 was comparable as well (Maria *et al.*, 2001; Ramakrishna *et al.*, 1970).

As shown in the Table 2, the oil contained a variety of fatty acids typical of many other oil seeds from cucurbitaceous family. Linoleic acid (octadecadienoic acid) was the principal fatty acid followed by oleic (octadecenoic), palmitic (hexadecanoic) and steraric (octadecanoic) acids with concentration of about 65, 13, 10 and 10%, respectively. The obtained fatty acids had a relatively high percentage (78%) of unsaturated fatty acids. These concentrations were slightly different from those reported by Maria *et al.* (2001) for seed oil of *Cucumis melo* and from Imbs and Pham (1995) who

Table 1: Physico-chemical values of *Cucumis amaris* seeds oil

| Characteristic | Value (average± SD) |
|---|---|
| Relative density | 0.90±0.002 |
| Refractive index | 1.47±0.002 |
| Acid value | 6.06±0.02 |
| Peroxide value | 34.4±0.04 |
| Iodine value | 117.2±0.71 |
| Saponification value | 192.3±0.95 |
| Viscosity ø = 0.2 mm | 12.6 mm $sec^{-1}$±0.20 |

Table 2: Fatty acids composition of *cucumis amaris* seed oil

| Fatty acid | Range | Value % |
|---|---|---|
| Palmitic | C16:0 | 10.21 |
| Stearic | C18:0 | 10.20 |
| Oleic | C18:1 | 12.68 |
| Linoleic | C18:2 | 65.20 |
| Linolenic | C18:3 | 0.12 |
| Arachidic | C20:0 | 0.34 |
| eicosenoic | C20:1 | 0.10 |
| Behenic | C22:0 | 0.25 |
| Unknown | - | 0.90 |

Table 3: Unsaponifiable fraction of *Cucumis amaris* seed oil

| Peak N° | Time (min) | Concentration (%) | Compound name |
|---|---|---|---|
| 1 | 8.622 | 0.6540 | Cholesterol |
| 2 | 10.907 | 0.6387 | 2,4-methylencholesterol |
| 3 | 11.159 | 0.3476 | Campesterol |
| 4 | 11.651 | 0.3401 | Unknown |
| 5 | 11.928 | 0.2786 | Stigmasterol |
| 6 | 12.293 | 1.3675 | Unknown |
| 7 | 12.486 | 2.2056 | Δ-7-campesterol |
| 8 | 12.970 | 1.4679 | Δ-5-23-stigmastadienol |
| 9 | 13.256 | 3.0219 | Chlerosterol |
| 10 | 13.491 | 21.3977 | Unknown |
| 11 | 13.714 | 37.4335 | β-sitosterol |
| 12 | 13.956 | 0.4351 | Sitostanol |
| 13 | 15.022 | 25.3561 | Δ-5,24-stigmastadienol |
| 14 | 15.270 | 2.5623 | Δ-7,stigmastenol |
| 15 | 16.048 | 1.4126 | Δ-7-avenasterol |
| 16 | 17.365 | 0.5038 | Unknown |

reported those of an unspecified variety of musk melon. In these studies, linoleic acid was also the principal fatty acid (51%), followed by oleic acid (31%), palmitic acid (8.5%) and steraric acid (6%). These differences emphasized the diversity in the two varieties.

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GC analysis of the unsaponifiable fraction showed that the latter contained a variety of steroids. From the Table 3, β-sitosterol (37.4%) and Δ-5, 24-stigmastadienol (25.35%) were the most prominent. The minor compounds have included 3% of Chlerosterol, 2.56% of Δ-7, stigmastenol, 1.4% of Δ-7-avenasterol, 2.2% of Δ-7-campesterol, 0.65% of cholesterol, 0.64% of 2,4-methylencholesterol, 0.35% of Campesterol. The unknown compound (21.4%) may be a stereoisomer of β-sitosterol.

## CONCLUSION

The fatty acids content, physico-chemical characteristics and unsaponifiable component of the various seed products such as vegetable oils are rich in unsaturated fatty acids. The acid part of the glycerides consists mainly of various unsaturated fatty acids. Most of these fatty acids enhance transdermal and buccal drug delivery. It has been reported that in addition the fatty acids possess a notable activity against various bacteria and viruses.

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