The preceding table has been constructed from the formula $(TS) - TS/1.34 = P$ and contains the total solids of milk from 10.00 to 16.50 and its equivalent in protein which runs from 2.54 to 4.19. The casein has been calculated on the assumption that 80 per cent. of the protein is casein.

In the preceding paragraph it was assumed that eighty per cent. of the total protein of milk is casein. Analytical data show the casein to range from 78 to 82 per cent. of the total protein, hence the casein can be calculated by multiplying the per cent. of protein by 0.8. Dr. Van Slyke's figures¹ for protein have been multiplied by 0.8 and compared with the actual results of casein as determined by him. The maximum, minimum and average results of fifty-eight analyses are as follows:

TABLE VI.—COMPARISON OF ACTUAL AND CALCULATED CASEIN CONTENT.

	Casein found. Per cent.	Casein calculated. Per cent.	Difference.
Maximum.....	3.55	3.50	+0.12 to -0.25
Minimum.....	2.11	2.07	0.00
Average.....	2.70	2.69	-0.01

The results obtained by calculation and summarized in Table VI are within the limits of error. From this it appears unnecessary to make casein determinations in milk.

CONCLUSIONS.

1. The relation of the solids-not-protein to total solids in different samples of milk is practically constant and may be considered on the average, equal to 1:1.34.

2. The protein content of normal milk can be calculated with a fair degree of accuracy when the total solids are known by the formula $(TS) - TS/1.34 = P$. The per cent. of casein can be found by multiplying the per cent. of protein by 0.8.

(CONTRIBUTION FROM THE BUREAU OF CHEMISTRY, U. S. DEPARTMENT OF AGRICULTURE.)

THE DETERMINATION OF BENZALDEHYDE IN ALMOND FLAVORING EXTRACT.

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Received February 1, 1909.

The methods proposed for the determination of benzaldehyde in flavoring extracts may be divided into three classes:

(1) Methods based on the formation of the addition product with acid sodium sulphite.²

¹ *Jour. Amer. Chem. Soc.*, **30** (1908), No. 7, pp. 1169-1174.

² U. S. Pharmacopoeia, VIII, p. 68. Leach, Food Inspection and Analysis, p. 750.

(2) Colorimetric methods.¹

(3) Methods involving the precipitation of the oil of bitter almonds.²

In the examination of almond extracts of known composition by these methods, we have found that the sodium hydrogen sulphite method invariably gives results far below the truth, with the colorimetric method we have not been successful, while Howard's precipitation method is apt to give figures much too high, due probably to the difficulty of removing the last traces of chloroform.

We have found that we are able to obtain results within 97 to 99 per cent. of the theory by precipitation of the benzaldehyde in almond extract, and in bitter almond oil, as the phenylhydrazone³ according to the equation

This method has already been proposed by Denner⁴ for the quantitative determination of benzaldehyde in bitter almond water; by Rocques⁵ for its determination in kirsch; and by Herissey⁶ for the determination of the benzaldehyde resulting from the hydrolysis of amygdalin.

The reagents used by us are:

Reagent (1): Phenyl hydrazine hydrochloride..... 2 grams
Crystals of sodium acetate..... 3 "
Water..... 20 cc.

Dissolve the sodium acetate in the water, add the phenyl hydrazine hydrochloride, shake for five or six minutes, and filter, or

Reagent (2): Phenyl hydrazine..... 1 cc.
Glacial acetic acid..... 1.5 cc.
Water..... 20 cc.

Mix the acetic acid and water, then pour in the phenyl hydrazine.

Reagent (2) we find to be much more convenient on account of the rapidity with which it may be prepared. Whether reagents (1) or (2) be used, the solution should be made up immediately before use, and solutions more than an hour old should be discarded. The method of precipitation is as follows:

Two 10 cc. portions of almond extract are measured into 300 cc. Erlenmeyer flasks; to one portion is added 10 cc., to the other 15 cc. of either reagent; shake, stopper tightly, and allow to stand over night in a dark place. The next day add 200 cc.

¹ Woodman and Lyford, *Jour. Amer. Chem. Soc.*, **30**, 1607.

² Howard, *Ibid.*, **30**, 610.

³ Fischer, *Liebig's Ann. d. Chem.*, **190**, 134.

⁴ Denner, *Zeit. für analyt. Chem.*, **29**, 228. *Pharm. Centralhalle*, **28**, 527.

⁵ Rocques, *Rev. Internat. des Falsifications*, **1907**, p. 66.

⁶ *Journ. de Pharm. et de Chim.*, **1901**, p. 60.

of cold water to each flask, and filter on tared Gooch crucibles provided with thin mats of asbestos. Wash with cold water and finally with 10 cc. of 10 per cent. alcohol. Dry for three hours in a vacuum oven at 70–80° C. If a vacuum oven is not available, the drying may be accomplished in a vacuum desiccator over sulphuric acid, but will of course take much longer than when a higher temperature is employed. The weight of the precipitate, multiplied by 5.408, gives the number of grams of benzaldehyde in 100 cc. of the solution.

Our reason for using 10 and 15 cc. of reagent on different portions of the same extract is based on the fact, that we have found in the examination of a large number of commercial extracts, that while the large majority conform to the official standards,¹ and contain in the neighborhood of 1 per cent. by volume of oil of bitter almonds, occasionally extracts are met with containing as much as 6 per cent. of benzaldehyde; in such preparations it is obvious, that, while the use of 10 cc. of the reagent may give good duplicates the results would be far below the truth.

The following results have been obtained on almond extracts made in this laboratory, and containing known amounts of benzaldehyde or oil of bitter almonds.

Analyst.	Gr. benzaldehyde per 100 cc. in sol.	Gr. bitter almond oil per 100 cc. in sol.	Gr. benzaldehyde per 100 cc. found.	Per cent. recovered.	Grs. bitter almond oil per 100 cc. found. ²
E. H. G.	0.995	...	0.989	99.5	...
W. E. H.	0.995	...	0.973	97.8	...
W. D.	1.659	...	1.600	97.0	...
W. D.	0.995	...	0.966	97.0	...
W. D.	...	1.086	0.949	...	1.090
W. D.	...	0.947	0.787	...	0.905
P. B. D.	1.00	...	0.980	98.0	...
P. B. D.	...	1.00	0.890	...	1.02

The presence of benzoic acid, which in varying amounts must always be present in almond extracts, does not affect the accuracy of the results.

(a) In a solution containing 1.6598 grams of benzaldehyde and 0.610 gram benzoic acid per 100 cc. there was found, on analysis, 1.638 grams benzaldehyde, which is equal to 98 per cent. theory.

(b) In a solution containing 1.6598 grams benzaldehyde and 1.220 grams benzoic acid per 100 cc. there was found, on analysis, 1.628 grams benzaldehyde per 100 cc. which is equal to 97 per cent. theory.

¹ Circular 19, Office of the Secretary, U. S. Department of Agriculture.

² Oil of bitter almonds calculated from the benzaldehyde by use of the U. S. P. Standard, *i. e.*, that oil of bitter almonds shall contain at least 85 per cent. benzaldehyde.

In the same way it was found that nitrobenzol, which is sometimes placed in almond extracts, has no effect on the precipitation.

(a) A solution containing 0.9950 gram benzaldehyde and 0.8676 gram nitrobenzol per 100 cc. gave 0.9756 gram benzaldehyde per 100 cc., which is equal to 98 per cent. of theory.

(b) A solution containing 0.5 gram benzaldehyde and 0.5 gram nitrobenzol per 100 cc. gave 0.498 gram benzaldehyde per 100 cc., which is equal to 99.6 per cent. theory.

REVIEW.

PHARMACEUTICAL CHEMISTRY DURING 1908.

Upon comparing the broad and rapid progress made during the last year along the lines of synthetic organic chemistry, with what has been accomplished among the medicinal synthetics, we regret to note that nothing original has appeared. No new fields have been opened; what progress has been made was along the well beaten paths with duplication of old ideas in other forms. The inevitable result of continuing such a multiplication along old lines is to increase confusion and finally compel the medical profession to fall back to their old standard remedies.

Local Anesthetics.

The study of the structure of cocaine, demonstrated that its local anesthetic action resided in two nuclei, namely, a substituted pyridin ring and an esterified benzoic acid. As chief synthetic representatives of the former class were the "Eucaines," along this line, nothing new has developed. Among the older and successful representatives of the latter class, esters of aromatic amino and oxyamino acids, are the ortho forms (oxybenzoic methyl esters) and anesthesin (*p*-amino-benzoic ethyl ester). They are non-toxic and serve especially for anesthesia of the nerve terminals. The objectionable insolubility was overcome through the introduction of an amino-alcohol in place of H of the COOH group as in novocain, a *p*-amino-benzoyl-diethyl-amino ethanol $[C_6H_4(NH_2)COO.C_2H_5N(C_2H_5)_2.HCl]$. The aminocinnamic alkaline esters (D. R. P. 187,593) are still more powerful local anesthetics. New among this class is Propaesin, the propyl ester of *p*-amino-benzoic acid, m. p. 73 to 74° C. $(NH_2C_6H_4COOC_3H_7)$ which, like others of this class, serves as a mild anesthetic adapted to diseases of the esophagus and inflamed mucous surfaces. Dipropaesin, a condensation-product of the former, which splits up into propaesin when in contact with alkalies, serves as a local anesthetic in gastro-intestinal affections. The esterifying group has, of recent years, grown to such proportions and pharmacologic importance, securing thereby more profound anesthesia, that such derivatives may be considered as substituted tertiary alcohols. As prototypes of this class are stovaine, the hydrochloride of dimethyl-amino-benzoyl-dimethyl carbinol $[(C_6H_5CO.O)C(CH_3)(C_2H_5)(CH_2.N(CH_3)_2).HCl]$ and alypin, the hydrochloride of benzoyl 1,3-tetramethyl-diamino-2-ethyl-isopropyl alcohol $[(C_6H_5CO.O)C(C_2H_5)(CH_2.N(CH_3)_2)_2.HCl]$. The success attending the introduction of these led to a number of recent patents along similar