J Am Oil Chem Soc (2010) 87:835–836
DOI 10.1007/s11746-010-1558-1

LETTER TO THE EDITOR

Rapid Oil Extraction from Potato Chips

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Received: 8 December 2009 / Revised: 1 February 2010 / Accepted: 9 February 2010 / Published online: 5 March 2010

Sir:

Total or crude fat determination is a common analytical technique in proximal analysis and lipid chemistry. This is done traditionally by Soxhlet or Goldfisch extraction. Both are solvent extraction methods which require hours of solvent reflux extraction. A long extraction may be necessary when lipids are well embedded into tissues and the surface area to weight ratio is low. However, many food materials may have oil that can be readily extracted without such exhaustive solvent extraction. Development of simple, practical, rapid extraction techniques would be more cost effective, particularly when dealing with large numbers of samples.

Such techniques have been developed for small particle lipid bearing materials. Clark and Snyder [1] developed a rapid 1 min equilibrium extraction method of a 1–2 g sample to determine total oil content in soy flour with hexane at ambient temperature that produced results similar to those obtained by Goldfisch extraction. This allowed the rapid screening of a large number of soybean cultivars. Similarly, total oil in 2 g of rice bran samples was obtained by a rapid 1 min hexane or isopropanol extraction that produced the same results as Goldfisch extraction [2]. This method allowed large number of rice bran samples to be quickly extracted for free fatty acid determination by wet chemistry to obtain a diffuse reflectance FTIR chemometric model of the free fatty content [3]. Similarly, the total surface oil on milled rice was determined by rapid solvent extraction [4].

We have recently produced conjugated linoleic acid (CLA) rich soy oil with approximately 20% CLA [5] and have used this oil to prepare American potato chips that contains oil with a similar CLA content, as measured by GC-FID [6]. In order to develop an attenuated total FTIR method to directly determine CLA in the chips we needed to quickly extract oil for CLA content determination by GC-FID from many samples, to develop a FTIR calibration model from the oil spectra of potato chips. The objective of the following study is to determine if potato chip total oil as measured by a rapid solvent extraction produces the same results as Soxhlet extraction. This rapid extraction would then be used instead of Soxhlet extraction to develop an FTIR calibration model and show that rapid extraction is a viable commercial alternative to Soxhlet extraction for industrial oil analysis in chips.

Potato chips were made using Russet potatoes obtained from a local grocery store. Approximately 300 g of potatoes were peeled, and sliced to 60–100/100th of an inch and were washed for 5 min using distilled water. The chips were then dried using a paper towel. The potato chips were fried in a *Presto Frybaby* fryer using 300 g of CLA rich soybean oil. Chips were fried for 3 min at 175 °C. The process was performed in duplicate.

Approximately, 2-g duplicate samples of freshly prepared potato chips were crushed and filled in centrifuge tubes and mixed with 30 mL of petroleum ether (boiling point 30–60 °C) [2]. Duplicates were vortexed for 1, 2, 5 and 10 min. The solvent and potato chip mixture was then centrifuged for 5 min at 1,700 rpm. The mixture was then filtered using Whatman filter paper number 4. The final weight of the potato chips after extraction was then measured. The weight difference in the potato chips

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Table 1 Oil extracted from 2 g of potato chips by petroleum ether (boiling point 30–60 °C) rapid vortex extraction, relative to a control Soxhlet extraction

Extraction time	Mean oil extracted (g) per gram of potato chips	Control (%)
1	0.44 ± 0.006[a]	96
2	0.46 ± 0.007[a]	100
5	0.45 ± 0.003[a]	98
10	0.46 ± 0.014[a]	100
Control (Soxhlet extraction)	0.46 ± 0.017[a]	100

Means are expressed with the standard error of the mean

[a] Numbers with the same letter in the same column are not statistically different ($p = 0.43$)

(corresponding to weight of the extracted oil) was then calculated.

As a control experiment, approximately 2 g of the potato chips was weighed accurately and placed in a cellulose thimble and the initial weight of potato chips was measured. The solvent used for the extraction of oil was 30 mL of petroleum ether (boiling point 30–60 °C). The Soxhlet extraction was performed in duplicate. The final weight of the potato chips after oil extraction was measured. The weight difference in the potato chips before and after extraction was used to determine the amount of extracted oil. One way ANOVA was performed using JMP 7.0.2 software. The difference between the treatment means were studied using Student's t distribution at an alpha level of 0.05.

Table 1 shows that the amount of oil extraction by rapid extraction was not statistically different than that obtained by Soxhlet extraction, for all the rapid extraction times. Therefore, a rapid solvent extraction is a valid alternative technique for determining total oil from potato chips.

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