[Jour. Indian Chem. Soc., Ind. & News Ed., Vol. 18, No. 2, 1955]

UTILITY OF THE 'ALBUMINOID AMMONIA VALUE' IN THE ANALYSIS OF FOODSTUFFS. PART I. ANALYSIS OF VINEGAR

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(*Received March* 31, 1954)

Estimation of total nitrogen is carried out in vinegars and some beverages like fruit juices, squashes and cordials, mainly to detect sophistication with artificial products which contain negligible or very little nitrogen. A significant deficiency in the nitrogen content of these products would indicate that they are adulterated more or less with synthetic stuff. This estimation has practically no nutritional significance, as the amount of proteins in such foodstuffs is relatively small, and the quantity of many of these consumed normally by us is not very considerable. The case may be compared with water analysis, where the amount of the little nitrogen present has no nutritional importance, but its determination is valuable for detecting evidences of pollution by organic matter or otherwise. In water analysis determination of total nitrogen by the Kjeldahl digestion method is time-consuming and supplies no more valuable information than the figure for the "albuminoid ammonia"[1], which is the ammonia produced by the action of alkaline potassium permanganate on the nitrogenous organic matter present. This latter figure can be obtained far more rapidly without having to undergo the tedious and troublesome process of digestion. Therefore, it occurred to the author whether it was possible to utilise the "albuminoid ammonia value" in the analysis of vinegars instead of having to undergo the long Kjeldahl process. For this purpose, genuine and artificial products were analysed for their "albuminoid ammonia values" and at once extremely encouraging results were obtained, as indicative as the total nitrogen figure, thus effecting a considerable saving in time and labour. This method of examination, which has so far been restricted to the analysis of water, has now been applied for the first time to the analysis of food, thus introducing a new conception in food analysis.

Experimental

The method for the determination of albuminoid ammonia of vinegar is somewhat different from that used in water analysis. The procedure is described in detail in the *Analyst*.[2] Results are summarised in Table I.

TABLE I

Comparative figures for genuine malt vinegars and artificial products

No.	(A) Genuine malt vinegars. Total N (p.p.m., w/w).	Albuminoid NH_3-N (p.p.m., w/w).	Acetic acid (g./100 ml.)	Oxidation value.[3]	I.V.[3]	(B) Artificial vinegars. Total N (p.p.m) w/w).	Albuminoid NH_3-N (p.p.m., w/w).	Acetic acid (g/100 ml.).	Oxidation value[3].	I.V.[3]
1	820	380	4.14	1460	910	4	Nil	4.95	54	10
2	810	375	4.86	1470	1810	22	3	2.28	22	40
3	460	230	4.89	870	350	11	Nil	2.40	70	40
4	440	208	4.98	780	356	17	,,	3.45	48	8
5	840	400	4.86	1448	904	31	4	1.08	77	10
6	600	320	4.86	1264	764	14	Nil	4.83	56	10
7	750	350	4.83	1320	835	13	,,	5.0	24	34
8	620	300	4.78	1100	840	14	,,	2.3	25	10
9	600	295	4.82	1050	800	20	2	3.5	40	15
10	760	360	4.94	1350	900	26	3	4.65	45	8
11	820	380	4.87	1450	920	12	Nil	4.50	56	20
12	850	400	4.83	1440	1000	34	4	5.20	110	60
13	475	235	4.75	900	380	22	3	4.86	320	105
14	450	215	4.88	810	360	34	4	4.74	370	250
15	880	420	4.90	...	...	45	4	5.70	244	194

*The figures for genuine malt vinegars from No. 8 to 15 and those of artificial products Nos. 1, 2, 5, 6, 13, 14 and 15 in Table I, did not appear in the *Analyst*. Also, the figures for other analytical constants like oxidation and iodine values, acidity, large parts of the Introduction and Discussion were not incorporated in the published Note. However, the method for estimating albuminoid ammonia of vinegars has been described in detail in the *Analyst* and has therefore been omitted in the present full paper.

DISCUSSION

It will be seen from the above figures that a gulf of difference exists between the albuminoid ammoniacal nitrogen of a genuine malt vinegar and that of an artificial product, the figures for genuine malt vinegars lying within the range of 200 to 420 p.p.m., and those of fictitious products, from nil to 4 only, which is, of course, practically negligible. Also, this value is in no way less helpful than the figure for total nitrogen to detect adulteration, and agrees well, in general, with other estimations such as the oxidation and the iodine values. There are, however, certain peculiarities, as for example, samples Nos. 13, 14 15 of Type (B). These samples have been declared to be molasses vinegars by the manufacturers and may actually be spirit vinegars prepared by acetous fermentation of the alcoholic fluid distilled from fermented molasses. These have very low total and albuminoid ammoniacal nitrogens, but comparatively high oxidation and iodine values. However, no certain conclusion could be drawn as no analysis was done of known samples of pure spirit vinegars on account of their non-availability in the market.

Samples Nos. 1 and 6 of Type (B) are artificial vinegars prepared in the laboratory by diluting acetic acid and colouring with burnt sugar (caramel) to impart to them an appearance of genuine malt vinegar. It will be noticed that market samples of artificial vinegars do not differ much from these two laboratory-made products in their analytical constants. The conclusion to be drawn is obvious. Organoleptically, there was a vast difference between the Types (A) and (B), the latter having practically no "body".

This new estimation provides an excellent rapid sorting test for differentiating fictitious products from genuine things. Also, a great advantage of this determination is that it gives an indication beforehand, in case of unknown samples, of the quantity of the sample to be taken for determining oxidation and iodine values, if these figures are required. It is far more simple and rapid than any other estimation done in vinegar analysis, namely the total nitrogen, potash and phosphate in the ash, oxidation, iodine and ester values, etc.

The reason why ultimately 1 ml. of vinegar was distilled in the determination of the albuminoid ammoniacal nitrogen was that with larger amount of genuine malt vinegars all the albuminoid ammonia did not come over in the 100 ml. distillate, giving consequently low values. One ml. of sample was found to be the optimum and a convenient amount to be distilled. To quote a specific case—when 2, 3, 4 and 5 ml. of vinegar were distilled, there was a progressive fall in the albuminoid ammoniacal nitrogen values from the true figure of 380 p.p.m. to 330, 270, 200 and 160 p.p.m. respectively. Also, when one ml. was distilled, after collection of 100 ml. of the second distillate no further ammonia came over.

Relation between total and albuminoid ammoniacal nitrogens.—In genuine malt vinegars (Table I, Type A), there exists a broad correlation between the figures for total and albuminoid ammoniacal nitrogens, and the ratio of total to albuminoid ammoniacal nitrogen (TN/AAN), varies from 1.9 to 2.16 with an average of 2.1. Therefore, the value for total nitrogen, if required, may be calculated on an average basis by multiplying the albuminoid ammoniacal nitrogen by 2.1.

The author wishes to thank Mr. J. M. Roy for his help.

SUMMARY

Estimation of albuminoid ammonia serves as an excellent rapid sorting test in deciding whether a vinegar is a genuine malt product or simply an artificial one. The determination of total nitrogen by the long Kjeldahl process, done hitherto as a matter of routine, may be dispensed with. Also, if the value of total nitrogen and hence of total proteins is required, this can be calculated approximately from the albuminoid nitrogen figure.

REFERENCES

1. Taylor, "The Examination of Waters and Water supplies", Thresh, Beale and Suckling, 6th. ed., 1949, pp. 161, 233.
2. Mitra, *Analyst*, 1953, **78**, 499.
3. Edwards & Nanji, *ibid.*, 1938, **63**, 410.