

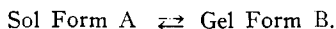
MUTAROTATION OF GELATIN AND ITS SIGNIFICANCE  
IN GELATION.<sup>1</sup>

By C. R. Smith.

[ABSTRACT.]

GELATIN at and above 35° C. has a constant specific rotation of -123°. Between 35° and 15° C. higher values are obtained which vary with concentration. Below 15° C. the specific rotation reaches a maximum and constant value of -268°. The increase in levorotation is progressive with time, and requires about 16 hours for completion.

These results point to the existence of two forms—Sol Form A, stable above 35° C., and Gel Form B, stable below 15° C.—and a condition of equilibrium at intermediate temperatures represented by the formula



Gelatin in the highest concentrations (50 grams per 100 cc.) does not form a gel at 35° C. as it exists entirely in the sol form. At and below 15° C. a minimum quantity, 0.6 grams per 100 cc., is necessary to form the "standard gel" which was marked by the resistance of the movements of an air bubble in the polariscope tube. This concentration of gelatin suffers a total change of 0.80°, in rotation between 35° and 15° when the standard gel is produced. In higher concentrations this same change of 0.80°, corresponding to the production of 0.60 gram of Form B, results in the production of the standard gel. The maximum temperatures at which any concentration can produce a gel is conditioned, therefore, by the existence of this amount in equilibrium. The "melting temperatures" become identical with maximum gelation temperatures when sufficient time is given for equilibrium to be reached.

When gelatin is cooled rapidly from 35° to 20°, 19° or 15° in polariscopic tubes and the changing rotation followed with time,

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\* Communicated by the Chief of the Bureau.

<sup>1</sup> Published in *Jour. Amer. Chem. Soc.*, v. 41, 1919, p. 135.

it is found that the reaction is bimolecular, showing that the laws of mass action apply to a colloid like gelatin even when in the gel form in which most of the readings were made.

Following up the relation indicated, it was found that two molecules of Sol Form A were in equilibrium with one molecule of Gel, Form B, according to the formula

$$k(a-x)^2 = k^1 x$$

Considering the change from the Sol Form A to the Gel Form B as bimolecular and further that a definite amount of the latter forms the standard gel, a formula was derived which permits the calculation of the time necessary for the production of gel in different concentrations at temperatures below 20° C. ( $y^2d - yb$ )  $t = a$  constant, where  $y$  is the concentration in grams per 100 cc.,  $d$  the total change in specific rotation observed between 35° and selected temperature, and  $b$  the change necessary to produce the standard gel. Experiment gave satisfactory results in agreement with the formula.

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## INFLAMMABILITY OF CARBONACEOUS DUSTS IN AIR AND IN ATMOSPHERES OF LOW OXYGEN CONTENT.<sup>2</sup>

By H. H. Brown.

SEVERE property losses, in some cases attended by the destruction of human life, have occurred because of the fact that dusts from all materials which will burn are explosive. The Grain Dust Explosion Investigation Laboratory of the Bureau of Chemistry has investigated the explosibility of such dusts, with a view to ascertaining ways to reduce to a minimum the danger from dust explosions and fires in mills, grain elevators and cotton gins.

The relative inflammability of various dusts was determined in the laboratory, using a modification of the method devised by the Bureau of Mines for testing coal dust. Briefly, this method consists in forcing a cloud of dust (75 milligrams), which will pass through a 200-mesh screen, against a platinum-covered heating element, placed in the centre of a round glass globe with a

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<sup>2</sup> Brown, H. H.: "Inflammability of Carbonaceous Dusts," *J. Ind. Eng. Chem.*, **9** (1917), 269. Brown, H. H., and Clement, J. K.: "Inflammability of Carbonaceous Dusts in Atmospheres of Low Oxygen Content," *J. Ind. Eng. Chem.*, **9** (1917), 347.