it can at once be transferred to a crucible and roasted. Oxidation takes place very rapidly, and in the course of about half an hour the sulphide is converted into a fine powder without stirring or grinding, and may be at once heated with four times its weight of the mixture of magnesia and sodium hydrate, and the chromate extracted and estimated as described.

Example.

Two grms. of the steel from the Hecla Works treated in this way—

—	Cr Found.	Cr Per Cent.
	Grm.	
1st fusion	0.0332	1.66
2nd fusion	0.0018	0.09
3rd fusion	..	..
Total	0.0350	1.75

These methods involve several fusions, but the time occupied in the estimation of the chromium should not exceed one day, and, of course, the filtrates from the different fusions can be united and titrated as one.

for a little while and then stopped by closing clip *x*. Some water is now poured into flask *R* and boiled down to expel all the air from the apparatus. At first clips *g* and *m* are open and clips *x* and *w* closed. After some time *m* is closed and the steam allowed to go out through *w*. When the water in flask *R* has been boiled down to about 5 or 10 cc. *w* is closed and the lamp withdrawn. Clip *e* is then closed and clip *x* is opened cautiously so as to prevent the water rushing too quickly into the collecting cylinder *S*. Clip *x* is now kept open to the end of the experiment. Any remaining air bells in *S* are forced out through *m*, and it is then connected with a Schiff's nitrogen measurer charged with mercury. It is then charged with 500 cc. of the water under analysis by means of the funnel and capillary delivery tube *i*, and the tube filled with mercury to prevent any gas lodging in it. The extraction is now carried out as usual. After the gases have been collected in *S* they are transferred to the Schiff and in many cases the analysis completed there.

The advantages of the apparatus over Jacobsen's are obvious, for both the troublesome process of sealing up the tube, and the still more troublesome operation of transferring the gas to an apparatus for its analysis are obviated, and also it is easy to test and find if all the gases are expelled.

A series of test analyses with the apparatus described gave very satisfactory results.

ON MAIZE OIL.

BY J. CRUICKSHANK SMITH, B.Sc.

MODIFICATION OF KREUSLER'S NITRIC ACID APPARATUS FOR THE EXTRACTION OF DISSOLVED GASES IN WATER.

BY JAS. ROHSON.

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SOME time ago, at the suggestion of the late Professor Dittmar, I carried out a number of experiments to see if Kreusler's apparatus could be adapted for the extraction of the dissolved gases in water. The first series of experiments was made with a combination of Jacobsen's and Kreusler's apparatus. Instead of Kreusler's nitrate flask I inserted a Florence flask and pear-shaped bulb. This method I found did not work well, as the pear-shaped bulb was liable to collapse when being pushed further into the Florence flask so as to establish communication between them.

The second series of experiments was carried out with the apparatus shown in the figure. The method of working the apparatus is as follows:—The bolt-head *T* is filled with

The grain of the maize plant (*Zea Mays*), which is extensively used in the manufacture of starch, can be made to furnish an oil whose properties would seem to render it suitable for several technical applications. At the suggestion of Professor E. J. Mills, I have recently examined a sample of this oil which is believed to be genuine, and the results have been embodied in the present paper.

The sample was of a bright golden colour, it had a somewhat peculiar "starchy" odour, and its taste was mild and not unpleasant.

Specific Gravity, &c.—At different temperatures the specific gravity was as follows:—

At 10° C.	0.9267
At 15° C.	0.9211
At 20° C.	0.9218

The mean coefficient of expansion (corrected for glass) between 10° and 20° C. was 0.000706.

Schaeffer (*Technologie der Fette und Oele*) gives the specific gravity at 15° as 0.9215, and Professor Mills informs me that in 1884 he found a rather coarse brown sample to have a specific gravity of 0.9262.

At -10°, according to Schaeffer, the oil sets to a solid mass. I find, however, that when exposed to intense cold, the oil becomes turbid, owing to the deposition of solid matter at -10°, and that below that temperature it becomes very viscous, but is still fluid at -20°. The precipitated solid matter is entirely redissolved on warming up again.

Bromine and Iodine Absorptions.—These were as follows:—

	Per Cent.
Bromine absorption	61.50
Iodine absorption	122.90
Iodine absorption (calculated; Br absorption $\times \frac{127}{80}$) ..	165.50

It was observed that when the bromine solution remained in contact with the oil for more than 15 minutes, the results obtained were somewhat higher, and did not agree among themselves, owing, no doubt, to a secondary oxidising action.

from 2 to 3 litres of boiled-out hot distilled water, which is kept about boiling to the end of the experiment. The syphon *n z* is filled by blowing in at *s* and allowed to run

A thick dark-coloured sample was found by Professor Mills in 1881 to have a bromine absorption of 74.42 per cent.

Saponification and Action of Alkalis.—On saponification with alcoholic potash, the total KOH absorbed was 19.34 per cent., which gives a "saponification equivalent" of 290.07.

The free acid, estimated directly by titration with $\frac{N}{10}$ soda, amounted to 0.55 per cent. in terms of KOH. On performing a check experiment, however, by placing in contact with the oil a measured excess of alkali of known strength, in presence of a little alcohol, and titrating back with standard acid, I found a much greater proportion of alkali absorbed, and examination showed this to be due to partial saponification. In order to determine how far saponification could proceed with this oil in the cold, the following experiments were carried out:—Solutions of caustic potash and soda in alcohol were prepared separately, the proportion of alkali to solvent being $5\frac{1}{2}$ per cent. in each case. Small quantities of the oil (1 to 2 grms.) were then placed in contact with a considerable excess of each of the solutions for four hours at the ordinary temperature. After that time it was found that the oil in the potash solution was completely saponified, 19.3 per cent. of KOH being absorbed, and a perfectly clear solution being obtained. On the other hand, the oil in the soda solution was only partially saponified, 10.36 per cent. of NaOH being absorbed, which is equivalent to 14.50 per cent. of KOH. In the latter case a pasty mass of soda soap, insoluble in the alcoholic solution, formed after a short time, and this may have had a retarding effect on the rate of saponification.

It was at first thought that this ready saponification in the cold might be made use of for the quantitative separation of maize oil from other oils; but while no other oil that I have examined gives such a high absorption in the cold as maize oil, many of them are undoubtedly acted upon under similar conditions, and concordant results could not be obtained.

The higher fatty acids present in maize oil seem to present no unusual features, but exact determinations as regards the proportion in which they are severally present were not made in the present instance.

The volatile fatty acids, separated by Reichert's distillation process, in 100 parts of the oil required for their neutralisation 0.56 parts of KOH.

Drying properties.—A tendency to oxidise or to gum is almost absent in this oil. No decided siccativ properties are communicated to it by simple "boiling," or by the addition of litharge to it. On passing a current of air through it for an hour at a temperature of about 150°C ., the oil becomes slightly darker in colour, and rather more viscous, but by no means to the same extent as cotton oil. If to the oil so treated a small quantity of borate of manganese is added, the oil requires to a small extent siccativ properties, and a thin film on lead dries in from 10 to 20 hours, but not completely, being tacky to the feel at the end of that time. Like cotton-seed oil the elaidin reaction gives rise to a mass having a pasty or buttery consistency.

Maumené test.—The rise in temperature when 5 cc. of strong sulphuric acid were mixed with 15 grms. of the oil was 89.0°C . For a non-drying oil this is a high figure, but it is in keeping with what may be called the "tenderness" of this oil in the presence of chemical reagents. The so-called qualitative tests for oils with sulphuric and nitric acid, &c., fail to give with maize oil reactions sufficiently characteristic to warrant their application in identifying or detecting this oil. Hence its bromine and iodine absorptions, its high Maumené figure, and the ease with which it saponifies in the cold, must be looked upon as the features by which the oil may be best recognised.

Technical applications.—Specimens of the potash and soda soaps were prepared, and both of these proved to be of good quality, being light in colour, and readily and completely soluble in water. The soda soap is distinctly

the harder of the two, but the potash soap is harder than the average "soft" soaps. Soap-making, therefore, is a use to which the oil might with advantage be put. The ease with which it saponifies, also, might make it useful to mix with other oils to accelerate their saponification. As a lubricant it might in certain cases be applicable, its low acidity, and its small tendency to deposit solid matter or to "gum," being properties that recommend it for this purpose.

The oil dissolves readily in acetone and more sparingly in alcohol or glacial acetic acid.

The following numbers represent the volume of oil dissolved by 100 vols. of the three above-mentioned solvents.

Solubility.—In 100 parts (by vol.) of—

Absolute Alcohol $t = 16^{\circ}\text{C}$.	Absolute Alcohol $t = 63^{\circ}\text{C}$.	Commercial Acetone $t = 16^{\circ}\text{C}$.	Glacial Acetic Acid $t = 16^{\circ}\text{C}$.	Glacial Acetic Acid $t = 63^{\circ}\text{C}$.
2	13	24	3	9

Viscosity.—This was determined roughly by observing the time of flow of 5 cc. of the oil through a burette with a capillary point, and comparing the results with standard oils.

$t = 18^{\circ}$ to 19°C .

—	Maize.	Olive.	Colza.	Mineral "910."
Specific gravity.	0.924	0.918	0.915	0.910
Time of flow	177.3"	211.5"	290.0"	213.5"
Viscosity.....	61.1	81.3	100	81.9
(Colza = 100)				
do. (water=1)	25.7	35.4	42.0	35.2

Maize oil thus possesses a striking individuality. In general it may be said that in properties it is somewhat akin to cotton-seed oil. At the same time there are differences between them which are very marked.

DISCUSSION.

The CHAIRMAN said that he gathered from the paper that castor oil was the nearest approach to this maize oil, and although it did not resemble it in appearance it did so by being soluble in alcohol. He wondered whether there were any particular acids present. He noticed too, that the potash soap was quite solid.

Dr. CLARK asked whether the sample of oil was obtained from the germ or from the whole maize.

Mr. SMITH, in reply to the Chairman, said that the exact determination of the acids had not been undertaken. Regarding the source of this sample of oil he could not give any particulars, but it seemed different from the sample which Professor Mills had some years ago. It, he supposed, was derived from the germ.