ing and weighing. The spent and regained acids may be analyzed as a check on the working of the regaining plant, while valuable information is often brought out by an examination of the various absorbents.

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PROTEID OF THE WHITE PODDED ADZUKI BEAN.[1]

(*Phaseolus Radiatus*).

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THIS is a small red bean cultivated in Japan. The seeds used in this investigation were grown in Kansas and sent to us by Professor C. C. Georgeson.

As our object was to discover the nature of the globulin forming the chief proteid constituent of various leguminous seeds, no attempt was made to determine the total amount of proteid contained in this seed, nor to study the other proteid substances occurring in small quantity.

It was impossible, by any means at our command, to remove the closely adhering red seed-coat, but as it was found that this yielded but little coloring matter to salt solution the entire seed was ground until all passed a sieve of fine bolting cloth.

Two kilograms of this meal were treated with eight liters of ten per cent. sodium chloride solution, and after stirring some time the mixture was strained on fine bolting cloth.

After standing long enough to deposit most of the suspended starch the extract was filtered quite clear and saturated with ammonium sulphate. The precipitate so produced was filtered out, suspended in water, and in order to remove the adherent ammonium sulphate, which prevented solution of the proteid in a sufficiently small volume of water, the mixture was dialyzed over night. The proteid was thus completely dissolved. The solution was filtered perfectly clear and again dialyzed four days. A large precipitate of globulin resulted, which was filtered out and a portion collected on a separate paper and washed thoroughly with water and alcohol and dried over sulphuric acid. This was found to weigh 13.21 grams and formed preparation 1.

[1] From the Report of the Connecticut Agricultural Experiment Station for 1896.

The remainder of the globulin was suspended in 850 cc. of water and 150 cc. of ten per cent. salt solution added, which yielded a nearly clear solution, showing the globulin to be readily soluble in one and a half per cent. brine. The solution was filtered clear and the filter washed with 100 cc. of one and a half per cent. salt solution. The filtered liquid, measuring 1100 cc., was treated with 500 cc. of water, thereby throwing down a large rapidly settling precipitate, which, after decanting the fluid, was dissolved in ten per cent. salt solution, filtered perfectly clear and dialyzed for three days. The globulin was thus nearly completely precipitated, for further dialysis of the filtered solution caused separation of very little more. Under the microscope the globulin appeared as well developed spheroids. After filtering this precipitete was washed with water and with alcohol and dried over sulphuric acid. This formed preparation 2, weighing 41.5 grams.

The solution decanted from the first precipitation of 2, caused by the addition of 500 cc. of water as described above, was further diluted with 500 cc. of water, which caused an abundant separation of proteid. After settling over night the clear solution was decanted from the precipitate and the latter washed thoroughly with water and with alcohol and dried over sulphuric acid, giving preparation 3, weighing 31.34 grams.

The solution decanted from 3 was cooled over night in an ice chest to 9°, which caused a further separation of proteid in large spheroids. This was filtered off, washed with water and alcohol, dried over sulphuric acid and found to weigh 6.18 grams, preparation 4.

The filtrate from 4 was dialyzed for twenty-four hours and filtered from an abundant precipitate. The latter was washed with water and alcohol, and after drying weighed 12.0 grams, preparation 5. The filtrate from 5 gave only a trace of precipitate on further dialysis.

The preparations were dried to constant weight at 110° and analyzed. The following figures show that fractional precipitation had caused no separation and that the globulin is identical in composition with phaseolin as obtained from the white bean, *Phaseolus vulgaris*.[1]

[1] This Journal, 16, 633.

PHASEOLIN.

Adzuki Bean.

	1	2	3	4	5
Carbon	52.31	52.56	52.74	52.74	52.44
Hydrogen	7.03	6.98	6.94	6.97	6.91
Nitrogen	16.43	16.41	16.34	16.62	16.47
Sulphur	0.57	0.62	0.56	0.49	0.61
Oxygen	23.66	23.43	23.42	23.18	23.57
	100.00	100.00	100.00	100.00	100.00
Ash	0.16	0.73	0.32	0.90	0.05

Average Adzuki bean.	Average White bean.
52.56	52.58
6.97	6.84
16.45	16.47
0.57	0.56
23.45	23.55
100.00	100.00

The reactions of phaseolin, whether obtained from the common white bean or the adzuki, are as follows:

In cold and warm water it is entirely insoluble.

In sodium chloride solutions it is readily soluble, one per cent. brine dissolving large quantities of phaseolin.

In dilute acids and alkalies it is readily soluble; the solutions are precipitated by neutralization.

Solutions in dilute nitric or acetic acid are not precipitated even by large excess of acid.

Dissolved in one-fourth per cent. sodium carbonate solution, phaseolin is precipitated by neutralization, the precipitate being wholly dissolved on adding sodium chloride.

Phaseolin dissolved in ten per cent. sodium chloride brine reacts as follows: It is *not* precipitated even by large excess of hydrochloric, nitric, sulphuric or acetic acids. By a large quantity of trichloracetic acid a precipitate is produced. By dilution with a sufficient quantity of water a precipitate results. Saturation with sodium chloride or magnesium sulphate does not precipitate the phaseolin, but saturation with ammonium sulphate completely throws it out of solution, while saturation with sodium sulphate at 34° precipitates it mostly, but not entirely. Potassium ferrocyanide together with a large excess of acetic acid gives a precipitate.

With mercuric chloride dissolved in ten per cent. salt solution, no precipitate is produced. With tannin large precipitates result. With picric acid dissolved in ten per cent. salt solution, no precipitate forms until a considerable quantity of the acid is added, and the precipitate thus produced dissolves on adding salt solution.

Phaseolin gives with the biuret, Adamkiewics', Millon', and xanthoproteic tests, the usual proteid reactions.

When solutions in ten per cent. sodium chloride brine are heated, turbidity occurs between 90° and 95° and a small flocculent coagulum separates at 97° to 98°; even prolonged heating in the boiling water-bath coagulates but a small part of this globulin.

The solution, filtered from globulin which had separated on dialyzing the solution of the proteids precipitated by saturating the seed extract with ammonium sulphate, was again saturated with this salt, and the precipitate thereby produced was dissolved in a small volume of water, and after filtering clear, the solution was dialyzed for six days. Three grams of a dark-colored globulin separated which seemed much contaminated with coloring matter. This was filtered out and the clear filtrate dialyzed five days longer, but no precipitate was obtained. The solution was then dialyzed into alcohol and the precipitate which resulted after drying weighed eight and a half grams. The filtrate contained but a trace of proteid. This substance was ground to a powder, thoroughly exhausted with water, washed with alcohol, dried and found to weigh 7.05 grams. Dried at 110° this preparation, 6, had the following composition, which it will be noticed is similar to that of preparations obtained in a like manner from the pea, vetch and cow pea.

Adzuki bean.	Pea.		Vetch.	Cow pea.	
6	5	8	20	8	9
53.97	53.33	53.54	53.55	53.13	53.36
7.01	6.98	6.99	6.70	7.09	7.05
16.31	16.14	16.69	16 46	16.51	16.21
0.88	1.00	1.01	1.02	1.09	1.13
21.83	22.55	21.77	22.27	22.18	22.25
100.00	100.00	100.00	100.00	100.00	100.00

Preparation 8 from the cow pea was obtained by prolonged dialysis in water, and accordingly must be regarded as a very

soluble globulin. Since preparations agreeing well in composition and general properties with it have been similarly obtained from other leguminous seeds by dialysis, it is our opinion that the above analyses represent a distinct globulin which can be only in part removed from its solutions by dialysis in water, but is wholly separated, in a coagulated form, by dialysis in alcohol. This globulin is at present being further investigated, and it is our intention to offer more respecting its properties in a subsequent paper.

NOTE.

The Electrolytic Determination of Cadmium.[1]—In preparing this paper we overlooked the paragraph on cadmium in Dr. Warwick's article, "Die Elektrolyse von Metall-Formiaten."[2] We are under obligations to Prof. Edgar F. Smith for calling attention to this oversight. S. AVERY and BENTON DALES.

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Texas Fever. (1) Experiments Confirming the "Tick Theory." (2)

[1] This Journal, 19, 379.

[2] *Ztschr. anorg. Chem.*, 1, 291.