TABLE V

GLC and GC-MS Analysis of Cocoa Butter and CBE Triterpene Alcohols After Fractionation by Argentation TLC

RRT[a]	Acetate	Percentage (approx.) Cocoa butter	Coberine
1.31	Lanostenyl	2.1	–
1.32	Euphyl	–	0.4
1.57	Lanosteryl	1.5	0.4
1.66	β-Amyrin	1.6	14.9
1.67	Dammaradienyl	–	0.6
1.69	24-Methyl-lanostenyl	0.1	–
1.70	4,4',14-Trimethyl--cholest-7,24(25)-dien-3β-yl	0.6	–
	Butyrospermyl	–	5.0
	Unidentified	0.9	0.4
1.76	24-Methylene-lanostenyl	11.4	–
1.77	Unidentified	3.4	–
1.80	Parkeyl	–	2.3
1.81	24-Methylene-dammarenyl	–	0.7
1.84	4,4'-Dimethyl-24-methylene--cholest-7en-3β-yl	2.0	–
1.87	α-Amyrin	–	48.2
1.88	Cycloartenyl	53.9	0.5
1.90	4,4',14-Trimethyl-24-methylene--cholest-7en-3β-yl	2.8	3.1
1.94	Lupeyl	0.4	19.2
2.08	24-Methylene cycloartanyl Cycloaudenyl	10.5	1.4
2.18	Unidentified	6.0	–
2.28	ψ-Taraxasteryl	–	2.4
2.29	Taraxasteryl	–	0.5
2.34	4,4'-Dimethyl-24-ethylidene--cholest-7en-3β-yl	1.6	–
2.56	Cyclobranyl	1.2	–

[a]Relative to cholesteryl acetate.

Coberine differ substantially from those of cocoa butter: they consist of ca 75% of pentacyclic triterpene alcohols, ca 17% of tetracyclic triterpene alcohols of non-sterolic nature, and ca 8% of 4,4'-dimethylsterols. On the contrary, ca 95% of the triterpene alcohols of cocoa butter are 4,4'-dimethylsterols.

As already noted, detection of CBE in chocolate by using packed columns can be based on the presence of β-amyrin, butyrospermol and lupeol. However, a better characteristic is α-amyrin which makes up 48% of the triterpene alcohols of Coberine and is completely absent from cocoa butter. α-Amyrin and cycloartenol, the latter being present in high proportions in cocoa butter triterpene alcohols, are not resolved on packed columns. Thus, the free 4,4'-dimethylsterols or triterpene alcohols of cocoa butter, Coberine and a mixture of 5% Coberine in cocoa butter were analyzed on an OV-17 glass capillary column. The three chromatograms obtained are shown in Figure 2. α-Amyrin and cycloartenol are quite satisfactorily resolved on the capillary column, and the presence of Coberine is obvious.

Work is in progress with other inadmissible fats used as cocoa butter substitutes and other permitted fats (e.g. hazelnut oil) for the final formulation of the method.

REFERENCES

1. Padley, F.B., and R.E. Timms, JAOCS 57:286 (1980).
2. Timms, R.E., J. Dairy Res. 47:295 (1980).
3. Fincke, A., Dtsch. Lebensm. Rdsch. 76:384 (1980), and EEC Doc. No. III/1257/83.
4. Presented in part at the following Symposia: 2nd International Flavor Conference, Athens, Greece, 1981: Gegiou, D. and K. Staphylakis, "The Quality of Foods and Beverages", Vol. 2, G. Charalambous and G. Inglett, eds, Academic Press, New York, 1981, p. 301, and 3rd International Flavor Conference, Corfu, Greece, 1983: Staphylakis, K., and D. Gegiou, "Instrumental Analysis of Foods – Recent Progress", Vol. 1, G. Charalambous and G. Inglett, eds, Academic Press, New York, 1983, p. 203.
5. Official and Tentative Methods of the American Oil Chemists' Society, 3rd edn., AOCS, Champaign, IL, 1958 (revised 1969).
6. Gegiou, D., and M. Georgouli, JAOCS 57:313 (1980).
7. Fincke, A., Fette Seifen Anstrichm. 73:534 (1971).
8. Jurriens, G., and A.C.J. Kroesen, JAOCS 42:9 (1965).
9. Itoh, T., T. Tamura, T. Iida and T. Matsumoto, Steroids 23: 687 (1974).
10. Homberg, E., and B. Bielefeld, Dtsch. Lebensm. Rdsch. 78:73 (1982).
11. Budzikiewicz, H., J.M. Wilson and C. Djerassi, JACS 85:3688 (1963).
12. Chandler, R.F., S.N. Hooper, D.L. Hooper, W.D. Jamieson and E. Lewis, Lipids 17:102 (1982).
13. Madrigal, R.V., R.D. Plattner and C.R. Smith Jr., Ibid. 10:208 (1975).
14. Hooper, S.N., R.F. Chandler, E. Lewis and W.D. Jamieson, Ibid. 17:60 (1982).
15. Itoh, T., T. Tamura and T. Matsumoto, Ibid. 11:434 (1976).
16. Itoh, T., T. Tamura and T. Matsumoto, Ibid. 9:173 (1974).
17. Itoh, T., T. Tamura and T. Matsumoto, Ibid. 10:808 (1975).
18. Staphylakis, K., and D. Gegiou, Fette Seifen Anstrichm, in press.

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Erratum

An incorrect address was given in the April 1985 *JAOCS* (62:745) for a co-author of the paper "Determination of Ascorbyl Palmitate by High Performance Liquid Chromatography." The proper current address for W. M. Cort is: Cort Consultants, 4395 Brandywine Drive, Sarasota, FL 33583.