NOTES ON COMMERCIAL ALBUMIN.

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The applications of albumin are now very numerous, and as it differs much in quality, according to its origin and the details of its preparation, it is sometimes necessary to ascertain its purity and freedom from adulteration.

Commercial albumin is obtained chiefly from two sources—eggs, and the serum of blood. Fish-albumin is also met with occasionally, and may be recognised by its fishy odour.

Blood or serum-albumin is obtained by separating the serum from the clot of perfectly fresh blood. The liquid is evaporated in shallow trays, at a temperature not exceeding 50° C., when the albumin is obtained in brittle scales or transparent flakes of a greyish, yellowish, reddish, brown, or black colour. The qualities of serum-albumin, made by leading firms, are "refined," "prime," "No. 1," "No. 2," and "black." *Refined* is made from highly rectified serum, and is of a dirty yellow colour, and, like *prime*, is employed for printing delicate colours. No. 1 is darker in colour and less valued, though suitable for all ordinary printing purposes. No. 2 quality is made from the second draining of the

serum, which, after the clear top serum has been syphoned off, is more or less tinged with red, and consequently is only fit for printing dark colours; as a rule, it also contains some insoluble matter, which is objectionable. *Black albumin* or "dried blood" is obtained from the last portions of serum, and is almost black in colour. It is not used in calico-printing, but finds applications in sugar-refining and turkey-red dyeing. The clot, left after separation of all serum, consists chiefly of fibrin and blood-corpuscles, and is dried, roasted, and used as manure.

Serum-albumin may be employed for printing all but the very finest and brightest colours. Perfectly colourless blood-albumin, equal to the finest egg-albumin, is said to have been recently produced in Germany.

Egg-albumin is obtained in a solid state by cautiously evaporating the white of eggs, at a temperature below 50° C. It is generally transparent, and of a light yellow colour. It is more valuable than serum-albumin, and consequently is more liable to adulteration. Two genuine qualities are made. Egg-albumin should be free from blisters, which are often present in partially coagulated samples.

Albumin of good quality is recognised by its transparency when in flakes, by its taste, not being disagreeable, and by having no odour of putrefaction. Treated with cold water, with constant stirring, it should dissolve entirely.*

Commercial albumin is liable to adulteration with gum, dextrin, flour, sugar, &c. For its examination, 5 grammes of the powdered sample should be treated with 50 c.c. of cold water, with frequent stirring, until all soluble matter is dissolved. Pure and good samples leave no residue. A few drops of acetic acid should next be added, and any undissolved matter filtered off through silk or fine muslin. It may consist of coagulated albumin, casein, starch, or membranous matter. The casein may be dissolved out by treatment with very dilute caustic soda, and precipitated by exactly neutralizing its solution with acetic acid. The aqueous solution of the sample is boiled, when the albumin is thrown down as a flocculent precipitate, which may be filtered off, washed, and weighed; or ignited with soda-lime, and the albumin deduced from the ammonia obtained. The filtrate should be treated with acetic acid and potassium ferrocyanide to make sure that no albuminoid remains in solution.† Its absence being proved, tannin may be added to precipitate any gelatin; and the filtrate concentrated to a small bulk and treated with alcohol to precipitate any gum or dextrin, while sugar, if present, will remain in solution in the alcoholic liquid, and may be detected by boiling off the alcohol, heating with hydrochloric acid, and testing the liquid with Fehling's solution. Sugar might also be extracted by treating the original solid sample with alcohol.

Ziegler's method of assaying commercial albumin is to dissolve 20 grammes of the sample in 100 c.c. of cold water, strain through a sieve, and add 10 c.c. of the clarified liquid to a

* For practical purposes, the albumin is best dissolved in warm water, of a *maximum* temperature of 45° to 50° C. The albumin should be added gradually, and the liquid constantly stirred. The water should on no account be added to the albumin. The liquid, after straining through a fine silk sieve, is usually mixed with a small proportion of ammonia, turpentine-oil, &c., in order to prevent frothing and make it work smoothly. Turpentine also tends to prevent putrefaction, but an addition of about 1 per cent. of arsenious oxide is said to be the best preservative.

† Any precipitate produced at this stage will probably consist of casein.

boiling 20 per cent. solution of alum. After noting the appearance and volume of the coagulum, it is washed, dried, and weighed. De Coninck (*Journ. Chem. Soc.* xxv., 1129) finds that the process gives a precipitate containing not more than 1 per cent. of alumina, and that it is sufficiently accurate for the purposes of the calico-printer. With pure albumin very good results are obtainable, and their accuracy is not affected by the presence of dextrin, but gum-arabic prevents the precipitation of albumin to a very notable extent.

I have made some observations on the proportion of ash yielded by various qualities of commercial albumin, and the results have some interest, although they are not applicable to the detection of any special adulterants. The proportion of ash cannot be readily ascertained by direct ignition of the albumin, owing to the fusible nature of the carbonate of sodium and other salts of which the ash is mainly composed. The difficulty may be obviated by treating a weighed quantity of the sample in a porcelain crucible, with nitric acid of 1·42 specific gravity and two or three drops of strong sulphuric acid. On heating gently, the albumin dissolves to a clear yellow liquid, which may be evaporated to dryness without trouble, giving a residue which readily burns and leaves an ash of tolerably high melting point. Operating in this manner, Mr. J. C. Belcher obtained in my laboratory the following percentages of "sulphated ash" from a series of samples of commercial albumin manufactured by a leading firm :—

	Sulphated Ash.
"No. 1" Egg Albumin	7·4 per cent.
"No. 2" „ „	7·0 „ „
"Refined" Blood Albumin	9·1 „ „
"Prime" „ „	8·5 „ „
"No. 1" „ „	9·2 „ „
"No. 2" „ „	8·9 „ „
"No. 3" „ „	9·7 „ „
"Black" „ „	6·2 „ „

All the ashes were white, except that yielded by the black albumin, which gave a reddish ash, owing to the presence of blood-corpuscles in the original sample. Curiously enough, in this, the lowest grade of genuine albumin, the ash is less than in the better kinds.