Short Paper

Chromatographic Rules in Elution of Individual Molecular Species of Triglyceride*1

We have discovered previously that there are two rules in the elution of diglyceride acetate derived from lecithin on high performance liquid chromatography[1], that is:

$$C=p_1\cdot\log RRT+q_1 \qquad C=\begin{vmatrix} x & d_1 \\ c_2 & d_2 \end{vmatrix} \tag{1}$$

$$D=p_2\cdot\log RRT+q_2 \qquad D=\begin{vmatrix} c_1 & y \\ c_2 & d_2 \end{vmatrix} \tag{2}$$

where p is the slope and q is the intersection on the ordinate. c and d are acyl carbon number and number of double bonds in each acyl group, respectively. x and y are variables of acyl carbon number and number of double bonds, respectively.

The structure of diglyceride acetate is:

$$\begin{bmatrix} -\text{Acyl}_1 \\ -\text{Acyl}_2 \\ -\text{CO}\cdot\text{CH}_3 \end{bmatrix} \quad \text{(Acyl: esterified fatty acid)} \tag{3}$$

And the structure of triglyceride is:

$$\begin{bmatrix} -\text{Acyl}_1 \\ -\text{Acyl}_2 \\ -\text{Acyl}_3 \end{bmatrix} \tag{4}$$

The difference between (3) and (4) is at position 3 in the molecule. But $CO\cdot CH_3$ can also be considered as the shortest chain in acyl group.

So: $\begin{bmatrix} -\text{Acyl}_1 \\ -\text{Acyl}_2 \\ -\text{Acyl}_3 \end{bmatrix} \ni \begin{bmatrix} -\text{Acyl}_1 \\ -\text{Acyl}_2 \\ -\text{CO}\cdot\text{CH}_3 \end{bmatrix}$ (where $\ni$ means "include")

therefore, (1) and (2) can be rewritten as:

$$C=p_1\cdot\log RRT+q_1 \qquad C=\begin{vmatrix} x & d_1 \\ c_2 & d_2 \\ 2 & 0 \end{vmatrix} \tag{1}'$$

$$D=p_2\cdot\log RRT+q_2 \qquad D=\begin{vmatrix} c_1 & y \\ c_2 & d_2 \\ 2 & 0 \end{vmatrix} \tag{2}'$$

since (2, 0) in position 3 exhibits the acyl (acetyl) group which has two carbons and no double bond. So we can conclude that (1) and (2) are members of the general rule for triglycerides under the condition of $\begin{vmatrix} x & d_1 \\ c_2 & d_2 \\ 2 & 0 \end{vmatrix}$ or $\begin{vmatrix} c_1 & y \\ c_2 & d_2 \\ 2 & 0 \end{vmatrix}$. By adapting the general expressions to triglyceride, the following equations will finally be obtained.

$$C=p_1\cdot\log RRT+q_1 \qquad C=\begin{vmatrix} x & d_1 \\ c_2 & d_2 \\ c_3 & d_3 \end{vmatrix} \tag{5}$$

$$D=p_2\cdot\log RRT+q_2 \qquad D=\begin{vmatrix} c_1 & y \\ c_2 & d_2 \\ c_3 & d_3 \end{vmatrix} \tag{6}$$

We have adapted (5) and (6) to the data of PERKINS *et al*[2,3] and discovered that the theory, that has proven mathematically, is available practically as illustrated in the two figures.

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*1 クロマトグラフィーにおける各トリグリセリド分子種の溶出順位性について

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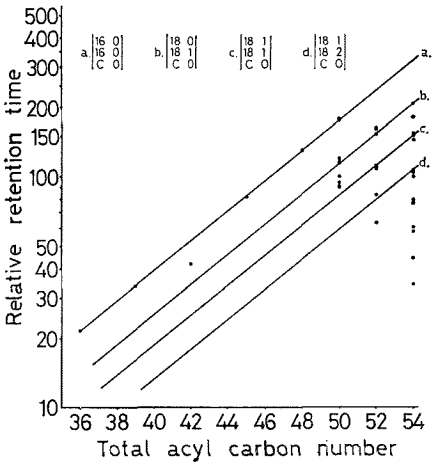

Fig. 1. Relation between relative retention time of triglyceride types and their total acyl carbon number.
* Triolein was used as a reference peak for the relative retention time calculation.

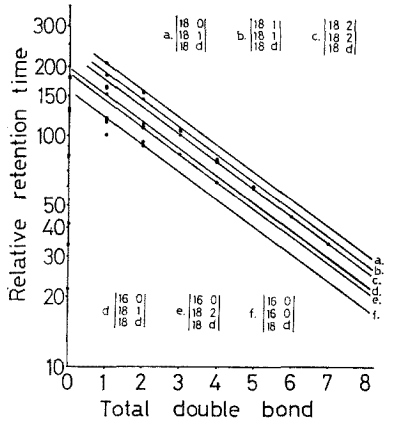

Fig. 2. Relation between relative retention time of triglyceride types and their total double bond.
* Triolein was used as a reference peak for the relative retention time calculation.

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