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Studies on the Egyptian Onion By-Products

1. Composition after oil extraction*

A.M. El-Abbady, A.D. El-Gindy and S.H. Doss**

Department of Chemistry, Alexandaria Univeristy, A.R.E., Tanta Faculty of Science

A trial was made to use economically the huge amounts of onion by-products daily produced during the drying process of onion. A study of the best way for extracting the valuable onion oil from the by-products was carried out using both the steam distillation and the corn oil extraction methods. The by-products after removing its oil were dried then subjected to complete chemical analysis. The results obtained were found to be comparable to many common foddors for cattle and sheep.

In Egypt there are five factories for drying onion, one in each of Souhag, Magaga, Port Said and two in Alexandria. During the drying process the outer scaly leaf together with two fleshy leaves are discarded. The fleshy by-products of the Souhag Factory only reach ten tons daily which constitute about 20 % of the whole amount of onion used. These by-products are usually used uneconomically as it is for feeding cattle and sheep or for burning purposes.

The increasing demand for the dried onion for export purposes as indicated from the following table indicates the importance of this study ; especially the unused waste products are directly proportional to the dehydrated amounts.

Year	Amounts of exported dehydrated onion expressed in Tons
1952	1942
1953	2620
1954	2715
1955	3245
1956	3890
1957	4900
1958	3892
1959	7210

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** Present address : Organisch Chemisches Institut der Universität Bonn, Meckenheimer Allee 168, W/Germany.

Year	Amounts of exported dehydrated onion expressen in Tons
1960	5572
1961	5206
1962	6960
1963	6353

(after Al-Iktsad Elzirai, Dec. 1965)

The aim of this work can be summarized as follows

(1) As it has been proved experimentally that the percentage of the oil in the outer fleshy leaves of the onion bulb is much higher than that in the inner leaves (Platenuis and Knott, 1941), then it was suggested to study the best way for extracting this valuable oil which has many useful uses in medicin and food industry.

(2) Experimentally it has been found that the use of rough or autoclaved onions, onion juice and crude fleshy by-products for feeding animals can cause severe anemia (Gruhzit, 1931 and Gebaner and Ploelz, 1954). Gruhzit (1931) found that dried onion was less harmful than the fresh onion juice. He also proved that the presence of disulphide compounds such as n-propyl, allyl and ditolyl disulphides in the diet of dogs caused severe anemia through its hemolytic action upon the red blood corpuscles. But no such harmful effect specifically on ruminants were stated.

As the disulphide derivatives together with other compounds constitute the onion oil, it was suggested to estimate the nutrient composition of the onion by-products after depriving it of its oil. If such treated by-products could prove to be nutritious, and economic and deadly sure harmless fodder for cattle and sheep will be available and damp the markets of all the agricultural arabic countries.

Such fodder will have no onion smell in meat and milk or at least will not need withholding the feed for a period before marketing the ruminant.

So, in this work, the onion oil was removed from the onion fleshy by-products using both the classical steam distillation method and the new corn oil extraction method (Doss, 1968). The structure and configuration of the constituents of this oil by physical and chemical methods is under publication (Doss, Snatzke, 1971). The residue of the by-product was dried then analysed to examine the possibility of incorporating it in farm animal's rations.

Experimental

Materials

Samples of the onion by-products (mainly the two outer fleshy leaves) are taken from the Egyptian onion "Giza 6" available from the Ministry of Agriculture and Souhag factory.

Methods of Removal of the onion oil from the samples

a) Steam distillation method: The sample was chopped into small pieces, steam distilled until the distillate gave negative test with lead acetate (as the oil is highly soluble in water).

b) Corn oil-water extraction method: The chopped sample (2kg) was boiled under reflux with a mixture of 5 litres water and 500 g. corn oil (as a carrier) for 2 hours (Doss, 1968).

Dehydration method

The residue after either steam distillation or corn oil extraction was passed into a mincer where it was subjedcted to pressure, then carefully dried at 70°C for 24 hrs., then at 100°C till constant weight.

Analytical Methods

Water content was estimated by difference in weight [Assoc. Official Agr. Chem., 1960 (a)]. Crude protein was estimated by Kjeldahl-Gunning-Arnold method [Assoc. Official Agr. Chem., 1960 (b)].

Fats were determined by direct ether extraction method (Assoc. Official Agr. Chem., 1960 (c).

Crude fibre [Assoc. Official Agr. Chem., 1960 (d)], ash (Pearson, 1962), calcium [Assoc. Official Agr. Chem., 1960 (e)], and Phosphorus (Blatherwick *et al.*, 1925) were estimated using standard methods.

Carbohydrates (NFE) were calculated by difference. Iron was determined according to Elvehjem (1930).

Thiamine (Assoc. Official Agr. Chem., 1965), Riboflavin (Arnold, 1945), and Clorine [Assoc. Official Agr. Chem., 1960 (f)] were estimated by standard methods.

Vitamin C was estimated by the indophenol method (Harries and Oliver, 1942). Sodium and Potassium were estimated by flame photometry using a flame photometer Unicam SP 900.

Carotene was determined colourimetrically by the method of oser *et al.* (1945), using a Coleman Jr. Spectrophotometer. The obtained figures were calculated according to the following equation (Inter-departmental Committee on Nutrition for National Defence, 1963).

$$D_{450} \times 7.28 \times [\text{dilution}] + \frac{100}{\text{weight}} \quad \mu \text{ g carotene/100 gr Sample}$$

The food energy was calculated according to the following equation considering onion as a vegetable (Inter-departmental Committee on Nutrition for National Defence, 1963).

$$\text{Food energy} = [\text{CHO}] \times 3.99 + \text{fat} \times 8.37 + \text{Protien} \times 3.81.$$

Results

The onion fresh by-products (1 kg) when subjected to the steam distillation method yielded 0.14 g onion oil. Using the corn oil extraction method, the yield was increased to 0.8-1.0 g. The physical and chemical properties of this oil will appear in another publication (part III).

TABLE 1.—Shows the analysis of the Egyptian onion by-products in comparison with that of the American onion.

The aim of this comparison is to prove that the components of the Egyptian onion waste products are in analogy with that of the american onion itself and the analysis of these compounds is in good accordance with the american reported results.

TABLE 2. —gives the analysis of the dehydrated by-products after removing its oil using the steam distillation method.

TABLE 3.—gives the anaylsis of the dehydrated by-products after removing its oil using the corn oil extraction method.

A comparison of the analysis of the dehydrated unoily onion by-products (corn oil method) with those of some of the common fodders (Ghonem, 1951, and Henry and Morrison, 1928), is shown in TABLE 4.

Discussion

Comparing the yields of the two methods used for the extraction of the onion oil from the fresh by-products it is clear that the corn oil method is more satisfactory and economic than the steam distillation method.

The results of analysis in general (Tables 1, 2 & 3) showed that the removal of the onion oil from the by-product did not reduce much its nutrient composition.

Comparing the by-products from the Egyptian onion (Giza 6) in both the fresh and dehydrated states with the American mature onion, table I, it is clear that although the by-products are poorer in Vitamin C yet they are markably richer in minerals such as Calcium, Phosphorous and Iron.

The dehydrated by-products (dry matter) when left in normal atmosphere absorbed moisture to a maximum of 9% (Table 3). This is agreable since moisture must not exceed 10% so that the fodder can be easily preserved

It is clear that both the steam distillation and the corn oil-water extraction processes (Table 2 & 3) destroyed and removed all the water soluble thermolabile ascorbic acid (Vitamin C) and thiamine (Vitamin B 1).

The sincing process increased the amounts of the insoluble costituents and at the same time decreased the amounts of the soluble components. The loss in some of the insoluble constituents may be due to the fact that the mincing process is usually accompanied by loss of a part of the by-products sap (Table 2 and 3).

TABLE 1.—ANALYSIS OF THE EGYPTIAN ONION BY PRODUCTS AND THE AMERICAN ONION

100g sample contain / sample	Water	Food energy	Protein	fat	Carbo-hydrates		Ash	Ca	P	Fe	Cl	Na	K	Carotene	Thiamine	Riboflavin	Ascorbic acid
					NFE	fiber											
	g	Cal.	g	g	g	g	g	mg	mg.	mg	mg	mg	mg	mg.	mg	mg	mg
1. fresh by-products (Egyptian) .	89.84	32	1.04	0.16	7.62	0.98	0.30	55.9	56.4	5.7	13.4	30	135	57.8	0.02	0.02	4.7
2. Onion, mature (American) (Hawk *et al.*, 1954)	87.50	45	1.40	0.20	9.50	0.80	0.60	32	44	0.5				50 I.U. Vit.A	0.03	0.04	9.0
3. Dehydrated by-products (Egyptian)	0.00	350	10.23	1.59	74.60	9.54	3.91	570	555.5	56.4	131	296	1331	134.9	0.0	0.21	0.0
4. Dehydrated flaked onion (American) (Hawk *et al*, 1954) . . .	4.00	347	10.80	1.10	75.70	4.50	3.90	168	273	3.4				130 I.U. Vit.A	0.25	0.18	36.0

TABLE II.—ANALYSIS OF THE DEHYDRATED ONION BY PRODUCTS AFTER REMOVING ITS OIL BY THE STEAM DISTILLATION METHOD

100 g sample / sample	Water	Food energy	Protein	Fat	Carbohydrates		Ash	Ca	P	Fe	Cl	Na	K	Carotene	Thiamine	Riboflavin	Ascorbic acid
					NFE	fibre											
	g	Cal	g	g	g	g	g	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
5. Dehydrated unoily byproducts (steam distillation method)	0.0	313	10.06	1.46	65.56	17.80	4.9	821.5	504	51.6	75.4	317	1498	218.3	0.0	1.30	0.0
6. Minced dehydrated unoily by-products (Steam distillation method)	0.0	321	14.78	3.17	59.41	18.42	4.0	881.6	187	38.6	0.0	316	968.9	221.4	0.0	0.09	0.0

* The changes in these results may be due to the mincing proces.

TABLE 3.—ANALYSIS OF THE DEHYDRATED ONION BY PRODUCTS AFTER REMOVING ITS OIL BY THE CORN OIL EXTRACTION METHOD.

100g sample contain / sample	Water	Food energy	Protain	Fat	Carbohydrates		Ash	Ca	P	Fe	Cl	Na	K	Caroten	Thiamine	Riboflavin	Ascorbic acid
					NFE	fibre											
7. Minced dehydrated unoily by-products (Corn oil extraction methed)	g 0.00	Cal 307	g 6.20	g 4.37	g 61.70	g 22.30	g 5.28	mg 1774	mg 221	mg 74.64	mg 0.0	mg 126	mg 684.7	mg 152.5	mg 0 0	mg 0.2	mg 6.0
8 Minced unoily by-products (Corn oil extraction methed) dehydrated at (100 °C. (**)	6.17	290	5.29	4.66	57.82	20.80	5.12	1664	207	60.44	0.0	118	642.4	143.1	0.0	0.19	0.0
9. Minced unoily by-products (Corn oil extraction methed) dehydrated at 70°C (**)	9.65	294	4.42	5.96	56.85	18.09	4.89	1645	199	62.72	0.0	114	618.6	137.8	0.0	0.21	0.0

(**) These samples were stored after dehydration in the open atmosphere for about one month then analysed.

(†) The unexpected increase in other extract fat may be due to any sort of fermentation during long storage.

TABLE 4.—COMPARISON OF ANALYSIS OF THE UNOILY DEHYDRATED ONION BY-PRODUCTS WITH THOSE OF SOME COMMON FODDERS

100g Fodder contains / Fodder	Water	Protein	Fat	Carbohydrates		Ash	Na	K	Ca	P	Fe	Cl
				NFE	Fibre							
	g	g	g	g	g.	g	Mg	Mg	Mg	Mg	Mg	Mg
Onion byproducts (oil extracted and dried)	6.17	5.29	4.66	57.82	20.80	5.12	118	642	1664	207	60.4	0·0
Berseem hay	7.5	14.4	2.4	43.0	23.2	9.5	62	1701	1710	169		239
Alfalfa hay	8.6	14.9	2.3	37.3	28.3	8.6	453	770	1046	221		149
Wheat straw	8.4	3.1	1.5	44.4	37.4	5.2	224	796	305	36		198
Rice bran (low grade)	9.5	10.9	9.8	42.7	15.8	11.3						
Cotton seed cake (cold-pressed)	7.9	26.1	7.7	30.1	24.0	4.2	259	1656	266	1352		38
Corn bran	10.0	9.7	5.7	62.4	9.8	2.4	—	365	27	139		46
Wheat bran (low grade)	10.0	11.9	3.6	51.7	16.6	6 2	201	1320	125	1110	9	90

The slight decrease in the amounts of Carotene Table III) is due to is solubility in corn oil.

Table IV shows that, the onion by-products, from the analytical point of view may form a good fodder for cattle and sheep especially after the removal of the sulphide constituents which may be harmful. The nutrition value of this fodder will be typical if sodium chloride and special species of microorganismus (Vitamins generator) are added.

The estimation of the residual sulphur compounds in the fodder and the evaluation of the fodder from the digestive point of view are under investigation.

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دراسات على مخلفات البصل المصرى

الجزء الأول : التركيب بعد استخلاص الزيت

عبد المحسن العبادى ، آمال درويش الجندى و سينوت حليم دوس

قسم الكيمياء ـ كلية البنات ـ جامعة عين شمس

يشتمل هـذا البحث على محاولة لاستخدام مخلفات تجفيف البصل استخداما اقتصاديا بقصد الحصول على أكبر فائدة ممكنة بأقل التكاليف وذلك بالبحث عن أفضل الطرق لاستخلاص زيت البصل القيم والمستخدم فى صناعة الدواء والغذاء من هذه الكميات الهائلة من المخلفات .

ولقد استخدمت فى هذه الدراسة طريقة التقطير التجارى وطريقة الاستخلاص بواسطة زيت الذرة .

ولقد أجرى على المخلفات الناتجة بعد المعالجة السالفة ثم تجفيفها تحليل كامل لجميع العناصر الموجودة بها حيث اتضح أن محتوياتها من المواد الغذائية يمكن مقارنتها ببعض الأعلاف الأخرى المألوفة للأغنام والماشية .