work at the sedimenting volume V_2. The values of V_1 and V_2 may be both related with the lyophilic properties of the powder. For example dry starch in benzene shows dilantancy and gives small values of V_1, and V_2, while wet starch in benzene which is thixotropic gives large values of V_1 and V_2. Further, ZnO in benzene which is also thixotropic gives large values of V_1 and V_2.

The rigidity of those systems at V_1 measured by Schwedoff's method showed very large values, but their limits of rigidity were very small comparing with the gel of gelatine at the volume concentration.

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18. Vapor Pressures and Inflammation Limits of Organic Volatile Substances

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Vapor pressure (p) of camphor, naphthalene and phthalic acid anhydride were measured by the flow method. The relation of p can be given approximately as follows:

$$P=\frac{62.4TPW}{PMV+62.4TW} \quad \cdots\cdots\cdots \quad (1)$$

where T is the absolute temperature of the vapor, P the atmospheric pressure, W the weight of the volatile substance sublimed, and M the molecular weight of the substance. Linear relations between log p and $1/T$ were obtained for those three kinds of volatile substance. Accordingly, the heat of vaporization (L) can be given by Clausius-Clapeyron's equation

$$\log p=\frac{a}{T}+b, \qquad \text{where } a=-\frac{L}{2.3R} \quad \text{and} \quad b=\text{const.}$$

a, b and L are shown in the Table 1.

Table I.

	a	b	L Kcal/mol	
			obs	from literature
Camphor	−2.83	8.87	12.95	12.43
Naphthalene	−2.69	9.39	12.32	11.31
Phthalic acid anhydride	−3.30	8.89	15.08	13.12

Next, the lowest temperature for inflammation or the flash point were observed in the air saturated with the vapor. The inflammable mixtuare were ignited in a large test tube (2.9×20cm) with the spark excited by an induction coil at various temperatures. From the atmospheric pressure and the vapor pressure at the lowest temperature for ignition, the limit (C_0) of inflammation was calculated. According to the theory proposed by Goto [this Bull. 21 1, (1950)], C_0 can be given approximately by the relation

$$1/C_0 = 11\,Q$$

where Q is the heat of combustion. Results obtained are shown in the Table II.

Table II.

	Q Kcal	Flash Pt. °C	Limit of Inflammation, C_0(%)	
			obs.	calc.
Camphor	1,410.7	80	0.91	0.78
Naphthalene	1,231.9	84	1.00	0.91
Phthalic acid anhydride	783.8	149	1.65	1.44

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19. Studies on Ship's Bottom Paints. (II)

Sedimentation Volume of Ferric Oxide

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The sedimentation volume of ferric oxide in various liquids was measured in order to investigate lyophilic properties of rouge, an important pigment of anti-corrosive ship's bottom paint.

Commercial ferric oxide was washed with benzene, alcohol and water. It was dried at about 110°C for several hours and finally in $CaCl_2$-desiccator for a few days. The average particle size was about 2 microns in diameter. 2 gm. of the ferric oxide was dispersed in 20ml. of each liquid and its sedimentation volume was determined after complete settling.

The chief results may be summarized as follows.

a) Non-polar liquids, such as benzene, ethyl butyrate, cymene, mineral spirit and solvent naphtha, gave larger values of the sedimentation volume: polar liquids, such as pyridine, oleic acid, methyl alcohol, ethyl alcohol and butyl alcohol, gave smaller values.

b) The sedimentation volume of dry ferric oxide in wet benzene showed a tendency to decrease with the water content. On the other hand, addition of moisture to ferric oxide increased the sedimentation volume in dry benzene.

c) Addition of other polar compounds, such as oleic acid, alcohols, rosin or dioxane, to dry benzene decreased the sedimentation volume of dry ferric oxide.

d) Addition of water to methyl alcohol had a slightly increasing effect on the sedimentation volume.