THE ALBUMINOIDS OF MAIZE.

By Dr. George Archbold.

Under this heading it was my first intention to have read an elaborate paper on the subject; but time and circumstances at my command are such that this must be considered only preliminary; inasmuch as it involves a very important feature in the manufacture of starch from maize. According to published analyses of average corn which is used in the 22 principal factories engaged in the manufacture of starch, the total albuminoids consist of ten and one-half per cent. of the maize. This includes what is commonly known as gluten, or nitrogen-yielding products. In the usual methods of making corn starch, it has been found advisable to macerate the corn under water at varying temperatures, with a view of softening the corn, and at the same time putting it in such a condition that it can be ground into a pulpy mass, and that all except the cellulose can be disintegrated from the mass. It will be obvious that a certain amount of the albuminoids will escape a sieve or any mechanical method of separation. It will also be understood that the time required, varying from three days to a week, for the softening of the grain in question requires a temperature sufficient to resolve anything of an albuminoid nature itself into further compounds of a very complex nature. In view of these facts, I have tried to find by direct investigation of the pure corn whether or not these albuminoids have undergone a decomposition that would entitle me to form a true hypothesis of the solution in question. With this purpose, I have taken corn recently ground and reduced it to an impalpable powder, and have placed it in a sealed box and forced water into it, until the extract that came from it showed nothing upon evaporation in a platinum dish except the salts existing in the water and a portion of the soluble

salts that existed in the maize. This being done all at a temperature not exceeding 70° F., I have taken the total aqueous extract, which was neutral to litmus paper, and added alkali to it, which precipitated a flocculent mass, giving 16.7% of nitrogen. When this was collected and dried in the air, it gave many of the properties of diastase. The magma that was in the box above referred to, by which I made the extraction under pressure with water at 70° F., was further ground so that all except the cellulose would go through an 80 mesh sieve, by repeated washings at 70° F.; or until the magma contained nothing but pure cellulose, thereby having all that passed through the sieve in a state of suspension, namely the starch and the albuminoids contained in the corn treated that were soluble in water. I now added by degrees to the total that had gone through the sieve a solution of caustic soda of a gravity of 8° until it gave a coloration of a greenish yellow color. This was done in a beaker, and the result was that a flocculent precipitate of a brownish green color fell to the bottom, and the starch was held in suspension in the upper strata of the liquid. Unless sufficient alkali is added the starch will fall to the bottom. I drew off by the usual methods of siphoning and by a repeated washing with distilled water and obtained the starch practically pure. But this water when mixed together from the several washings of starch, contained an albuminoid, precipitated on neutralizing with hydrochloric acid as a light brown substance which, when dried at 212° F., or until it ceased to lose weight, gave 18% of nitrogen. The starch was practically pure. The substance underneath the strata of suspended starch which I have mentioned above, was of a greenish color, and contained only a small percentage of nitrogen. It appeared to be in part an insoluble soap, and contained most of the oils contained in the corn. Supposing that I had taken corn or maize from the steeps, and separated the starch by the means herein set forth, I would obtain different results and be able to gain nearly the same amount of nitrogen but would also separate substances of albuminoid nature, that I will submit to this Society later on. Now, under these circumstances, when commercial maize in the dried state, such as I submit herewith, is taken, and when the

experiments are carried out as I have stated, it will be found that only two definite albuminoid substances are obtained, one of which is thrown down by alkalies as a greenish precipitate, and the other soluble in alkalies, which precipitate is of a greenish color (except ammonia, which yields a white precipitate) and precipitated by acids. By the most careful methods used in various factories, the whole of the albuminoids that are soluble in alkali are never entirely washed out as will be shown in the various colorations in the starches found in the American market, which show the variation in composition.

No.	Pure Starch.	Fibre.	Gluten.	Ash.	Moisture.	Total.	Mean Polariscopic Observation.	MI	
								Calcium Carbonate	C Ph
1	96.250	None	None	0.098	3.650	100.000	96°.2+	0.090	
2	95.821	None	None	0.100	4.079	100.000	95°.8+	0.100	
3	88.000	0.100	None	0.420	11.480	100.000	87°.9+	0.223	
4	89.250	0.110	0.200	0.400	10.040	100.000	89°. +	0.221	
5	88.230	0.381	0.400	0.400	10.589	100.000	87°.9+	0.221	
6	88.000	0.110	0.190	0.200	11.500	100.000	87°.9+	0.091	
7	88.010	0.201	0.099	0.700	10.990	100.000	87°.5+	0.500	
8	87.901	0.750	0.249	0.600	10.500	100.000	87°.8+	0.380	
9	88.210	0.220	0.201	0.800	10.569	100.000	87°.9+	0.421	
10	87.561	0.439	0.100	0.400	11.500	100.000	87°.3+	0.200	
11	87.200	0.310	0.190	0.200	12.100	100.000	87°. +	0.090	
12	87.000	0.150	0.050	0.400	12.400	100.000	87°. +	0.200	
13	87.000	0.250	.....	1.600	11.150	100.000	87°. +	1.311	
14	87.000	0.327	0.423	1.000	11.250	100.000	87°. +	0.822	
15	86.920	0.750	0.280	0.800	11.250	100.000	86°.9+	0.621	
16	86.725	0.211	0.198	0.620	12.246	100.000	86°.5+	0.420	
17	86.500	0.721	0 280	0.800	11.699	100.000	86°.5+	0.590	
18	86.520	0.750	0.110	1.120	11.500	100.000	86°.4+	0.801	
19	87.260	0.421	0.480	0.600	11.239	100.000	87°. +	0.360	
20	87.260	0.300	0.381	0.600	11.459	100.000	87°. +	0.321	
21	87.520	0.330	0.410	1.400	10.340	100.000	87°. +	0.831	
22	87.253	1.010	0.912	1.549	9.276	100.000	86°.9+	1.251	
23	86.900	0.211	0.150	1.100	12.639	100.000	85°.5+	0.621	
24	86.821	0.411	0.519	1.000	11.249	100.000	86°. +	0.721	
25	86.250	0.221	0.301	1.000	12.228	100.000	86°. +	0.681	
26	86.225	0.120	0.555	1.000	12.100	100.000	86°. +	0.725	
27	86.225	1.100	0.325	1.100	11.250	100.000	85°.5+	0.791	
28	87.110	0.501	0.389	1.479	10.521	100,000	87°. +	1.010	
29	87.234	1.100	0.481	0.800	10.385	100.000	86°.8+	0.541	
30	87.210	0.110	0.210	1.000	11.470	100.000	87°. +	0.762	
31	87.250	0.110	0.009	0.800	11.831	100.000	87°. +	0.521	
32	87.110	0.230	0.331	0.400	11.929	100.000	85°.2+	0.158	
33	86.521	0.933	0.216	0.800	11.530	100.006	85°.9+	0.530	
34	85.430	1.120	0.800	1.400	11.250	100.000	84°. +	0.922	
35	82.250	1.120	0.750	1.510	14.370	100.000	82°. +	0.821	

MIXED STARCHES.

No.	Starch.	Fibre.	Gluten.	Borax.	Soda.	Calcium Carbonate	Moisture.	Stearine.	
1	85.230	0.220	0.321	2.003	0.249	0.351	11.629	....	1
2	65.221	0.530	0.389	21.350	0.320	0.330	11.339	0.521	1
3	79.225	0.811	0.331	1.959	0.110	0.331	16.713	0.520	1
4	80.250	0.521	0.430	2.275	0.225	0.500	14.239	0.560	1
5	79.210	0.310	0.421	7.000	0.120	0.110	11.848	0.981	1
6	80.921	1.121	0.725	5.450	0.321	....	10.252	1.210	1

ITIES.			REMARKS.
	Calcium Sulphate	Sodium Chloride.	
06			Superior quality of starch, being *four* to *five* times purer than average commercial starch.
9			A fair sample of commercial starch.
1			An average sample commercial starch.
1			An average commercial starch.
1			An average commercial starch.
7			A fair commercial starch.
2			An impure commercial starch.
9			Unfit for culinary use.
2			A poor sample of commercial starch.
0			A fair sample of commercial starch.
0			An average sample of *rice* starch.
7			Excess of caustic alkali.
0			An ordinary commercial starch.
1			A fair commercial sample.
2			A fair commercial sample.
2			Too impure for culinary use.
6			Too high in mineral matter for food.
3			Impure commercial sample—excess alkali.
3			Impure commercial sample—excess alkali.
1	0.228		A very impure starch, unfit for food.
7			Below standard of commercial purity.
1			A very impure starch, unfit for human food.
1			A very ordinary sample of starch.
6		0.100	Too high in mineral impurities for culinary use.
1			An impure commercial starch.
8			Too high in mineral impurities for food.
3			Too high in mineral impurities and alkali for food.
3			Imperfectly separated and impure.
0			A fair commercial sample with excess of alkali.
1			A very impure rice starch with excess of alkali.
4			A poor starch, strength killed by use of free alkali.
0			Very impure and imperfectly prepared.
0			Very impure and unfit for culinary purposes.
1		0.088	Contains an abnormal % alkali—unfit for food