case exceeding 0.5 mg., and the S as H_2S, except in the case of veal, was indeterminably small. With or without the use of $CuSO_4$ during these days there would have been no danger of declaring sulphites present when none had been added. After the 4th day somewhat larger amounts of S as SO_2 were obtained, but in no case did the amount exceed 1.9 mg. (from veal, series II).

The maximum amount of S as SO_2 obtained from beef was 1.0 mg. (series I, 19th day) and from pork 0.8 mg. (series I, 9th day). These results are especially valuable since Hamburg steak and sausages are the meat products commonly preserved with sulphites.

The amounts of S as H_2S, were larger than of S as SO_2, especially in the case of veal, the maximum being 3.4 mg. (series II, 9th day). The largest amount of total volatile sulphur was also obtained from veal, (series II, 9th day) and amounted to 4.6 mg.

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THE DETECTION OF BLEACHED FLOURS.

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All the processes of technical value that are used for the bleaching of wheat flour employ nitrogen peroxide as the active agent.[1] Chlorine, bromine and sulphur dioxide have been suggested, but while they bleach more or less effectively, they offer no advantages over nitrogen peroxide and possess disadvantages that the latter does not.

The results given in this article were obtained in the course of an investigation, the detailed discussion of which is published elsewhere.[2]

Early in December, 1906, paper-lined sacks were sent to twenty-four different Nebraska mills with the request that, as far as convenient, both bleached and unbleached samples of three grades of flour, *viz.*, patent, straight and bakers', be forwarded. The samples, all freshly milled, were sent by express to Lincoln. The paper linings of the sample sacks prevented sifting of the flours; accordingly the bleached flour did not enter the sacks of unbleached, while in transit. The 127 five-pound samples were placed side by side, in the order of their numbers, on the shelves of a storeroom.

Some of the mills bleach the lower grades of flour while others do not, considering that it injures the appearance of the flour. Some of the latter class, however, were so obliging as to bleach samples of their low-grade flours for the purpose of the investigation.

Besides the flours secured directly from the mills, fifteen samples, some bleached, others unbleached, that had been stored in paper boxes,

[1] Fleurent, Compt. rend., **142**, 180 (1906); Avery, This Journal, **29**, 571 (1907).

[2] Bull. 102, Nebraska Agr. Exp. Sta. (1907).

side by side, for from two to fifteen months, were obtained from Mr. H. B. Smith, of Lincoln. A considerable number of flours obtained on the market and elsewhere, were examined, but, as the quantity of nitrites in these did not differ from those in the samples furnished by the millers, no further work was done with them.

Two unbleached flours, one a patent, and the other a straight grade, made by different mills, and of which large quantities were available, were used in bleaching experiments performed on a small scale in this laboratory. To each of these two unbleached flours there was a corresponding sample that had been bleached at the mill. In some three hundred experiments measured volumes of the bleaching agent were allowed to act upon weighed quantities of flour.

Tests for Flours Bleached by Nitrogen Peroxide.

Three changes are produced in flour by bleaching with nitrogen peroxide, *viz.*:

1. The addition of a small amount of nitrates.
2. The addition of a small amount of nitrites.
3. The change of the coloring matter of the fat or the change in the fat itself.

The tests proposed for bleached flours have been based upon one or other of the above changes. The test proposed by Fleurent[1] is based upon the change in the fat. The writers were unable to distinguish, by this test, the bleached from the unbleached flours.

Shaw[2] has proposed the use of diphenylamine sulphate, which gives an indigo-blue color with nitrates and nitrites. The method of separating the nitrates and nitrites from the flour is very tedious, and in the hands of the writers this test has failed to prove reliable.

Others[3] have used the well known Griess-Ilosvay test for nitrites and nitrous acid. The extreme delicacy of this test was pointed out by Warrington[4] in 1881. No other chemical compounds give the test and it is extremely sensitive, allowing of so small a quantity as one part of nitrite in five hundred million parts of water to be detected. It may also be employed for the quantitative determination of the nitrites in the flour.[5]

Nitrous acid and nitrites, with the Griess-Ilosvay reagent, produce a more or less intense pink coloration according to the amount present. The pink color develops within fifteen minutes at ordinary temperatures, and in less time when heat is applied to the mixture of the reagent with

[1] Compt. rend., **142**, 180 (1906).
[2] This Journal, **28**, 687 (1906).
[3] J. T. Willard, Bull., Kansas State Board of Health, **2**, 158 (1906); E. F. Ladd, Bull., **72**, N. D. Agr. Exp. Sta. (1906).
[4] J. Chem. Soc., 1881, 231.
[5] Sutton, Volumetric Analysis, p. 449.

the solution being tested. There has been much difference of opinion as to how definitely this test distinguishes a bleached from an unbleached flour. Ladd, for instance, states that unbleached flours which have been stored beside bleached flours give the characteristic test for nitrites. Up to the present time, however, the writer has found no unbleached flour that has given even the faintest pink coloration when the test was conducted with the necessary precautions. The precautions necessary in the case of this test are extraordinary. All tests made indoors at this laboratory have proven unreliable, because the flour or the water absorbed, during the operation, sufficient nitrite, nitrous acid or nitrogen peroxide from the atmosphere to give a pink coloration with all unbleached flours. It has accordingly been found necessary to make all of the tests out of doors. Most filter papers contain small amounts of nitrites. Many natural waters as well as distilled water frequently contain considerable quantities of nitrites, those found in the latter probably being derived from the gas flames. The large amount of nitrites found in a mixture of nitrite-free water and an unbleached flour after exposure to the air of the laboratory for several hours is noteworthy.

The following method was found reliable and satisfactory both for the detection of nitrites in flour and for their quantitative determination. A laboratory table was fitted up out of doors. The water to be used in the experiments was tested in order to insure the absence of nitrites. All apparatus to be used was well washed with this nitrite-free water. The filter papers placed in funnels, were washed until the washings gave no test for nitrites. Twenty grams of the flour to be tested and 200 cc. of water were placed in a stoppered flask and shaken at frequent intervals for half an hour. The mixture was allowed to stand until the flour had largely settled to the bottom of the flask. A portion of the liquid in the flask was carefully transferred to a washed filter, and 10 cc. of the filtrate thus obtained, diluted to 50 cc. with water, treated with 2 cc. of the Griess-Ilosvay reagent, and heated in a water-bath to 80° for fifteen minutes. If no pink coloration developed, the absence of nitrites was established; if the mixture acquired a more or less pink color it was transferred to a Nessler tube and compared with a standard color solution prepared by warming a known amount of sodium nitrite with an excess of the Griess-Ilosvay reagent. Tested in this manner none of the 21 samples of flour from the eleven mills without bleachers, gave a reaction for nitrites; 46 samples of unbleached flour from 24 mills having bleachers gave none, while 12 samples sent from six of these mills as unbleached flour, gave a more or less pink color. Of the samples sent as those of bleached flours 56 gave the coloration, while two gave none. The failure of these two to give the reaction was doubtless due to the millers having sent them by mistake, as their color gave no evidence of any bleaching.

The explanation of the coloration produced by the 12 of the samples sent us unbleached, is likewise simple; two were bleached flours, as shown both by the color and the amount of nitrites; into the others small amounts of bleached flour had been accidentally introduced. In the case of some mills the bleachers are so located that it is very difficult to take a sample of the flour before it comes into contact with the bleaching gas.

The particles of bleached flour floating in the air also add to the difficulty of getting a sample of unbleached flour. In the case of several hundred experiments in this laboratory, in which nitrite-free flours were treated with nitrogen peroxide, every sample of treated flour gave the test for nitrites.

As already pointed out it has been claimed that "unbleached flours lying along side of bleached flours, or unbleached flours from a mill where bleaching is practiced will become contaminated, as it is a well known fact that flours have the power of readily absorbing any gas or foreign odor in which they are placed."[1] If this statement were true it would not be possible to distinguish, by the Griess-Ilosvay test, between unbleached and bleached flours, in case the former had been stored near some of the latter. In the above quotation it is assumed that some of the nitrogen peroxide remains as such or as nitrous acid in the bleached flours. That the conclusions stated in the above quotation are untenable is evident from the following. Of the 58 samples of unbleached flour, from 24 mills where bleaching was practiced, only 12 gave any reaction with the Griess-Ilosvay test, the other 46 being as free of nitrites and nitrous acid as the samples of unbleached flour from mills having no bleachers. All of the samples of flour that had arrived at this experiment station previous to December 26, 1906, were tested on December 26th, to December 31st for nitrites. All were again tested on March 1st to 5th. The results of the second series of tests were the same as those of the first. During the interval of eight weeks the samples had been stored in paper-lined sacks, side by side, in the order of their numbers.

To decide whether any trace of nitrogen peroxide or of nitrous acid is given off by a strongly bleached flour the following three experiments were performed.

Experiment 1—Two beakers, the one nearly filled with bleached flour, and the other equally full of unbleached flour, were placed on a ground glass plate, covered with a bell jar and allowed to stand three days. At the end of this time the unbleached flour gave no coloration with the Griess-Ilosvay test.

Experiment 2—A layer of bleached flour, a quarter of an inch in thickness, was placed on the bottom of a Raikow gas wash-bottle and subjected

[1] Bull., 72, N. D. Agr. Exp. Sta., p. 228 (1906).

to the action of a rapid current of air for ten days. At the end of this time quantitative determinations of the nitrites in the untreated flour and in the treated flour showed no difference in the amount of nitrites.

Experiment 3—A series of six gas wash-bottles was arranged so that a current of air supplied by a water blast passed through caustic potash solution in bottles 1 and 2, over a layer of bleached flour in bottle 3, through densely packed absorbent cotton in bottles 4 and 5 over a layer of unbleached flour in bottle 6. The flour in bottle 6 was tested every twelve hours for nitrites. At the end of forty-eight hours, no coloration being produced with the Griess-Ilosvay reagent, the experiment was discontinued. The absorbent cotton in bottles 5 and 6 was used to prevent particles of the bleached flour being carried from bottle 3. When the experiment was repeated, omitting bottles 1 and 2 from the series, the flour in the last bottle gave a distinct reaction at the end of two hours. This is to be attributed to the air of the laboratory containing nitrites, nitrous acid, or a gas which acted upon nitrates in the flour to produce nitrites; when the air was washed with caustic potash these were removed.

It is to be concluded from the above that neither nitrous acid nor nitrogen peroxide is contained in the bleached flours, the coloration with the Griess-Ilosvay reagent being due entirely to the nitrites present, and further, that an unbleached flour stored beside a bleached flour acquires none of the properties of the latter unless particles of the bleached flour are actually introduced into the unbleached flour.

The Amount of Nitrites in Flours Obtained from Nebraska Mills.

The average amount of nitrite, expressed as the sodium salt, in all the bleached samples was 6.3 parts per million of flour. There was little difference between the averages for the electrical and the chemical bleachers, they being 6.1 and 6.6, respectively. There was no general relation between the grade of flour and the amount of nitrite present. The average amounts in the three grades were: patent, 5.8; straight, 5.1; and bakers, 8.4. The largest amount found in any sample was 27.5 parts and the lowest 0.5 parts per million. It is important in this connection to note that most mills do not bleach their lowest grade for the market.

In all cases in which there was conclusive evidence that the flour had neither been treated with nitrogen peroxide nor allowed to become mixed with bleached flour no trace of nitrites was found.

Experiments With Measured Volumes of Nitrogen Peroxide.

Very little has hitherto been reported as to the effects of varying amounts of nitrogen peroxide upon a definite amount of flour. Fleurent states that the amount of nitrogenous matter added in the bleaching process varies from 20 to 50 parts per million of flour, or 18 to 38 parts per million of bread, and that the volume of nitrogen peroxide required to bleach one kilogram of flour varies from 15 to 40 cc.

Nitrogen peroxide, itself, cannot conveniently be measured on account of the readiness with which it is absorbed by water and other liquids, and because its relative density changes with the temperature. Nitric oxide, however, may easily be obtained pure, and may conveniently be measured over water; when it is brought into contact with the atmosphere it is entirely changed into nitrogen peroxide, provided that the volume of the air is not less than 2½ times that of the nitric oxide.

The method of bleaching flours practiced by the writers was as follows: A weighed quantity of flour, from 200 to 1000 g., was placed in a 3-liter glass flask. By means of a glass tube, drawn to a long fine point and reaching to the middle of the flask, the desired volume of nitric oxide was delivered from a gas burette. The glass tube was at once withdrawn, the flask stoppered and vigorously shaken. Before delivering the first measured portion of gas a large quantity of nitric oxide was passed through the delivery tube to expel all air. When a considerable number of samples of flour were treated in rapid succession the capillary end of the delivery tube prevented any appreciable diffusion of gas. Where the volume of nitric oxide was less than 50 cc. per kilogram of flour, the brown fumes disappeared quickly on shaking the flask. With larger proportions of gas the shaking had to be continued longer, with 100 cc. from one to two minutes and with 1000 cc. more than five minutes.

On October 16th, 1906, fifteen portions of an unbleached flour were treated with different amounts of nitric oxide, varying from 5 cc. to 1000 cc. per kilogram.

TABLE I.

THE EFFECT OF DIFFERENT QUANTITIES OF NITROGEN PEROXIDE UPON THE SAME FLOUR.

No. of Experiment	Volume of nitric oxide per kg. of flour.	Weight of nitrites per million parts of flour	Color of flour	Color of fat solution in ether	Color of solid fat
0	0cc.	0	Yellow	Yellow	Yellow
1	5cc.	——	Light yellow	Light yellow	Light yellow
2	10cc.	6.25	(1)	(1)	(1)
3	20cc.	7.50			
4	30cc.	12.50			
5	50cc.	25.00			
6	75cc.	40.00			
7	100cc.	50.00	White	Colorless	Almost colorless
8	125cc.	37.5	Whtie	Colorless	Almost colorless
9	150cc.	30.0	(1)	(1)	(1)
10	175cc.	30.			
11	200cc.	24.			
12	300cc.	15.			
13	400cc.	16.			
14	500cc.	12.5			
15	1000cc.	6.6	Light yellow	Light yellow	Brownish yellow

1. The change in color from number to number between 2 and 7 and again between 8 and 15, was too small to be satisfactorily described.

The colors of the fifteen bleached samples were compared by Pekar's method. There was a distinct difference between the unbleached flour and that to which nitric peroxide had been applied at the rate of 5 cc. per kilogram. The difference between adjacent members of the series of bleached samples was very slight, but when samples, separated by two numbers, such as No. 3 and No. 6, were compared, a difference was apparent. There was an increase in the whiteness from No. 0 to No. 8 (125 cc. per kilogram), and a decrease from No. 8 to No. 15 (1000 cc. per kilogram). Twenty-five grams of each flour were extracted with ether. The ethereal solutions of the fats thus obtained were diluted in each case to 50 cc., and their colors compared. No. 0 was bright yellow, No. 8 colorless, and No. 15 very slightly yellow. The colors of the fat solutions bore the same relations to one another that the colors of the flours did. The solid fats were obtained by the evaporation of the ethereal solutions, and their color and odor compared. Qualitative tests made soon after the bleaching in October showed very large amounts of nitrites in Nos. 7 to 15, but the quantities had become surprisingly small before the quantitative determination was made at the end of December. Other series of experiments gave results similar to the first, the maximum bleaching effect being produced by from 100 to 150 cc. of nitric oxide per kilogram of flour; larger amounts imparted a yellow color to the flour. When the maximum bleaching effect was attained the fat was practically colorless and gave a colorless ethereal solution. The odor of the flour remained agreeable when the amount of nitrogen peroxide did not exceed this amount. The greater the amount of nitrogen peroxide that was used in excess of the quantity required for this maximum effect, the darker was the color of the flour and also of its extracted fat, the more yellow was the ethereal solution of the latter, the more disagreeable was the odor of the flour, and the more objectionable its use for bread making purposes. It is highly probable that many of the adverse opinions that have been expressed regarding bleached flour are due to the investigation of samples to which excessive quantities of nitrogen peroxide had been added, and which might be designated "overtreated" flours.

In order to decide whether it is possible from the amount of nitrites in bleached flour to estimate the amount of the bleaching agent that has been used, a large number of flours were bleached, and allowed to stand three or four weeks before the final determination of nitrites was made. The results, given in Table 2, indicate that it is possible to make an approximate estimate of the amount of nitrogen peroxide that has been used.

The amount of nitrite found in a bleached flour is approximately proportional to the amount of gas used, up to 50 cc. per kilogram; the

TABLE 2.

THE QUANTITY OF NITRITES PRODUCED BY THE ACTION OF DIFFERENT QUANTITIES OF NITROGEN PEROXIDE UPON THE SAME WEIGHT OF FLOUR.

Experiment number	Volume of nitric oxide used for each kg. of flour	Weight of nitrites per million of flour	Series number of flour	Reported grade of flour
1	2 cc.	3.7	112	Straight
2	2 "	3.3	113	Bakers'
3	2 "	3.1	113	Bakers'
4	2 "	3.0	131	Straight
5	2 "	3.0	131	Straight
6	2 "	4.2	139	Patent
7	2 "	4.3	139	Patent
8	2 "	3.8	132	Bakers'
9	5 "	7.8	120	Patent
10	5 "	7.8	120	Patent
11	5 "	6.2	23	Bakers'
12	5 "	6.0	23	Bakers'
13	5 "	5.6	130	Patent
14	5 "	5.6	130	Patent
15	5 "	6.4	132	Bakers'
16	5 "	6.4	132	Bakers'
17	5 "	6.4	140	Straight
18	5 "	5.6	140	Straight
19	5 "	6.5	141	Bakers'
20	5 "	5.1	141	Bakers'
21	25 "	20.3	20	Bakers'
22	25 "	20.0	89	Bakers'
23	25 "	18.1	147	Patent
24	25 "	23.0	147	Patent
25	25 "	21.5	147	Patent
26	25 "	19.0	147	Patent
27	25 "	21.0	147	Patent
28	50 "	30.0	147	Patent
29	50 "	30.0	147	Patent
30	50 "	31.1	147	Patent
31	50 "	27.0	147	Patent
32	50 "	33.0	147	Patent
33	50 "	30.0	147	Patent
34	50 "	31.0	147	Patent
35	50 "	32.0	147	Patent
36	50 "	31.0	147	Patent
37	50 "	29.0	89	Bakers'
38	50 "	28.5	20	Bakers'
39	80 "	30.0	A mixture of 147 with 5%	shorts
40	90 "	43.0	A mixture of 147 with 10%	shorts
41	90 "	38	A mixture of 147 with 20%	shorts
42	100 "	26		Shorts
43	100 "	50	145	Straight
44	100 "	42	20	Bakers'
45	100 "	40	89	Bakers'
46	100 "	60	147	Patent
47	100 "	52	147	Patent
48	100 "	51	147	Patent
49	100 "	49	147	Patent
50	100 "	56	147	Patent
51	100 "	40	147	Patent
52	150 "	55	147	Patent
53	200 "	58	147	Patent
54	200 "	60	147	Patent
55	250 "	56	147	Patent
56	300 "	42	147	Patent
57	400 "	31	147	Patent
58	500 "	26	147	Patent
59	1000 "	10.0	147	Patent

more gas that is used the smaller is the proportion of it left as nitrite in the flour, 2 cc. per kilogram giving from 3 to 4 parts per million of nitrites, and 50 cc. per kilogram giving only 30 parts per million. When not more than 50 cc. per kilogram of flour had been used the proportion of nitrites was not found to become less on allowing the flour to stand, while with the larger volumes of gas the amount of nitrites fell rapidly; the more nitric oxide that was used up to 1000 cc. per kilogram the smaller was the quantity of nitrites eventually found in the flour.

TABLE 3.

THE CHANGE IN THE AMOUNT OF NITRITES IN BLEACHED AND IN OVERTREATED FLOURS.

Experiment number	Series number of flour	Volume of nitric oxide per kg.	Date of bleaching	Nitrites per million of flour March 1	March 4	March 27
22	89	25	Mar. 1	21	....	20
23	147	25	Feb. 28	20	....	18.1
24	147	25	Feb. 28	19	....	23
28	147	50	Feb. 28	30	....	30
29	147	50	Feb. 28	30	....	30
32	147	50	Feb. 28	30	....	33
35	147	50	Feb. 28	30	....	32
52	147	150	Feb. 28	170	80	55
53	147	200	Feb. 28	92	....	58
55	147	250	Feb. 28	150	92	56
56	147	300	Feb. 28	115	106	42
57	147	400	Feb. 28	155	112	31
58	147	500	Feb. 28	245	110	26
59	147	1000	Peb. 28	334	85	10

As is evident from this table the mere determination of the amount of nitrites does not serve to distinguish a flour to which an objectionably large quantity of bleaching agent has been applied, (an over-treated flour), from one to which only a comparatively small amount has been applied. This is not a serious matter, however, because a miller is not apt to overtreat a flour when, by so doing, he not only injures the quality of the flour but also, by spoiling its color and odor, lowers its market value. All overtreated flours, (produced in this laboratory). that the writers have examined have given a bluish coloration when added to diphenylamine in sulphuric acid solution. A small quantity of the overbleached was first moistened with water, and then stirred into this test solution.

The volume occupied by a definite amount of gas depends upon the temperature and pressure. As the differences in the weight of a given volume of the nitric oxide, due to the varying pressure of the atmosphere and the slight fluctuations in the temperature of the laboratory, are much smaller than those due to the method of determination, neither the temperature nor the pressure is given in the tables 1, 2 and 3.

In order to determine how concordant the results were for the same flour, the quantity of nitrites in a mill-bleached flour was determined on each of several different days by three different persons. The results ranged from 11 to 15 parts of nitrites per million parts of flour.

The Action of Chlorine and Bromine Upon Flour.

An unbleached flour was treated with different amounts of chlorine and bromine. The maximum effect was produced by the use of approximately 0.7 g. and 1.6 g. respectively, of the bleaching agents for each kilogram of flour. When the quantity of the bleaching agent exceeded 0.8 g. in the case of bromine, or 0.35 g. in that of chlorine, for each kilogram of flour, there was an increase in the acidity of the latter. The greater the excess of the bleaching agent the more acid was the flour.

By means of the following test it is possible to detect a flour that has been bleached by chlorine or bromine even when the quantity of bleaching agent does not exceed 0.035 g. of chlorine or 0.08 g. of bromine per kilogram of flour. Thirty grams of the flour are extracted with benzene, and the latter evaporated. A small amount of oil remains. A piece of copper wire is heated in a colorless gas flame until it is black and no longer colors the flame green. The hot end of the wire is dipped into the oil and again brought into the flame. If chlorine or bromine has been used as a bleaching agent, a green or blue coloration will be produced.

It is evident from the above test that chlorine and bromine are largely absorbed by the oil of the flour. When the quantity of bleaching agent used exceeded 0.175 g. of chlorine or 0.40 g. of bromine per kilogram of flour it was possible to estimate the amount that had been used. A watery extract of the flour was prepared and titrated with decinormal silver nitrate solution. It was found that in each case practically half of the chlorine or bromine added to the flour had been left as chlorides or bromides.

Conclusions.

1. A bleached flour may with certainty be distinguished from an unbleached flour, and the kind of bleaching agent employed may be identified as nitrogen peroxide or halogen. The amount of bleaching agent that has been applied to a flour may be estimated from the amount of certain reaction products remaining in the flour.

2. With the Griess-Ilosvay reagent all flours bleached by means of nitrogen peroxide give a pink coloration, while unbleached flours give no coloration. Only when extreme precautions are observed is the test reliable.

3. Bleached flours lying along side of unbleacded flours do not give off any substance which will so effect the latter that they will give the test for bleached flours. Neither nitrogen peroxide nor nitrous acid is present in bleached flours, the characteristic reaction being produced by nitrites.

4. The amount of nitrites in bleached flours is very small, the average being 6.3 parts per million for all the samples examined. There is little difference in the amount of nitrites produced by the two kinds of bleachers.

5. The amount of nitrite in a bleached flour is approximately proportional to the amount of nitrogen peroxide that has been used. The average amount of the bleaching agent used by twenty-five Nebraska mills would accordingly be approximately 5 cc. per kilogram of flour.

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THE COMPOSITION OF SOME EDIBLE SEEDS FROM CHINA.

BY RALPH W. LANGLEY.

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The chemical study of the products described in this paper was undertaken at the suggestion of Prof. Lafayette B. Mendel, to whom the seeds had been forwarded by the Hon. Wu Ting Fang, ex-Minister to the United States from China, with a request for information regarding their nutritive value.

Three types of seeds were examined

Chinese Lotus	*Nympaea tetragona*
Chinese Sweet Almond	*Prunus Amygdalus*
Gingko Nut	*Gingko biloba*

The literature on food stuffs contains few references to these plants or their seeds.

The sweet almond is reported to contain 2.9 per cent. of cane sugar and *Lotus Suaveolens* an alkaloid cytosine, $C_{11}H_{14}N_2O$.

Lotus Arabicus is stated to contain a glucoside, lotusin, associated with an enzyme, lotase.[2] Under the influence of the latter, or when boiled with a dilute mineral acid, lotusin yields glucose, prussic acid, and lotoflavin, $C_{15}H_{10}O_6$. *Gingko Biloba* also called the maidenhair tree, is fully described in the annals of Botany, XIV. It is cultivated as a sacred tree in gardens in China and Japan, and is grown to some extent in Europe and America. It sometimes attains a height of 30 meters and a circumference of 8 meters. Formic acid has been found in the growing tree,[3] and the nuts contain caprylic acid and as much as 4 per cent. cane sugar.[4]

Methods of Analysis.

Only the edible portion of the nuts were used. In the case of the gingko nuts the kernels comprise 59 per cent. and the shells 41 per cent. of the entire nut. The gingko nuts and lotus seeds were ground to a

[1] Czapek. Biochemie der Pflanzen, I, 306.
[2] Loc. cit.
[3] Ibid 2, 442.
[4] Ibid 1, 306.