On the MG Values in Paper-electrophoresis

Sir:

We have already reported on the MG values of amino acids in paper-electrophoresis^{1,2)}, which were the constants regardless of voltage, current, time of electrophoresis, dropped point and length of filterpaper. Afterwards, mathematical analysis was applied to the migration distance of amino acids and serum proteins under the influence of evaporation from filterpaper and electroosmosis and it was found that the net-initial velocity of migrant A (B, C, D, E) shown in Fig. 1, $V_{0A(B,C,D,E)}$, could be calculated by the following formula, which was in conformity in a considerable accuracy of 96% (92%~105%), with the net-migration velocity in the filterpaper clamped between glass plates³⁾.

$$V_{0A(B,C,D,E)} = \frac{(MD'_{A(B,C,D,E)} - MD'_{dex}) \cdot \log a'/a}{a'/a - 1} \dots (1)$$

In formula (1), $MD'_{A(B,C,D,E)}$ shows the ap-

FIG. 1. The Relationships between the Migration Distance of A (B, C, D, E, Dextran) and Dropped Points²⁾.

parent migration distance of A (B, C, D, E) from the original point at the time of t_1 , MD'_{dex} the apparent migration distance of dextran at the same time, a'/a the decrement ratio of migration velocity of the migrant at the interval of t_1 .

When we take the following ratio as MG of B (C, D),

$$MG_{B(C,D)} = \frac{\text{migration distance of B (C, D) from A}}{\text{migration distance of E from A}}$$

then, the MG of B (C, D) is expressed as:

$$\begin{aligned} MG_{B(C,D)} &= \frac{MD'_{B(C,D)} - MD'_A}{MD'_E - MD'_A} = \frac{V_{0B(C,D)} - V_{0A}}{V_{0E} - V_{0A}} \\ &= \frac{l/l' \cdot m_{B(C,D)} - l/l' \cdot m_A}{l/l' \cdot m_E - l/l' \cdot m_A} \\ &= \frac{m_{B(C,D)} - m_A}{m_E - m_A} \dots \dots \dots (2) \end{aligned}$$

where m_A , m_B , m_C , m_D and m_E is respectively the mobilities of A, B, C, D and E, l/l' the correction factor of filterpaper for calculation of mobility of migrant³⁾. From formula (2) it is evident that the MG value in this definition is equal to the ratio of differences of mobilities, which is constant regardless of voltage, current, time of electrophoresis, dropped point and length of filterpaper. Table I shows the MG values of amino acids and serum proteins, each in accordance with the following definition, which were obtained both by actual measurement under the influence of evaporation from paper surface and by calculation of substituting $l/l' \cdot m \text{ cm}^2 \cdot \text{volt}^{-1} \cdot \text{sec}^{-1}$ in equation (2), where $l/l' \cdot m \text{ cm}^2 \cdot \text{volt}^{-1} \cdot \text{sec}^{-1}$ was acquired by a method of clamping filterpaper between glass plates³⁾.

$$\begin{aligned} MG &= \frac{\text{migration distance of other serum proteins from } \gamma\text{-globuline}}{\text{migration distance of serum albumine from } \gamma\text{-globuline}} \\ MG &= \frac{\text{migration distance of other amino acids from arginine}}{\text{migration distance of aspartic acid from arginine}} \end{aligned}$$

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2) K. Sakamoto, K. Tateoka, J. Agr. Chem. Soc. Jap, **30**, 463 (1956).

3) H.G. Kunkel, A. Tiselius, J. Gen. Physiol., **35**, 89 (1951).

TABLE I
THE MG VALUES OF AMINO ACIDS OBSERVED IN SEVERAL pH OF PHOSPHATE BUFFERS (A)
AND SERUM PROTEINS IN A BARBITAL BUFFER OF pH 8.5 (B)

F: found values C: calculated values from l/l' ·m

		(A)				
Amino acid pH		Aspartic acid	Glutamic acid	Neutral amino acid	Histidine	Arginine Lysine
8.3	{ F	1.00	0.92±0.03	0.34±0.03	0.30±0.02	0
	{ C	1.00	0.89		0.28	0
7.3	{ F	1.00	0.87±0.03	0.38±0.03	0.24±0.03	0
	{ C	1.00	0.85		0.27	0
6.4	{ F	1.00	0.85±0.04	0.45±0.03	0.18±0.02	0
	{ C	1.00	0.82		0.17	0
5.5	{ F	1.00	0.82±0.03	0.50±0.02	0.09±0.03	0
	{ C	1.00	0.81		0.08	0
4.5	{ F	1.00	0.78±0.04	0.54±0.03	0.04±0.02	0
	{ C	1.00	0.79		0.02	0
(B)						
		Albumine	α_1 -Globuline	α_2 -Globuline	β -Globuline	γ -Globuline
MG { F		1.00	0.81±0.03	0.59±0.04	0.35±0.03	0
	{ C	1.00	0.82	0.56	0.35	0

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