reduced, but it minimizes the possibilities of adding excessive quantities of protective colloids which might stabilize the cuprous oxide in its finely divided form. Finally, in doubtful cases, a dilution of the reaction mixture is always to be tried. By this method there is avoided not only excessive concentration of the reducing body itself, but through adequate dilution, both those protective colloids which may be added from without, or those which may be formed in the reaction mixture itself are likely to be diluted to a point where their effect in stabilizing the cuprous oxide in its finely divided form is largely lost.

II

While working on the reduction of Fehling's solution by formaldehyde, we encountered a series of reactions which, while largely familiar to the physical chemists since Bredig's classical studies on the inorganic ferments, are somewhat new in their sum total; and since the reactions are strikingly like those observed in biological material, we have used them to elucidate the nature of such biological reactions for our students.

Formaldehyde reduces a Fehling's solution not only to the ordinary cuprous oxide, but to the metallic copper. The copper comes down in colloid form, but as this happens, a second reaction ensues in which the metallic copper acts upon the formaldehyde and decomposes it with the liberation of hydrogen. The liberation of hydrogen continues for hours, until either all the formaldehyde has been decomposed or all the copper salt has been reduced.

We use this reaction as a biological analogue illustrating the formation of an enzyme (the reduced copper) from a series of simple "dead" materials (alkali, salts, carbohydrate). From another point of view we may say that the formaldehyde poisons or acts as a toxin upon the Fehling's solution. Against this the reaction mixture produces an antitoxin (the metallic copper).

The reaction may also be used to illustrate the action of different enzymatic poisons. Potassium cyanide, for example, when added to the Fehling's solution will not only prevent its reduction by the formaldehyde but, added after the reduction has been initiated, will inhibit or stop further reduction and liberation of hydrogen.

As emphasized by Hoppe-Seyler, the production of nascent hydrogen is held to be essential in the chemistry of respiration. But depending upon whether this production of hydrogen in a biological oxidation mixture occurs in the presence or in the absence of oxygen, totally different effects (as an oxidation in the one case or a reduction in the other) may be brought about. The same is true of the chemistry of a Fehling's solution when reduced by formaldehyde.

If a substance like methylene blue or phenolsulphonephthalein is added to the reaction mixture, these dyes are left untouched or are deoxidized, depending upon whether the reaction mixture is kept in a flat dish exposed to oxygen or in a tall tube from which oxygen is largely excluded. In other words, the first dye behaves just as in the classical experiments of Paul Ehrlich upon tissue oxidations; the phenolsulphonephthalein acts as in the experiments of E. C. Kendall. Phenolsulphonephthalein suffers reduction in the body whenever oxygen is absent while it is left untouched when this is not the case.

A detailed account of these experiments has been sent to the *Kolloid-Zeitschrift* for publication.

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THE OIL CONTENT OF COTTON SEED AN ACCURATE BASIS FOR COMMERCIAL STANDARDIZATION

As a result of four years' work by the author, three of which are shown in the table below, and based on more than 500 determinations in the cotton industry laboratory of the Georgia State College of Agriculture, it was found that the oil content of cotton seed is an inherent characteristic of the variety, and that the percentage of oil in any variety can be increased by selection with no corresponding loss of other desirable qualities. Although there may be slight variations from year to year, depending upon the season, these environmental factors influence all varieties alike, and the seed of the varieties that were high in percentage of oil the first year have remained so during subsequent seasons. The seed of the same variety when grown on the sandy soil of the coastal plains produce uniformly less oil than when grown during the same season on the red clay soil of the Piedmont Plateau. This difference varies from 0.51 gallon to 2.3 gallons per ton of seed, depending upon the variety. In a general way the varieties with the highest proportion of meats to hulls produce the most oil; but there is no positive correlation between percentage of meats and the oil content, since the percentage of oil in the meats varies with the variety.

TABLE SHOWING AVERAGE RESULTS OBTAINED WITH AIR-DRY SEED OF TWENTY-ONE VARIETIES OF COTTON GROWN FOR THREE SUCCESSIVE YEARS ON THE COLLEGE DEMONSTRATION FIELD, AT ATHENS, GEORGIA

Name of Variety	Per Cent. Moisture	Per Cent. Hulls	Per Cent. Oil in Seed	Total Gallons per Ton	Available Gallons per Ton	Per Cent.[1] Nitrogen in Seed	Equivalent to Standard 6.18 Per Cent. Meal
Rexall	7.62	38.34	23.30	62.14	50.50	3.47	1,067
Hite's	7.99	40.44	22.55	60.14	48.90	3.38	1,030
Perfection	7.15	38.91	22.38	59.68	48.10	3.50	1,037
Cook's	7.01	41.17	21.94	58.50	47.40	3.34	1,013
Willet's Ideal	7.46	41.43	21.78	58.08	47.00	3.33	1,016
Poulnot	7.63	41.16	21.38	57.01	45.70	3.39	1,052
Brown's No. 3	7.66	42.18	21.24	56.64	45.60	3.31	1,018
Livesey's	7.70	40.75	21.07	56.19	44.90	3.45	1,052
Texas Bur	6.80	41.33	20.93	55.82	44.70	3.42	1,038
Brown's No. 1	7.93	41.85	20.89	55.70	44.40	3.37	1,057
College No. 1	8.78	43.25	20.63	55.01	44.30	3.27	994
Hooper's	6.81	41.75	20.76	55.36	44.20	3.39	1,046
William's	7.51	41.44	20.75	55.34	44.10	3.42	1,061
Culpepper's	8.50	42.90	20.40	54.40	43.60	3.32	1,016
Cleveland	8.20	42.90	20.37	54.32	43.30	3.32	1,032
Brown's No. 2	7.79	43.32	20.24	53.98	43.10	3.30	1,019
Christopher	7.25	42.52	20.18	53.82	42.80	3.37	1,034
Bramblett's	6.60	42.56	20.11	53.62	42.50	3.38	1,047
Meadow's	7.51	42.40	20.05	53.46	42.50	3.40	1,032
Caldwell's	7.04	43.01	19.93	53.14	42.30	3.35	1,018
Lankford's	7.94	46.38	18.88	50.34	40.10	3.14	969
Average	7.56	41.94	20.94	55.84	44.76	3.36	1,030

[1] Nitrogen determinations made by department of agricultural chemistry.

The seed from cotton plants grown upon soil to which fertilizer high in nitrogen has been applied are uniformly higher in nitrogen than seed from plants of the same variety grown during the same season on soil not so liberally supplied with this element—the average difference being less than one half of one per cent. The amount of nitrogen found in the seed from different varieties is fairly constant. In the seed of one variety only, did this variation exceed twenty-three hundredths of one per cent.

The difference in the value of the cottonseed meal and the hulls, produced by a ton of seed from the variety yielding the most oil and the one yielding the least amount of oil was only forty-four cents, and the increased amount of lint on the seed of the inferior variety more than offset this difference. Therefore, there is practically no difference in the value of cotton seed aside from oil content, and the greatest variation between different varieties of seed in this respect was found in the season of 1914, when the percentages were 23.69 and 17.38, respectively. The average variation for three years was four and forty-two one hundredths per cent., or eleven and eight tenths gallons of oil per ton of seed. Taking the average price of seed for the same three years and the average yield of oil in gallons per ton of seed, it will be found that the price paid for the oil they contained was 82½ cents per gallon. On this basis there is a difference in value of seed from the varieties of high and low oil content shown in the above table of $9.73 per ton.

By eliminating the inferior varieties, the quality of the seed could easily be improved, thereby increasing their average value $5.00 per ton, and the present annual crush of more than five million tons would represent a saving of twenty-five million dollars per annum. This elimination could easily be effected if the seed were purchased on the basis of their oil content, and these data show conclusively that this is the only accurate basis of commercial standardization.

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