

A Rapid Method of Estimating Moisture in Dehydrated Fish

THE determination of moisture in foods by extraction with alcohol has been limited by the lack of a rapid and accurate method of estimation of the resulting alcohol-water mixtures. Robertson¹ has recently shown that both dicyclohexyl and a mixture of seven volumes of 'Elaine' kerosene and one volume of Standard White Oil No. 7 (both products of the Standard Oil Co. of California) possess very critical temperatures of solution with water-alcohol mixtures. The critical temperature of solution is clearly demarcated by loss or appearance of turbidity with the paraffin mixture, but this is preceded by a hazy appearance with dicyclohexyl. As the method can be adjusted to give a range of up to 20° C. for a water content of 1 per cent in water-alcohol mixtures, the method appeared to be sufficiently critical for food analyses.

As neither dicyclohexyl nor the grades of paraffin mentioned by Robertson was available, a blend of Standard White Oils No. 5, No. 12, and liquid paraffin was used. This blend approximated to the physical characteristics of Standard White Oil No. 7. The critical temperature of solution was determined for water-alcohol mixtures of known low water content with (a) 7 parts of kerosene to 1 part of blended white oil, (b) 3 parts of kerosene to 1 part of blended white oil. The ratio of alcohol-water to paraffin mixture was kept constant at 2-4. The relationships so derived were used as reference curves for all subsequent determinations. These curves are not reproduced, as each particular mixture of paraffin has a different critical temperature of solution for the same amount of water.

The time required for extraction of water from any food by refluxing with absolute alcohol or with alcohol of low but known water content varies with the nature of the food. Extraction of water from 10 gm. dehydrated fish with 50 ml. of boiling alcohol reached equilibrium in 30 minutes. Only slightly less water was extracted in 15 minutes. The results obtained by the critical temperature of solution method and the more conventional methods of oven drying are compared in the accompanying table. The vacuum oven used was designed and constructed by workers at this Laboratory and gives quicker drying than the normal laboratory design.

WATER CONTENT OF DEHYDRATED FISH DETERMINED BY DIFFERENT METHODS.

Sample No.	Per cent loss in weight		
	Crit. temp. of sol. method	Vacuum oven 20 hr. at 70° C.	Oven drying at 100° C.
1	9.5	—	9.2 (6)*
2	5.7	5.8	6.0 (6½)
3	7.7	—	8.1 (9)
4	7.8	—	7.5 (7)
5	8.55	8.1	8.5 (6)
6	9.5	9.4	9.25 (6)

* Hours of drying to give constant weight.

The results obtained by the three methods do not differ by more than 0.4 per cent except for sample 5, where there is a maximum difference of 0.45 per cent between the results obtained by vacuum oven drying and the critical temperature of solution method.

The samples determined were of four common South African fish of commercial importance with oil contents on a fresh-weight basis ranging from about 0.1 to 3.0 per cent.

The critical temperature of solution method can be recommended for rapid and accurate determination of the water content of dehydrated fish, since with this material there is rapid and complete extraction of water by alcohol and the necessary calibration curves need only be drawn up once for a single large consignment of kerosene and white oil. Where dicyclohexyl is obtainable, even this is not necessary, since the curve is given by Robertson¹. It is necessary to take precautions to dry all glassware thoroughly.

Work is proceeding with other dehydrated products, including vegetables, but these latter present certain difficulties.

REES DAVIES.

WM. EDWYN ISAAC.

Low Temperature Research Laboratory,
Cape Town. May 16.

¹ Robertson, G. R., "Estimation of Water in Alcohol with Aid of Dicyclohexyl", *Ind. Engineering Chem. A.E.*, 15, 451 (1943).

Measurement of Potential Difference as a Method for Studying the Action of Water on Lead Pipes

WHEN working a R.A.M.C. mobile hygiene laboratory in Northern Ireland in 1941, I found that a number of the water samples submitted for examination had a definite plumbo-solvent action. Thresh¹ showed that mere acidity or alkalinity was of minor importance, but the presence of lime with a silicate or organic acid, such as citric, lessened the action.

Nine samples attacked lead; they were mostly acid and very soft. The customary routine was followed, freshly scraped and old lead surfaces being immersed and the effects noted. Such comparative tests can give an approximately quantitative determination of the rate of attack. Thus water from the Glen River, Newcastle, was at pH 5.8 and gave a strong reaction for lead after 20 minutes with a fresh surface. The source, recognized as dangerous, is regularly treated with sodium silicate. The water was then at pH 8 and gave only a slight positive test for lead after an hour; the new surface tarnished rapidly. Water from Castlewella Lake, at pH 7.3 and with ten parts per million temporary hardness and thirty permanent, gave a negative result after twenty minutes and showed less lead after one day than did the untreated river water after twenty minutes.

The diverse chemical factors affecting the action of water on lead appear to be summed up by a measurement of the difference of electrical potential between old and new lead surfaces immersed in the sample. Differences of a few millivolts were, however, found between various old surfaces. Accordingly, the gold electrode, supplied with the potentiometer provided in the mobile hygiene laboratory for pH determinations, was used in measuring the potential difference between gold and old or new lead surfaces.

Sample	Period of immersion pH	Two min.		Ten-forty min.		About one day	
		Old	New	Old	New	Old	New
Distilled	6.0	617	725*	—	—	—	—
River	5.8	584	682	537	581	472	476-505†
River, with silicate	8.0	507	506	—	—	—	—
Lake	7.3	514	556	390	396	282	390

* Obtained indirectly, 108 millivolts more than old surface.

† After stirring.