Phosphatides of Red Currant, Raspberry and Plum Seeds

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We occasionally find in literature that the oils of some of our soft fruit seeds have been extracted, but there is no indication that the phosphatides have ever been extracted or investigated. It was interesting to find out whether these seeds contained the same type of phosphatides as those seeds which are known to have large quantities of these phosphorus containing, fat-like substances, i.e. soya beans, ground nuts, etc., and whether the phosphatides could be extracted in the usual way.

Red currant seed oil has principally been investigated by Krzizan (1). According to his work he obtained 16-18.5% of a dark brown oil, containing a high amount of linolic and linoleic acids. It can therefore be regarded as a drying oil. Rothea (2) found that red currant seeds contain 21.34% of oil, with an I.N. of 162 and S.N. of 191. The amount of nitrogen containing material—protein—in the residue is 14.4%.

Red currant seeds are hard and difficult to crush. For my investigation I used 54.9 gr., containing 5.1% moisture. The finely powdered seeds were first extracted with petrol ether, yielding 17.6% of a dark, reddish oil. This oil does not contain any appreciable quantity of phosphatides, but it was to be expected that most of the phosphatides would remain in the seed residue. The residue was therefore extracted three times with an alcohol-benzene mixture—20:80. It has been found during previous investigations that phosphatides are bound by a kind of physical "linkage"—probably to the proteins—and that this "linkage" can only be broken by using alcohol. Alcohol alone, however, is not a good solvent for plant phosphatides since one of the components—kephalin—which usually amounts to about 60 or 70% of the whole, is insoluble in boiling alcohol. Benzene is a good solvent for all types of phosphatide components, and the alcohol-benzene mixture has proved to be an excellent method for the extraction of plant phosphatides.

This mixed solvent, however, has one disadvantage: other products besides phosphatides are also extracted by it, notably carbohydrates which are easily soluble in boiling alcohol. Therefore the solvent has to be driven off from the alcohol-benzene extract, and the dry residue extracted with petrol ether. Phosphatides are easily soluble in petrol ether and can thus be freed of carbohydrates and other impurities.

By this method another 2.349 gr.—4.28%—of a dark brown substance were extracted. This product differs considerably from the oil obtained previously, it is semi-solid when hot and solidifies to a wax-like substance when cold. A phosphorus estimation proves that it contained a rather large amount, 0.68%. If we assume that the average "pure" plant phosphatide,—composed of lecithin, kephalin, etc.,—contains 3.8% of phosphorus, the phosphatides in the crude alcohol-benzene extract amount to 17.89%. The balance is a fat which is not extracted by petrol ether alone. This too has been found in previous experiments with other seeds.

The results from these experiments are therefore as follows:

Petrol ether extract	17.60%
Oil from alcohol-benzene extract—including phosphatides	4.28%
Total fatty matter	21.88%
Total amount of phosphatides in seeds	0.76%

The fat free residue contains 3.42% N. = 21.37% protein. The quantity of phosphatides in red currant seeds is rather high.

Raspberry seeds are dealt with on two occasions in literature, Krzizan (3) and Klemont (4). Krzizan extracted 14.6% of a drying oil containing a high amount of linolic and linoleic acids. Klemont confirms these results and also mentions that the S.N. is 192 and the I.N. 157.

The procedure of extraction was the same as in the case of the red currant seeds.

The total quantity of crushed seed used was 30.8 gr., containing 5.5% moisture. The dark, yellowish petrol ether extract amounted to 15.3% and did not contain any appreciable amount of phosphorus or phosphatides. The alcohol-benzene extract was much smaller in this case than the previous one, amounting to only 1.21% of the total weight of seed. It has, however, a much higher percentage of phosphatides. It was a dark brown, waxy solid, even when hot. It contained no less than 1.72% phosphorus, which is equivalent to 45.2% phosphatides. Very rarely can a product with such a high phosphatide content be extracted directly from seed material.

The results of these experiments are therefore as follows:

Petrol ether extract	15.3%
Oil from alcohol-benzene extract—including phosphatides	1.2%
Total fatty matter	16.5%
Total amount of phosphatide in seeds	0.547%

The fat free residue contained 1.46% N. = 8.5% protein.

The oil of plum kernels has been investigated many times (5) but there is no indication that plum kernel oil has been examined for its phosphatide content (6).

The method of extracting the oil and phosphatides was the same as that previously described. The oil content was rather low, only 22.88%, but this may be due to the type of plum kernel used and the rather high moisture content of the raw material. The alcohol-benzene extract yielded a further 1.75% of

a dark brown, semi-liquid oil containing 20.5% phosphatide. The total amount of phosphatides in the fresh, wet, raw material was 0.31%.

Conclusion

It has been proved that all the tree seeds investigated contain a certain amount of phosphatides. The quantities are as follows:

Red currant seeds	0.76%
Raspberry seeds	0.55%
Plum seeds	0.31%

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Preparation and Analysis of Peanuts

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Peanuts are analyzed either to find their comparative values for grading purposes or for their actual value in terms of oil and cake to a mill crushing the nuts.

In either case the analysis must show the quantity of moisture, oil, and nitrogen present, together with the free fatty acid content of the oil. Since all of the valuable constituents are found in the kernels, the first and most obvious method of preparation for analysis was to separate the shells and kernels and determine the percentage of each. The oil and nitrogen were then determined on the kernels and calculated from those figures back to the whole nuts. Moisture was determined either on whole nuts or on the two portions.

The two main difficulties in this method were, first, that a large quantity of nuts had to be shelled before the analyst could be sure the percentages of meats and hulls were correct and, second, that proper grinding and mixing of the kernels was very difficult, if not impossible. The grinding was usually done in a mortar by hand. Despite these drawbacks, the method was in use for some time.

The next step forward was the present official method in which the whole nuts are first roughly ground in a food chopper, dried, and then ground again in a food chopper, using the peanut butter blade. This procedure was much better as it eliminated all errors arising from incorrect kernel percentage and the presence of the shell made grinding much more satisfactory by absorbing part of the oil. The resultant ground material, however, is oily and does not mix well. The method I am suggesting seems to me to eliminate all of these objections.

Since by the inclusion of the shells some of the oil was absorbed, making the mixture much more readily ground than the kernels alone, it seemed possible that the addition of a quantity of a still more absorptive material might make the mixture even more easily ground and the finished product finer and in better mechanical condition.

With this in view I thoroughly mixed with the dried, coarsely ground nuts a weighed proportion of diatomaceous earth, allowed the mixture to stand for a short time, and then ground it through the Bauer Brothers mill specified for cottonseed. The result was extremely satisfactory. The ground product was almost as fine as wheat flour and could be mixed and handled without any danger of loss of oil.

Only one precaution was found necessary. The sample must be so handled that no loss occurs. That can be accomplished by having a tight box for recovering the ground material and feeding the mill through a rather small opening in the removable cover. This method of preparation can also be applied to the analysis of the shelled nuts. In this case the diatomaceous earth is added in slightly larger proportions and a material is obtained which grinds perfectly.

The very satisfactory results obtained by this method, particularly with the shelled nuts, led to the conclusion that it would probably be a great help in the preparation for analysis of tung nuts and possibly for copra or palm kernels. We have, however, made no experiments along that line.

One of the greatest advantages of the proposed method for peanuts is that the regrinding during the extraction period is unnecessary. The present method requires that the extraction be taken down after two hours, reground, and re-extracted for three additional hours. The mechanical condition of the samples ground with the diatomaceous earth is such that a complete removal of the oil takes place in a straight four-hour extraction. This amounts to a saving of time and labor that considerably outweighs the slight extra trouble in preparation. Our experience also shows that duplicate portions of nuts prepared in this manner agree more closely for both oil and ammonia. This necessitates fewer rechecks.

In order to simplify the calculation, a quantity of the mixture is weighed that will give exactly 2.0 grams of the nuts for oil and 1.401 grams for nitrogen. A second moisture is run on the ground material as a basis for recalculation to the original basis.

We have analyzed a series of peanut samples by both the present official method and the proposed method, in each sample a single portion of the roughly ground nuts having been divided and used as the material for both methods of analysis. The results by the two methods are in very close agreement—in fact, much better agreement than seems possible to obtain from duplicate portions of the whole nuts analyzed by either method.

One reason for the latter variation, we believe, is the fact that some shelled nuts are almost always