QUANTITATIVE INTERPRETATION OF GAS-LIQUID CHROMATOGRAMS OF METHYL ESTERS OF SATURATED FATTY ACIDS

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In view of the fact that one of the main components of phospholipid molecules consists of fatty acids (FAs), the correct quantitative interpretation of gas-liquid chromatograms of methyl esters of these acids is necessary. There has been a discussion [1, 2] of what gives the best approximation to the areas bounded by the recorder curve of a chromatograph with a thermal conductivity detector — weight or molar percentages. To answer this question we obtained a mixture of FAs with known contents of each component, methylated them, and separated them on a UKh-2 chromatograph [carrier gas helium, support Celite-545, liquid phase polyethyleneglycol succinate (17%), temperatures 199 and 203°C, katharometer detector]. Below we give the composition and $\frac{C_i\ h_i}{\sum_{i=1}^{i=n} C_i\ h^i} \cdot 100\%$ values (where C is the resonance time and h is the height of the peak):

Sample	Acid	mol. wt.	wt. %	mole %	Δ	$\frac{C_i\ h_i}{\sum_{i=1}^{i=n} C_i\ h_i} \cdot 100\ \%$
I	12:0	200	50,8	58,2	−7,4	57,9
	17:0	270	49,2	41,8	+7,4	42,1
II	12:0	200	13,5	18,1	−4,6	17,6
	18:0	284	86,5	81,9	+4,6	82,4
III	12:0	200	26,8	33,0	−6,2	32,4
	16:0	256	23,8	23,0	+0,8	24,4
	17:0	270	24,1	22,0	+2,1	20,9
	18:0	284	25,3	22,0	+3,3	22,3
IV	12:0	200	7,7	10,2	−2,5	10,0
	16:0	256	19,3	20,0	−0,7	20,5
	17:0	270	36,1	35,3	+0,8	34,5
	18:0	284	36,9	34,5	+2,4	35,0

Thus, in the samples investigated the molar percentages are far closer to the values calculated from the readings of the instrument than the weight percentages. With an increase in the number of acids in the sample and a decrease in the difference between the molecular weights of the FA esters, the difference between the weight and molar percentages decreases. With an increase in the difference between the molecular weights with equal weight percentages when two acids are present in the mixture (sample I), the difference between the weight and molar percentages becomes quite considerable.

Since a katharometer shows a change in thermal conductivity depending on the amount of substance and its heat capacity, we can state that for the saturated straight-chain FAs the heat capacities of their methyl esters under the given conditions are similar. This is due to the fact that the heat capacities of the FAs are also close [3, 4]. In its turn, the heat capacity depends on the molecular weight, which changes smoothly from acid to acid, and also on the structure, and therefore it may be assumed that branched FAs and those having double bonds will have different heat capacities, an exception being straight-chain acids having only trans double bonds, for which a different approach is necessary.

Thus, the content of saturated normal fatty acids according to the results of GLC with a thermal conductivity detector corresponds to molar percentages.

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AMOUNTS OF PHOSPHOLIPIDS AND PHYTIN IN THE SEEDS OF VARIOUS PLANTS. II

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Continuing an investigation of the seeds of various plants for their phospholipid and phytin contents [1, 2] we have studied the seeds of twenty plants belonging to three families. The combined phospholipids were isolated and freed from carbohydrates and their qualitative composition was determined as described in the preceding communication [1], and the amount of phytin in the meal was determined as described previously [2] (Table 1).

The crude combined phospholipids always contained considerable amounts of neutral lipids as impurities, and they were freed from these by treatment with acetone. However, depending on the content of neutral lipids, in some cases on purification a considerable amount of phospholipids passed into the acetone, which interfered with the determination of the true amount of combined phospholipids. Consequently, to purify the total phospholipids from neutral lipids we investigated column chromatography on silica gel. The neutral lipids were eluted from the column with chloroform.

TABLE 1. Total Phospholipids and Phytin in Seeds

Plant	Total phospholipids, %	Number of components in the total	Yield of phytin, %
Leguminosae			
Sophora japonica L.	1.1	10	1.5
Psoralea drupacea Bge.	1.0	8	1.3
Gleditschia triacantos L.	0.8	8	2.2
Glycyrrhiza glabra L.	0.8	9	0.5
Amorpha fruticosa L.	1.3	9	3.8
Lens culinaris Medic.	1.6	7	1.2
Phaseolus vulgaris L. (variety "Altyn")	1.6	7	1.6
Phaseolus aureus Roxb. (variety "Angelika")	1.4	8	1.7
Phaseolus aureus Roxb. (variety "Pobeda")	1.3	8	1.8
Albizzia julibrissin Durazz.	1.3	7	1.4
Pisum sativum L. (variety "Vostok-55")	1.1	8	2.1
Glycine hispida Maxim. (variety "Uzbekskaya-2")	1.5	8	2.3
Rosaceae			
Amygdalus bucharica Korsh.	1.1	9	3.7
Amygdalus petunnikowii Litv.	0.7	5	3.5
Poterium polygamum Waldst. et Kit.	0.2	6	2.0
Cerasus mahaleb (L.) Mill.	1.1	6	2.2
Chaenomeles japonica Lindl.	0.5	6	1.4
Boraginaceae			
Echium italicum L.	0.2	5	2.8
Cynoglossum creticum Mill.	1.1	5	2.5
Heliotropium olgae Bge.	1.0	7	2.0

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