「食品의 物性과 Rheology의 기본 이론」

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A.

1. Definition of Rheology
2. Rheology의 대상물질
3. Flow type
   1) Newtonian Flow
   2) Non-Newtonian Flow
      ① Plastic(Bingham)
      ② Pseudoplastic
      ③ Dilatant

B.

Relation between the viscosity and the temperature

$\eta = Ae^{a/T}$

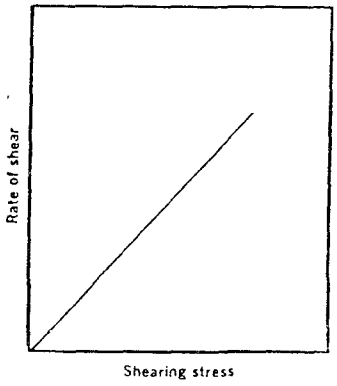
1. Viscosity of Gas

   $\eta = \sqrt{T}$ or $\eta \propto \sqrt{T}$

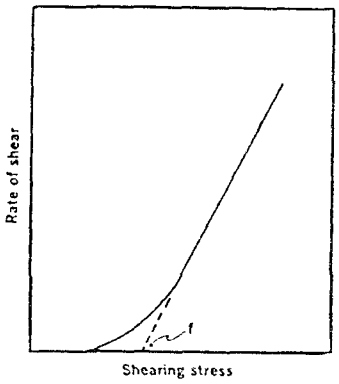
2. Viscosity of liquid

   1) by Arrhenius theory(Activation energy)

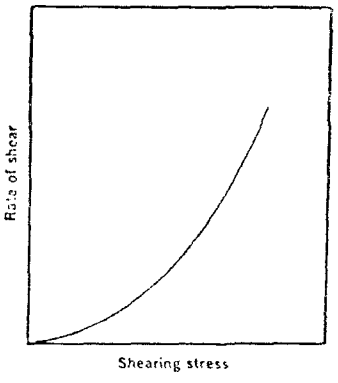
   $\eta = Ae^{B/T} = Ae^{\varepsilon/kT} = Ae^{Ea/RT}$



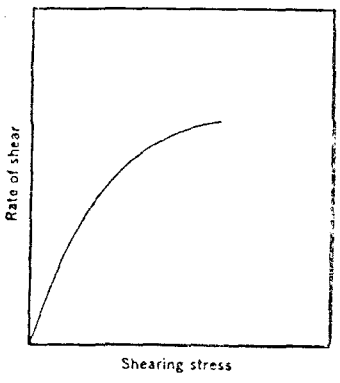
(a) Newtonian flow



(b) Simple plastic flow



(c) Simple pseudoplastic flow



(d) Dilatant flow

2) by Eyring(Entropy factor, Energy factor)

$$\eta=\frac{h}{\lambda_1\lambda_2\lambda_3}\ e^{\Delta S\neq/R}\ e^{-\Delta H\neq/RT}$$

$$A=\frac{h}{\lambda_1\lambda_2\lambda_3}\ e^{\Delta S\neq/R},\quad B=e^{-\Delta H\neq/RT}$$

3. Viscosity of Hydrocarbon-series by Doolittle (fraction free volume)

C.

Viscosity of Solution

1. Relation between the viscosity and the concentration

1) $\eta_{rel}=\eta/\eta_0$

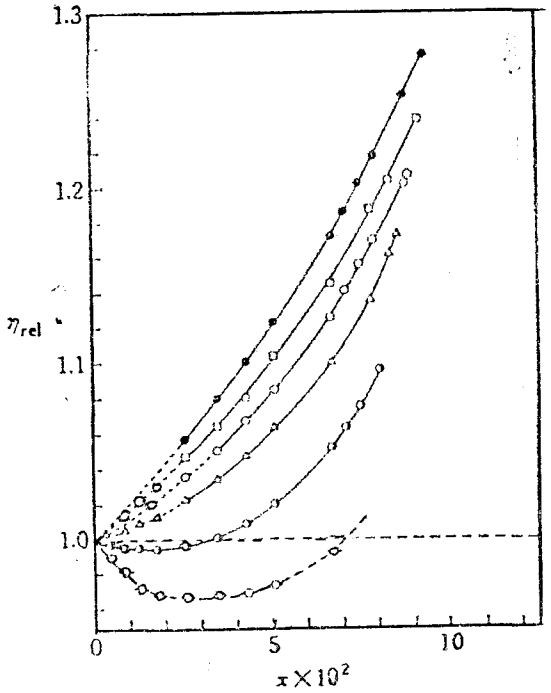
2) $\eta_{sp}=\frac{\eta-\eta_0}{\eta_0}=\eta_{rel}-1$

3) $\eta_{red}=\frac{\eta-\eta_0}{\eta_0 C}=\frac{\eta_{sp}}{C}$

4) $[\eta]=\left[\frac{\eta_{sp}}{C}\right]_{c\to 0}$

2. Viscosity of Suspension solution

$\eta_{sp}=2.5\phi$



KCl • : 50°C, □ : 45°C, ○ : 40°C,
△ : 35°C, ◦ : 25°C, ◇ : 15°C

$[\eta]=\left[\frac{\eta_{sp}}{C}\right]_{c\to 0}=\frac{2.5}{\rho}=2.5\upsilon$

$[\eta]=2.5$ V/m

3. Negative viscosity of Electrolyte solution (by Jones-Dole equation)

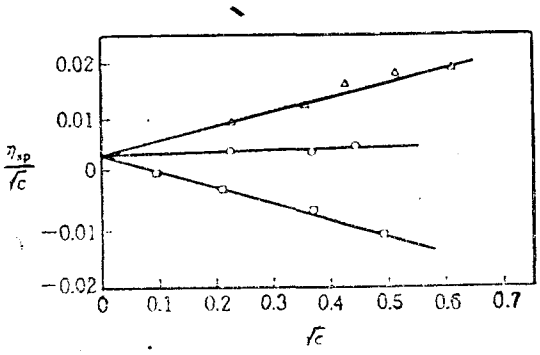
$\eta_{rel}=1+A\sqrt{C}+BC$

$\eta_{sp}=A\sqrt{C}+BC$

A : Interaction of ion-ion of electrolyte
B : Interaction of ion-solvent of electrolyte (구조생성 및 구조파괴)

$$\frac{\eta_{rel}-1}{\sqrt{C}}=A+B\sqrt{C}$$

$$\eta_{sp}/\sqrt{C}=A+B\sqrt{C}$$



溫度 (°C) △ : 35, ○ : 25, □ : 10

D.

용질에 의한 수용액의 구조변화(구조촉진)

1. Hydrophilic Hydration

Li^+, F^-이온반경이 작은 것은 수화(물분자의 흡인) 친수성의 수화에 의하여 구조화를 일으킨다.

2. Negative Hydration

3. Hydrophobic Hydration

E.

Shear-thinning→Thixotropy
Shear-thickening→Rheopexy

Thixotropy
Rheopexy