Egypt. J. Agric. Res., 78 (3), 2000.

DETERMINATION OF UNSAPONIFIABLE MATTERS TO DIFFERENTIATE BETWEEN ANIMAL FAT AND HYDROGENATED VEGETABLE OIL

ZEINAB H.DARWEESH

Food Technol. Res. Institute, Agric. Research Center, Egypt.

(Manuscript received 13 Jan. 1999)

Abstract

Hydrogenated vegetable oil (El-Nakhletane) and two different animal fats (cows Butter and Buffallo Samn) were analysed by gas liquid chromatography to separate, identify and determine hydrocarbon, sterol and tocopherol in order to detect adulteration of fats.

This investigation indicated that hydrogenated vegetable oil is characterized by the absence of cholestrol and E-tocopherol and the presence of C24. Cow Butter is characterized by the presence of hydrocarbon C28 and buffalo-Samn by the presence of hydrocarbon C21.

INTRODUCTION

There is a great shortage in butter fat. Hydrogenation of oils is important for improving the shelf life of oils and to offer a substitute for butter fat.

Also the tocopherols in the unsaponifiable fraction as suggested by Anglin, *et al.*, (1955) and Shipe (1956) who reported that tocopherols are present only in animal fats while vegetable fats contain non-alpha form.

Eisener *et al.*, (1966) isolated the sterol of butter and margarine by chromatographic separation. The sterol fractions from six samples of butter indicated only one component, cholestrol. The sterols from six samples of margarine consisted of three major components, sitosterol, B-sitosterol and stigmaterol. On the basis of these findings, it can be deduced that the presence of margarine in butter can be detected easily.

Eisener *et al.*, (1966) denoted that gas-chromatograms of most of the oils displayed characteristic patterns which could be identified as indivedual oil.

Gerda and William (1975) isolated hydrocarbons from butter fat by cold finger molecular distillation at 35^{o}C. They identified the major hydrocarbons as the C20 compounds.

The aim of this research is to establisha method for the differentiation between the animal and vegetable fats.

MATERIALS AND METHODS

Two fat samples, cow butter, buffallo-Samn and one of the hydrogenated vegetable oils were used in this work.

Buffallo-Samn and cow butter were obtained from Dairy Res. Dept., Animal Production Res. Institute, A.R.C.

Hydrogenated vegetable oil (El-Nakhlitane) was purchased from Cairo Company for oils.

Buffalo-Samn was prepared from buffalo-butter by gently heating at 120-140oC, and kept in cold place after decantation from the coagulated proteins (morta).

The collected samples were subjected to oil saponificantion according to the A.O.A.C. 1990.

The unsaponifiable matters were extracted after saponification as described in the A.O.A.C.1990.

Hydrocarbons were isolated on GLC as outlined in the A.O.A.C. 1990.

Sterol and hydrocarbon contents were determined and identified by GLC, according to the method of Cummont and Richon (1970).

Sterol components were determined according to the A.O.A.C. (1990).

Tocopherols in the unsaponifiable matters were determined colorimetericaly according to Emmerie and Engel method (1939).

The relative percentage of each unsaponifiable compound was estimated by using triangulation according to the method explained by the A.O.A.C. (1990).

RESULTS AND DISCUSSION

The unsaponifiable matter contents of the animal fats and hydrogenated vegetable oil are tabulated in Table 1. It is clear that buffallo-samn contained the highest unsaponifiable matters 4.17%, while cow butter contained the highest hydrocarbons,

1.59%, sterols; 1.92% and tocopherol; 0.096%.

Table 1. Unsaponifiable matter contents in animal and vegetable fats.

Fats	Unsaponifiable matter %	Hydrocarbon %	Sterols %	Tocopherol %
Cow-Butter	4.11	1.59	1.92	0.0960
Buffalo-samn	4.17	0.38	1.74	0.0140
Hydrogenated-vegetable oil	4.12	1.00	1.03	0.0135

Results in table 2 clarifies the hydrocarbon contents of the three fats used in this work. It can be noticed that the hydrogenated vegetable oil does not contain the compounds; C18, C20 and C26, that are found in both of the other fats. Only Buffallo-samn contained C21; (14.21%) and only cow-butter contained C28 (6.97%). The hydrogenated vegetable oil was the only sample that contained C24 (9.41%). The major hydrocarbon compounds are C14 in hydrogenated vegetable oil (42.35%), C20 in buffallo-samn (27.29%) and C15 in butter-cow (20.23%).

Table 2. Hydrocarbon contents in animal and vegetable fats.

Hydrocarbons	Cow Butter %	Buffalo samn %	Hydrogenated vegetable oil %
C13			
C14	11.94	6.60	42.35
C14:1			
C14:2			
C15	20.23	13.20	11.18
C16	12.93	15.23	32.94
C18	14.59	13.20	-
C20	7.96	27.92	-
C21	-	14.21	-
C24	-	-	9.41
C25	16.86	3.55	4.12
C26	8.62	6.09	-
C28	6.97	-	-
C30	-	-	-

The results in this work are some what different from that of Gerda and Williams (1975) who isolated hydrocarbon from butter and identified that the major hydrocarbons was the C20 compounds.

Data in table 3 show the sterol components in animal and vegetable fats. It is clear that hydrogenated vegetable oil does not contain cholesterol and the animal fats does not contain B-sitosterol. Cholesterol is the major sterol in cow-butter, 3.9%.

Table 3. Sterol components in animal and vegetable fats.

Hydrocarbons	Cow Butter %	Buffallo samn %	Hydrogenated vegetable oil %
Cholesterol %	3.9	1.4	-
B-sitosterol %	-	-	0.3
Stigmasterol %	1.7	-	5.5
Bracscicasterol %	-	-	5.1

The results obtained in this work are somewhat in agreement with the work of Guyot (1971) who mentioned that butter did not contain sitosterol and Cummont and Richon-Bac (1970) who deduced that animal fats contain by nature only cholesterol & vegetable fats contain a mixture of B-sitosterol, stigmasterol, campesterol, bracsicaterol and possibly trace of cholesterol.

Results in Table 4 show that the tocopherol contents of animal & vegetable fats, where hydrogenated vegetable oil is free from E-tocopherol which is the major tocopherol compound in buffallo-samn, 56.96%. Also the δ–tocopherol is the major sterol in hydrogenated vegetable oil; 49.18%.

The results obtained in this work are differentiated from that obtained by Mahen and Chapman (1954), who found that tocopherol in butter is low; e. 0.002-0.005% as well as most vegetable oil, except cocconut oil which is considerably high in tocopherol.

The differences in hydrocarbon, sterol and tocopherol components may be due to various reasons, also may be due to seasonal weather as reported by McDowell (1954) who stated that one could expect a wide variation in data concerning the Physical and Chemical Properties.

Finally, determination and identification of sterol components by GLC can lead to

characterize the hydrogenated vegeetable oil from the animal fats by its freedom from cholesterol.

Moreover gas liquid chromatography can be used to detect the addition of hydrogenated vegetable oil to cow-butter and buffalosamn through the presence of hydrocarbon C24, since both the caw butter and buffallo-samn are free from C24. Also the addition of hydrogenated vegetale oil to buffer-cow and buffallo-samn can be detected by the presence of α–tocopherol fraction in large amount, since it is present in both of them at levels of; 21.33 and 16.45%, and in the hydrogenated vegetable oil; 49.18%. Also, it was mentioned by Mahen and Chapman (1954) that the addition of as little as 5% of margarine to butter increases the tocopherol contents.

Table 4. Tocopherol components in animal and vegetable fats.

Tocopherol	Cow Butter %	Buffallo samn %	Hydrogenated vegetable oil %
α-Tocopherol	25.53	15.18	13.93
β-Tocopherol	20.63	11.39	36.89
χ-Tocopherol	21.33	16.45	49.18
ε-Tocopherol	32.52	56.96	Traces
Total	100.00	99.98	100.00

REFERENCES

1. Anglin, C., Mahon, J.H. and R.A. Chapman, 1955. Tocopherol content of canadian butterfat and its use in detecting adulteration. J. Dairy Sci., 38, 333.

2. A.O.A.C. 1990. Official Methods ofAnalysis of the Association of Official Agric. Chemists Published by A.O.A.C. Benjamin Franklin Stat. Washington D.C.

3. Cummont and Richon-Bac, L.1970. Study of sterols by gas chromatography Res. Med. Vet., 146 (8) 735-751.

4. Eisner, J.; Iverson, J.L. and Firestone, D. 1966. Oil, fats and Waxes Gas chromatography of unsaponifiable matter IV. Aliphatic Alcohols, Tocopherols and Triterpenoid Alcohols in Butter and vegetable oils. J. of the A.O.A.C., 49, 3, 580. (1966).

5. Emmerie A., and Engel, C. 1939. Colorimetric determination of dL-oc-Tocopherol (Vitamin E). Nature, 142, 873. (1939).

6. Gerda U-and Williams. S. 1975. The C-20 Hydrocarbons of Butterfat J.Agric. & Food Chem., 23 (1) 20.

7. Guyot A., L. 1971. Etude des tracteures de la matiere grasse butyrique 3-Le beta sitosterol. Bull. Res. Agron. Gembloux, 6 (3-4) 362. (1971).

8. Mahen, H.H. and Chapman, T.A. 1954. Detection of adulteration of butter with vegetable oils by tocopherol contents. Anal. Chem., 26, 1195, (1954).

9. Mc Dowell, F.H. 1954. The properties of New Zeland butters and Butterfats. IV-Refractive index and density of the Butterfat. J. Dairy Res., 21, 383.

10. Shipe, W.F. 1956. A summary of Methods for the detection of Foreign fats inDairy products. Dairy sci., 39, 956. (1956).

تقدير المواد غير القابلة للتصبن للتفرقة بين الدهون الحيوانية والنباتيه

زينب حسن درويش

معهد بحوث تكنولوجيا الأغذية - مركز البحوث الزراعية -الجيزة - مصر.

تم دراسه زيت نباتي مهدرج (النخلتين) ودهنين حيوانيين مختلفين هما زبدا البقر وسمن الجاموسي وقد تم تحليلهم بواسطة جهاز التحليل الكروماتوجرافي الغازي لفصل ووصف وتقدير الهيدروكربون والاستيرولات والتوكوفيرولات من أجل تقدير غش الدهون الحيوانيه بالزيوت النباتيه المهدرجه والأقل في الدرجة والسعر.

وهذا البحث يشير الي أن الزيت المهدرج يتميز بغياب الكوليسترول والتوكوفيرول E ووجوذ ك٢٤ أما الزبد البقري يتميز بوجود هيدروكربون ك٢٨ والسمن الجاموسي يتميز بوجود هيدروكربون ك٢١.