[CONTRIBUTION FROM THE ANALYTICAL LABORATORY OF THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.]

ON THE COMPOSITION OF AMERICAN NOODLES AND METHODS FOR THE ANALYSIS OF NOODLES.

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EGG-NOODLES are prepared by German housewives and reputable manufacturers from flour with the addition of eggs or egg yolks and salt. They are more or less yellow in color, according to the proportion of eggs used, whereas water-noodles, macaroni, spaghetti, vermicelli and other dough products prepared without eggs or foreign color are white or cream-colored.

Of late years unprincipled manufacturers have placed on the market so-called "egg-noodles" colored golden yellow with turmeric or coal-tar dyes but containing no eggs whatever or only very small amounts. As these dyes make the products appear better or of greater value than they really are, their presence without a declaration, according to the food laws of most states, constitutes an adulteration.

In 1901 tests for dyes and proximate analyses were made at this station on thirty-seven samples of macaroni, eight of spaghetti, ten of vermicelli and twenty-eight of noodles.

None of the samples of macaroni or spaghetti was artificially colored but two of the samples of vermicelli and twelve of noodles contained coal-tar dyes and ten of the samples of noodles contained turmeric. The coal-tar dye, except in one sample which contained a nitro-color, was an azo-dye related to the orange dyes commonly used as butter colors.

Judging from the percentages of fat and the reactions of the coloring-matter, only four samples of noodles contained an appreciable amount of eggs.

Since these analyses were made, Juckenack has described a method for determining the lecithin-phosphoric acid in noodles which has come into quite general use in German food laboratories. From the results obtained by this method may be calculated approximately the number of eggs or egg yolks per pound of flour used in making the noodles.

With the view of studying this method and developing methods for the detection of dyes as well as gaining some knowledge as to the composition of American noodles, analyses and examina-

tions for dyes have been made of twenty-two samples of commercial noodles found on sale in Connecticut, the results of which are given in the accompanying table.

ANALYSES OF AMERICAN NOODLES.

		In the water-free material.					
No.	Water.	Ash.	Protein (N × 6¼).	Nitrogen-free extract and fiber.	Fat.	Lecithin-phosphoric acid.	Color.
10718	Evidence of eggs	12.84	1.00	18.07	78.60	2.33	0.053	Turmeric
10470	" " " [1]	12.36	1.02	17.82	78.87	2.29	0.058	"
10672	" " "	12.91	0.65	17.57	79.95	1.83	0.046	Tropeolin
10829	" " " [2]	12.72	0.69	15.18	82.26	1.87	0.040	"
10674	" " "	13.59	0.73	16.21	81.12	1.94	0.036	"
10568	No evidence of eggs	13.66	1.19	14.53	83.63	0.65	0.015	Turmeric
10767	" " " "	12.79	0.79	17.12	79.59	2.50	0.029	Tropeolin
10569	" " " "	13.16	0.59	14.82	84.23	0.36	0.028	"
10368	" " " "	12.66	0.76	17.39	80.68	1.17	0.032	"
10781	" " " "	11.78	1.14	16.01	82.35	0.50	0.019	Turmeric
10798	" " " "	12.57	1.20	14.08	84.17	0.55	0.026	"
10759	" " " "	13.03	1.15	14.73	83.80	0.32	0.027	Tropeolin
10760	" " " "	13.16	1.28	14.39	83.72	0.61	0.025	Turmeric
10797	" " " "	12.49	0.61	14.92	83.84	0.63	0.024	Tropeolin
10717	" " " "	11.98	1.29	15.69	82.51	0.51	0.024	Turmeric
1981	" " " "	11.42	1.23	14.33	83.83	0.61	0.023	"
1980	" " " "	12.10	1.14	15.65	82.93	0.28	0.019	"
10784	" " " "	11.96	1.09	15.84	82.55	0.52	0.022	"
10785	" " " "	12.76	1.18	16.34	81.93	0.55	0.019	"
10675	" " " "	13.62	0.61	15.48	83.22	0.69	0.022	Tropeolin
10473	" " " "	12.27	1.21	14.32	83.79	0.68	0.023	Turmeric
10374	" " " "	13.02	0.49	13.92	85.20	0.39	0.018	Tropeolin

[1] Same brand as No. 10718.

[2] Same brand as No. 10672.

Juckenack's Method for Determination of Lecithin-Phosphoric Acid.—Wichelhaus[1] describes a method for the detection of yolk of egg in foods based on the extraction of lecithin with ether and the determination of phosphoric acid in the extract after its saponification. Juckenack finds hot alcohol a more efficient solvent for lecithin, his process in other respects being similar to that of Wichelhaus.

The details of Juckenack's method[2] are as follows:

Extract 30 grams of the finely ground material for ten hours with absolute alcohol in a Soxhlet extractor at a temperature,

[1] *Pharm. Ztg.*, 1890; Abs. Analyst, 1890, **15**, 116.

[2] *Ztschr. f. Unters. d. Nahr.- u. Genuss.*, 1900, **3**, 13.

inside the extractor, not below 55°-60° C. The extraction flask should be provided with a small quantity of pumice stone to prevent bumping during the boiling and the extractor enclosed by asbestos paper, if the desired temperature is not readily maintained. After the extraction is completed, add 5 cc. of alcoholic solution of potash (prepared by dissolving 40 grams of phosphorus-free caustic potash in 1000 cc. alcohol) and distil off all the alcohol. Transfer the residue to a platinum dish by means of hot water, evaporate to dryness on a water-bath, and char over asbestos. Treat the charred mass with dilute nitric acid, filter and wash with water. Return the residue with the paper to the platinum dish and burn to a white ash. Treat again with nitric acid, filter and wash, uniting finally the filtrates. Determine phosphoric acid by the usual method.

Juckenack calculated the percentages of ash, total phosphoric acid, lecithin-phosphoric acid and protein ($N \times 6\frac{1}{4}$) in noodles containing per pound of flour one to twelve eggs and one to twelve egg-yolks, assuming an average weight of the eggs and an average composition of both the eggs and the flour. Beythien and Wrampelmeyer,[1] also Sendtner,[2] later called attention to the importance of determining fat, as this constituent is present in but small amount in flour and the addition of only a single egg increases the percentage more than twofold. Juckenack and Pasternack[3] in a recent paper have substituted for the protein column in Juckenack's original table, which because of the variation of this constituent in the flour, is of little value, a column giving the percentages of fat (ether extract).

The following table is compiled from figures given in the tables named.[4]

Number of eggs per pound of flour.	Composition of the dry matter.				
	Ash. Per cent.	Total phosphoric acid. Per cent.	Lecithin-phosphoric acid. Per cent.	Ether extract. Per cent.	$N \times 6\frac{1}{4}$. Per cent.
0	0.460	0.2300	0.0225	0.66	12.00
1	0.565	0.2716	0.0513	1.56	12.99
2	0.664	0.3110	0.0786	2.42	13.92
3	0.758	0.3482	0.1044	3.24	14.81
*	* *	* *	* *	* *	* *
12	1.426	0.6123	0.2875	7.94	21.09

[1] *Ztschr. f. Unters. d. Nahr.- u. Genuss.*, 1901, **4**, 145.

[2] *Ibid.*, 1902, **5**, 1018.

[3] *Ibid.*, 1904, **8**, 94.

[4] The German pound used in this calculation is approximately 468 grams. The avoirdupois pound is 454 grams.

Number of egg yolks per pound of flour.	Composition of the dry matter. Ash. Per cent.	Total phosphoric acid. Per cent.	Lecithin-phosphoric acid. Per cent.	Ether extract. Per cent.	N × 6¼. Per cent.
0	0.460	0.2300	0.0225	0.66	12.03
1	0.488	0.2720	0.0518	1.57	12.37
2	0.516	0.3127	0.0801	2.47	12.73
3	0.542	0.3520	0.1075	3.33	13.07
*	* *	* *	* *	* *	* *
12	0.745	0.6533	0.3171	8.64	15.71

According to these data our analyses show that only five samples (Nos. 10718, 10470, 10672, 10829, and 10674) contained appreciable amounts of eggs. Since Nos. 10718 and 10470 were sold under the same label as were also Nos. 10672 and 10829 the five samples represent but three brands. Accepting Juckenack's standards, none of the noodles with the possible exception of the first two samples, contained appreciably more than one egg or the yolk of one egg per pound of flour.

According to Jaeckle's experiments[1] the lecithin-phosphoric acid in noodles decreases considerably on long standing. For example, in water noodles the percentage decreased in eight months from 0.0220 to 0.0119, in noodles made with three eggs per pound of flour, from 0.1226 to 0.0607 and so on. On the other hand, the iodine number of the fat and also the percentages of fat increased with time, the latter, however, but slightly.

Juckenack's and Pasternack's and Sendtner's experiments do not bear out Jaeckle's conclusions, at least as applied to the commercial product, but a final verdict cannot be reaced until numerous experiments now in progress in European laboratories are completed.

Owing to lack of material we are unable to report results bearing on this point except on one sample (No. 10718). In the finely ground sample analyzed early in February, 1904, we found 0.0461 per cent. of lecithin-phosphoric acid while in the same ground sample, kept in the meantime in a glass-stoppered bottle, we obtained, late in October of the same year, 0.0431 per cent. These results indicate that no appreciable loss of lecithin-phosphoric acid was sustained on standing nearly nine months during the warmest seasons.

Since analyses made by Sendtner and more recently by Juckenack and Pasternack indicate that flour used for noodles may contain

[1] *Ztschr. f. Unters. d. Nahr.- u. Genuss.*, 1904, I, 513.

as high as 0.0533 per cent. of lecithin-phosphoric acid, there is little fear of injustice to the manufacturers, if the percentages of lecithin-phosphoric acid and fat are both taken into consideration in judging commercial noodles. It should, however, be remembered that fat may be added to noodles in some form other than in eggs.

Tests for Dyes.—Turmeric and nitro-colors are extracted from the finely ground materials by long-continued shaking with alcohol, and are identified by the usual tests.

The orange coal-tar dyes commonly employed are not dissolved by this treatment but are readily extracted by shaking with a mixture of 10 parts of alcohol and 1 part of hydrochloric acid. The dye designated "tropeolin" in the table is soluble in the acid alcohol, the filtered liquid being a rich orange color which, on evaporation at a gentle heat, changes to a rose-red. After a time this rose-red color also appears on the edges of the filter and in the extracted (but not washed) starchy residue. It disappears on addition of alcohol but reappears on drying. Ammonia changes the color of the extract to a golden yellow.

The color by Arata's test[1] dyes wool a dirty yellow which changes to rose-red on addition of acid. Concentrated hydrochloric acid added to the powdered material imparts a rose-red coloration. These reactions indicate that the dye is an azo-color closely related to methyl orange and is probably the same as Geissler and Crampton[2] find in butter colors.

The following analytical scheme applies to the colors thus far detected at this station in noodles and other similar products:

I. Yellow color extracted by 95 per cent. alcohol.

A. Filter-paper dipped in the concentrated alcoholic solution and dried becomes, on moistening with dilute boric-hydrochloric acid and drying, cherry-red, changing to blue-black with ammonia ..... *Turmeric.*

B. No cherry-red color obtained on the filter-paper when treated as under A, or else the color is not changed to blue-black with ammonia.

(1) Yellow color after evaporation of alcoholic solution soluble in water; solution partially decolorized by hydrochloric acid ..... *Nitro-colors.*

(2) Yellow color after evaporation of alcoholic solution insoluble in water ..... *Egg color.*

[1] This Journal, **22**, 582 (1900).

[2] *Ibid.*, **20**, 110 (1898).

II. No yellow color extracted by 95 per cent. alcohol but an orange color extracted by a mixture of 10 parts of 95 per cent. alcohol and 1 part of concentrated hydrochloric acid. Filter-paper moistened with the acid-alcohol extract on drying at room temperature, becomes rose-red ..... *Azo-color* ("Tropeolin").

All of the twenty-one samples examined, including those containing eggs, were artificially colored. The color in twelve cases was turmeric, in ten was an azo-color of the nature described, which we have designated as "tropeolin."

As the color in the samples containing eggs conveys the impression that greater amounts were used than were actually present, these samples, like the others, must be classed as adulterated.

ON THE UTILIZATION OF FINE ORE, FLUE-DUST, DOWNCOMER-DUST, AND STOVE-DUST, IN THE BLAST-FURNACE.

By James C. Attix.

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At large furnace plants there accumulates vast quantities of these fine ores—flue-dust, downcomer-dust and stove dust—hereafter to be referred to as fine materials. It is quite a problem and considerable expense to get rid of them. Especially is this the case in the Pittsburg, Youngstown and Lake Districts, where the furnace burden is made up of from 40 to 75 per cent. of Mesabi ores. Not only is this the case where Mesabi ores are used to a large extent, but also at other furnace plants where other ores and especially concentrates are used.

It has been no small problem for furnace managers to work these fine materials. Many methods have been tried to get these fine materials in a shape to be utilized in the furnace and at the same time have the mass porous, or at least in such a shape that when they descend with the furnace burden they will not prevent the passage of the blast and gases.

Briquetting has been tried and given considerable notoriety, especially with the New Jersey concentrates, but so far as the writer has been able to learn, not a ton of these have been made