Summary.

1. The reaction between sulfur monochloride and ethylene proceeds in two stages. The course of this reaction has been followed by a method of analysis based on freezing-point determinations.

2. It is probable that the intermediate compound is CH_2ClCH_2SCl. A similar intermediate product has been obtained in impure condition by the action of sulfur dichloride on ethylene.

3. 15 to 20% of non-volatile side products are always formed in the monochloride reaction. These side products are organic polysulfides.

WASHINGTON, D. C.

[CONTRIBUTION FROM THE DIVISION OF AGRICULTURAL BIOCHEMISTRY, MINNESOTA AGRICULTURAL EXPERIMENT STATION.]

THE GOLD NUMBERS OF PROTALBINIC AND LYSALBINIC ACIDS.[1]

BY ROSS AIKEN GORTNER.

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In 1902 Paal[2] prepared 2 substances by the action of sodium hydroxide upon egg albumin which he regarded as definite compounds. To these substances he gave the names of "protalbinic" and "lysalbinic" acids. These preparations exert a strong protective or stabilizing action when added to suspensoid sols. From the statements which occur in the textbooks one would assume the protective action of these materials to be of the highest order. Thus Freundlich[3] states "Peptone solutions are so slightly colloidal that they have no protective action whatever. On the other hand, protalbinic and lysalbinic acids possess unusual ability to hold the most varied kinds of finely divided materials in colloidal solution." Taylor[4] states, "Paal's protalbic acid and lysalbic acid are extremely active protectors," and Bechhold[5] concludes that "Peptones have no protective action at all whereas some of the albumoses, especially *sodium lysalbinate* and *sodium protalbinate* have a very powerful protective action."

In view of these statements it appeared to be rather surprising that no exact measure of their value as protective colloids appeared in the litera-

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[1] Presented before the Division of Biological Chemistry at the Cleveland meeting of the American Chemical Society, Sept. 9–13, 1918. Published with the approval of the Director as Paper No. 189, Journal Series, Minnesota Agricultural Experiment Station.

[2] C. Paal, *Ber.*, 35, 2195–2206 (1902).

[3] Freundlich, H. "Kapillarchemie," Leipzig, 1909, p. 451.

[4] W. W. Taylor, "The Chemistry of Colloids," Longmans, Green & Co., N. Y., 1915, p. 130.

[5] H. Bechhold, "Colloids in Biology and Medicine," translated by J. G. M. Bullowa, Van Nostrand Co., N. Y., 1919, p. 86.

ture with the exception of a statement by Zsigmondy[1] that the sodium salt of protalbinic acid had a gold number of 0.03–0.08 and that of lysalbinic acid 0.02–0.06. The gold numbers of various other protective colloids are given in almost all of the colloid texts. From the statements noted, one would infer that protalbinic and lysalbinic acids exceeded all of the usually available materials in their protective value.

Inasmuch as we possessed a quantity of highly purified protalbinic and lysalbinic acids prepared for another purpose, it was thought advisable to make a careful determination of their relative value as protective colloids, utilizing as a measure the gold number of Zsigmondy.[2] The preparation of our protalbinic and lysalbinic acids has already been described.[3] In determining the gold number, a weighed amount of the "acid" was brought into solution in water by the cautious addition of 0.0714 *N* sodium hydroxide solution, taking care that no more alkali was added than was required to effect complete solation. Only a very small quantity of alkali was needed to peptize the preparations, so that the gold numbers which I obtained are not necessarily comparable with those which Zsigmondy found for the sodium salts of the acid, but are more nearly a measure of the protective value of the organic radical. The presence of additional alkali would undoubtedly alter the gold numbers which I obtained, due to the well known stabilizing effect of the hydroxyl ion. After making up to definite volume, this solution, or a dilution made from it, was used at once in the tests. The gold number determination, including the preparation of the red gold sol, was carried out exactly as described by Schulz and Zsigmondy.[4] In order to check the values obtained with those of other workers, the gold numbers of a number of other materials were likewise determined. The values obtained are shown in Table I. The values given by Zsigmondy[5] are also included.

It will be noted that in the cases of gelatin, egg albumen and gum arabic, my values are in good agreement with those of other workers. The sample of sodium oleate which I used had been in stock for a long time and has a somewhat rancid odor, which may explain my high values. At any rate, it would appear as if my values were reliable for the materials

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[1] R. Zsigmondy, "The Chemistry of Colloids," translated by E. B. Spear. Wiley and Sons, N. Y., 1917, p. 212. This statement of Zsigmondy was not known to me until long after my work was completed. The figures are not given in his tables of comparative gold numbers nor is the reference indexed so as to be readily found.

[2] R. Zsigmondy, *Z. anal. Chem.*, 40, 697–719 (1901).

[3] C. Kennedy and R. A. Gortner, "The Nitrogen Distribution in Protalbinic and Lysalbinic Acids," THIS JOURNAL, 39, 2734–2736 (1917).

[4] Fr. N. Schulz and R. Zsigmondy. *Beitr. Chem. Physiol. Pathol.*, 3, 137–160 (1903).

[5] R. Zsigmondy and E. B. Spear, "The Chemistry of Colloids," Wiley and Sons, N. Y., 1917, p. 107.

TABLE I.
Gold Numbers of Various Emulsoid Colloids.

Substance.	Gold number. Gortner.	Gold number. Zsigmondy.[a]
Dextrin (British gum)	125–150	
Soluble starch	10–15	
Sodium oleate	2–4	0.4–1.0
Egg albumen	0.08–0.10	0.15–0.25 (Taylor[b])
Gum arabic	0.10–0.125	0.15–0.25
Protalbinic acid	0.15–0.20	0.03–0.08 (sodium salt)
Lysalbinic acid	0.10–0.125	0.02–0.06 (sodium salt)
Gelatin	0.005–0.0125	0.005–0.010

[a] R. Zsigmondy and E. B. Spear, *loc. cit.*
[b] Taylor, *loc. cit.*

under investigation, and that be the case, we must conclude that the *protective action of Paal's protalbinic and lysalbinic acids, as measured by the gold number, has been much over-rated, inasmuch as their gold number is only approximately equal to that of gum arabic and only about $^1/_{10}$ that of gelatin.*

ST. PAUL, MINN.

[CONTRIBUTION FROM THE ESSENTIAL OILS LABORATORY, DRUG DIVISION, BUREAU OF CHEMISTRY, U. S. DEPARTMENT OF AGRICULTURE.]

THE CONSTITUTION OF CAPSAICIN, THE PUNGENT PRINCIPLE OF CAPSICUM. II.

BY E. K. NELSON.

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Since the appearance of the author's first communication[1] on this subject, Lapworth and Royle[2] have published the results of their work on capsaicin. These investigators are not fully disposed to accept the author's view of the constitution of capsaicin as final, on the ground that "his (Nelson's) conception of capsaicin as an acid amide is not easily reconciled with the somewhat ready reduction of a part of capsaicin to ammonia and an aliphatic alcohol boiling at about 216–217°; its distinctly, basic character and the great stability of the substance toward alkalies are also somewhat difficult to understand." They surmize that "under the energetic conditions used by Nelson internal oxidation or molecular rearrangement would not be surprizing."

Proof of the structure of capsaicin is now given by its generation from synthetic vanillyl amine and the decenoic acid previously isolated from capsaicin. The complete synthesis is impossible, of course, until we know the exact structure of the decenoic acid entering into the molecule. In view of the great number of possible isomers and the difficulty

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[1] THIS JOURNAL, 41, 1115 (1919).
[2] *J. Chem. Soc. Trans.*, 115, 1109 (1919).