C02

Cheese Chemistry Program

6-04-19 (Shipment Date)

7-12-19 (Report Issue Date)



Proficiency Testing Provider Certificate 1782.01

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Report Authorization

This report has been authorized by Arlene Fox, Senior Director of the AOAC laboratory Proficiency Testing Program.

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REPORT TO PARTICIPANTS IN THE AOAC® LABORATORY PROFICIENCY TESTING PROGRAM CHEESE CHEMISTRY PROGRAM

SITE IDENTIFICATION:

1.0 Introduction

Test materials for the Cheese Chemistry Program were shipped to participants on June 4, 2019. Each laboratory was given a site identification number in order to maintain confidentiality. An instruction packet on how to use the confidential online data submission system was also included in the shipment. The participants were to submit an electronic response online to verify the condition of the test materials upon receipt. Participants were also instructed to report methods and results electronically. Participants were instructed to analyze the test materials according to procedures routinely used in their laboratories. The results were to be recorded and submitted to AOAC INTERNATIONAL by June 19, 2019.

2.0 Preparation of Test Materials

Each set of test materials included two samples, each containing approximately 70 grams of a processed cheese sample. The samples were duplicate samples.

Ten quantitative samples were randomly selected and analyzed in duplicate to verify the homogeneity of the test material (Appendix D) for fat, moisture, calcium, and potassium. The requirements of ISO/IEC Standard 17043:2010(E) Conformity Assessment - General requirements of proficiency testing schemes were met.

Samples were prepared by the following laboratory:

Silliker Solution Center 3600 Eagles Nest Drive, Bldg. A Crete, IL 60417

3.0 Analyses Requested

% Moisture	Iron (ppm)
% Fat (Gravimetric)	% Calcium
% Fat (Gas Chromatography)	Calories (cal/100 g)
% Protein	% Lactose*
% Ash	% Galactose*
% Carbohydrate (By calculation)	% Phosphorus
Cholesterol (mg/100 g)	% Saturated Fat
% Sodium	% Monounsaturated Fat
% Salt	% Polyunsaturated fat
Potassium (ppm)	% Trans Fatty Acids (% of the total sample)
Magnesium (ppm)	рН *

* Currently not under scope of accreditation.

The participants had the option of marking the analysis as "Not Tested" for any test. Information on the method used for each analyses was requested.

4.0 Calculation and Interpretation of z-scores:

For each individual result, a z-score was calculated as follows:

$$z = \frac{(x - X)}{s}$$
where:

- z = the z score (standard score)
- x = the reported value of analyte
- X = the assigned value, the best estimate of the "true" concentration
- s = the estimate of variation (standard deviation)

The robust procedure from *ISO 13528:2005 (E), Statistical methods for use in proficiency testing by interlaboratory comparisons* is used in processing the result data. Robust statistics relies on <u>medians</u> rather than <u>means</u>, and uses more information from the central than from the outlying observations. This approach is being used to minimize the effect of

extreme results on the calculation of z-scores. There are two types of extreme results in these analyses: "Blunders" and "Outliers". Blunder results were likely due to errors, such as transcription errors, incorrect sample identification, or a major problem performing the analysis. Blunders are defined as results that differ from the initial median of the participant's by a factor of 2. These results have been labeled as "pre-screened as an outlier."

The assigned value was determined by the consensus of the majority after the removal of outliers by the robust procedure. Outlier results have been labeled "Outlier: Z beyond 3". The assigned value, standard deviation, and the z-scores were recalculated without the outliers. The blunder results and outlier results were still evaluated within the proficiency scheme and given the appropriate performance rating. Measurement uncertainty (standard uncertainty of the assigned value) has also been provided.

The following interpretation of z-scores for each individual test result is provided in of ISO/IEC Standard 17043:2010(E) Conformity Assessment - General requirements for proficiency testing schemes common examples of application of z-scores:

Results Obtained	<u>Rating</u>
z 2	Satisfactory
2 < z < 3	Questionable
z 1í 3	Unsatisfactory

AOAC has calculated z-scores according to methodology for the % Moisture. All statistics for the % Moisture have been computed according to methodology when more than 10 participants specified the same method. When participants specified a method used by fewer than 10 participants (O for % Moisture OF for % Fat and OP for % Protein), z-scores for their results were based on all results for the specific analysis. Calculations for z scores based on the data presented in the results sheet might be slightly different from the z-scores assigned by AOAC. The z-scores assigned by AOAC are based on calculations that use more significant figures than is possible to display on the results sheet.

5.0 Results

5.1 General Discussion of Results

Confidentiality of results will be maintained by issuing site identification codes to the participants. Results in reports will only be identified by the site identification code. AOAC believes its participants should be evaluated based on only those samples which pass all the rigorous testing and ISO 13528 criteria (for homogeneity, stability, and participant results). Zscores have been provided for moisture, fat (gravimetric), protein, ash, and salt. AOAC requires at least 12 data points, without blunders, for z-scores to be provided for an analyte. All available information on the distribution of results for the analytes has been provided. Some tests had fewer participants submitting results because some of the laboratories do not routinely perform all the analyses. At the recommendation of food and nutrition experts the carbohydrate analyses will not be used for evaluation. Results for % Saturated, % Monounsaturated, % Polyunsaturated, and % Trans Fatty Acids should be presented as % of the total sample, not % of total fat. Analyses % Lactose and % Galactose are currently not under AOAC INTERNATIONAL's scope of accreditation. The assigned value was determined by the consensus of the majority after the outliers were removed.

On the result page the Z-score calculation is now bolded and is listed in the second to last data column on the result page.

AOAC is instituting an approach to provide information on the performance of the different methods used by participants. Results from equivalent methods have been grouped together. More specific method information will be requested from participants in the future. Participants will have to make sure that their method number is correctly transcribed so that their results are scored with the right group in the future. Participants must follow an appropriate method for a cheese matrix.

If a participant would like to appeal against the assessment of their performance in this proficiency testing scheme please contact staff at <u>LPTP@AOAC.org</u>

Individual laboratory results are in Appendix A

Moisture:

The table below indicates which methods were grouped together for statistical computation of % Moisture. There was an insufficient number of participating laboratories using Method B (AOAC 948.12.) and Method C (*Standard Methods for Examination of Dairy Products*). Therefore, results have not been calculated specifically based on Methods B and C.

% Moisture Method Indicated in Individual Result Section	% Moisture Methods Included
Method A	Method A includes AOAC 926.08.
Method O*	All Other Methods

* When participants specified a method used by fewer than 10 participants (O for % moisture), z-scores for their results were based on all results for the specific analysis.

A table has been provided to compare the standard deviations and assigned values for the various methods. There is inadequate data to compare Method A to Method O, because Method O represents all other methods.

% Moisture	Sample 1	Sample 2
Method A Standard Deviation	0.233	0.141
Method O Standard Deviation	0.432	0.331
Method A Assigned Value	52.96	52.84
Method O Assigned Value	53.05	52.94

Fat (Gravimetric Method):

There were insufficient laboratories using a specific method for the Fat analyses, therefore fat results for this round are based only on method "OF" (All Other Methods).

Protein:

There were insufficient laboratories using a specific method for the Protein analyses, therefore protein results for this round are based only on method "OP" (All Other Methods).

5.2 Discussion of Data Plots

z-Score Plots

z-score plots allow a visual comparison of z-score results from each separate laboratory against the entire distribution of all data for a given test. These plots are made up of three components. For each sample, the leftmost "stripe" is the entire set of reported z-scores. Each separate value is a thin horizontal line. Tightly clustered values show as dense, dark areas. The entire distribution can be seen spread above and below the mean of zero. A box-whisker plot is included to focus attention on several well known descriptors, notably the median and the upper and lower quartiles (25th and 75th percentiles). The box in these plots itself represents the middle 50% of the data, while the whiskers give a sense of reasonable tails. Inside the box, the median is indicated by a horizontal line. The top whisker goes up to the largest data point which lies no further than 1.5 box-heights from the top of the box. The bottom whisker is analogous. The large black dot locates the individual z-score derived from the original value reported by the lab for each sample.

Distribution of Results Plots

For a given test, the minimum and maximum of all results (all samples combined) determine the range. The numbers of reported results falling into each bin are counted. The bars depict these counts as percentages of the total for each sample.

Individual laboratory Plots are in Appendix B

Appendix C

Instructions -CO2 Cheese Chemistry Proficiency Testing Program

Enclosed are two samples, each containing approximately 70 grams of processed cheese. Samples should be stored frozen until analysis at 4 ° Celsius.

RESULTS ARE DUE ON JUNE 19, 2019

If applicable to your laboratory, analyze each of the samples for the following:

- 1. % Moisture
- 2. % Fat (gravimetric and/or gas chromatography)
- 3. % Protein Use protein factor 6.38
- 4. % Ash
- 5. % Carbohydrate (by calculation)
- 6. Cholesterol (mg/ 100 g)
- 7. % Sodium
- 8. % Salt
- 9. Potassium (ppm)
- 10. Magnesium (ppm)
- 11. Iron (ppm)
- 12. % Calcium
- 13. Calories (cal/100g)
- 14. % Lactose *
- 15. % Galactose *
- 16. % Phosphorus
- 17. % Saturated Fat
- 18. % Monounsaturated Fat
- 19. % Polyunsaturated Fat
- 20. % Trans Fatty Acids
- 21. pH *
 - * Not Under current scope of accreditation New Analyte

If you need assistance at any time, please contact Proficiency Testing Staff at LPTP@AOAC.org

Appendix D Cheese Chemistry (C02) Processed Cheese (Kraft Velveeta - 2% Milk) Homogeneity Analysis Sample Ship Date June 4, 2019

Fat (Acid Hydrolysis Mojonnier) %

Moisture (Vacuum Oven) %

Calcium (ppm)

Potassium (ppm)

	Fat 1,2 -	Fat 1,2 -					
Sample #	Rep 1	Rep 2					
1	9.75	9.67					
2	9.58	9.45					
3	9.46	9.16					
4	9.54	9.79					
5	9.47	9.60					
6	9.55	9.93					
7	9.88	9.43					
8	9.57	9.72					
9	9.75	9.62					
10	9.70	9.76					
Average (x̄)	9.62						
S _x	0.13						
S _w	0.17						
Ss	0.05						
	PASSED						

	Moist. 1,2 -	Moist. 1,2 -					
Sample #	Rep 1	Rep 2					
1	52.74	52.46					
2	52.78	52.66					
3	52.67	52.67					
4	52.32	52.64					
5	52.91	52.71					
6	52.63	52.90					
7	52.66	52.80					
8	52.63	52.80					
9	52.67	52.45					
10	52.37	52.72					
Average (x̄)	52.66						
S _x	0.11						
Sw	0.16						

0.00

PASSED

Ss

	Calcium 1,2	Calcium 1,2
Sample #	- Rep 1	- Rep 2
1	8,770	8,420
2	8,400	8,380
3	8,460	8,390
4	8,290	8,610
5	8,370	8,360
6	8,360	8,270
7	8,580	8,490
8	8,490	8,410
9	8,480	8,470
10	8,150	8,590
Average (x̄)	8,437	
S _x	83.84	

0	Potassium	Potassium
Sample #	1,2 - Rep 1	1,2 - Rep 2
1	3,590	3,470
2	3,480	3,300
3	3,480	3,420
4	3,480	3,410
5	3,460	3,450
6	3,370	3,390
7	3,450	3,430
8	3,450	3,420
9	3,400	3,550
10	3.440	3.410

erage (x̄)	8,437
	83.84
	149.43
	0.00

 S_w

 S_s

PASSED

-	-, -
Average (x̄)	3,443
S _x	42.11
S _w	63.44
S _s	0.00
	PASSED

Appendix A C02 Quantitative Results 06/04/2019

				Number						Accienced			Standard uncertainty	
			Reported	reported	Minimum	Lower		Upper	Maximum	Assigned value	Standard		assigned	
Site ID Test	Sample	Method	result	results	result	quartile	Median	quartile	result	(Mean)	deviation 2	Z-score	value	Notes
xxxxx % Moisture xxxxx	1	А	52.81	10	52.63	52.81	52.98	53.10	53.33	52.96	0.233	-0.64	0.092	
	2	А	52.85	10	52.41	52.75	52.83	53.05	53.38	52.84	0.141	0.04	0.056	
% Gravimetric Fat	1	OF	9.51	15	8.72	9.33	9.55	9.82	10.02	9.53	0.352	-0.06	0.114	
	2	OF	9.64	15	8.50	9.08	9.67	9.75	10.01	9.59	0.314	0.15	0.101	
xxxxx % Gas Chromatography Fat	1		9.51	4	7.92	8.51	9.15	9.36	9.51	9.12	0.390		0.244	
	2		9.64	4	7.72	8.34	9.06	9.40	9.64	9.01	0.630		0.394	
xxxxx % Protein	1	OP	16.41	14	16.41	16.50	16.72	16.91	17.13	16.71	0.222	-1.35	0.074	
	2	OP	16.44	14	16.10	16.44	16.63	16.78	17.02	16.62	0.246	-0.73	0.082	
xxxxx % Ash	1		6.64	12	6.45	6.57	6.63	6.68	6.73	6.62	0.077	0.22	0.028	
	2		6.67	12	6.46	6.60	6.64	6.67	6.69	6.64	0.049	0.71	0.018	
xxxxx % Carbohydrate	1		14.63	8	13.52	13.58	14.48	14.74	14.86	14.30	0.590	•	0.261	
	2		14.40	8	13.82	13.94	14.32	14.69	14.95	14.33	0.480		0.212	
xxxxx mg/100 g Cholesterol	1		30.04	5	30.04	32.00	38.00	40.43	44.90	37.07	6.912	•	3.864	
	2		30.29	5	30.10	30.29	37.00	40.99	42.60	36.20	6.629	•	3.706	
xxxxx % Sodium	1		1.39	6	1.33	1.34	1.38	1.42	1.61	1.38	0.058	•	0.030	
	2		1.43	6	1.35	1.36	1.40	1.46	1.66	1.41	0.066		0.034	
xxxxx % Salt	1		1.71	14	1.71	1.78	1.83	1.84	2.54	1.82	0.047	-2.33	0.016	
	2		1.73	14	1.66	1.74	1.83	1.84	2.50	1.82	0.053	-1.73	0.018	
xxxxx ppm Potassium	1		3445.90	5	3340.00	3445.90	3500.00	3989.00	7249.00	3484.2	146.841		82.087	
	2		3592.47	5	3430.00	3580.00	3592.47	4082.00	4576.00	3702.0	270.594		151.267	
xxxxx ppm Magnesium	1		358.27	5	358.27	362.00	376.00	382.00	559.00	377.08	22.036		12.318	
	2		391.11	5	366.00	369.00	391.11	403.00	418.00	389.42	25.163		14.067	
xxxxx ppm Iron	1		4.01	5	0.00	4.01	4.98	5.00	9.00	5.02	0.964		0.539	
	2		4.02	5	0.00	2.48	4.02	5.00	5.40	4.35	1.229		0.687	
xxxxx % Calcium	1		0.86	6	0.74	0.82	0.83	0.86	0.87	0.83	0.036	•	0.019	
	2		0.85	6	0.71	0.81	0.85	0.85	0.88	0.84	0.033		0.017	
xxxx Number of Calories	1		210.00	7	208.00	208.00	210.00	210.00	212.00	209.44	1.687	•	0.797	
	2		210.00	7	207.90	209.00	211.00	211.00	213.00	210.54	1.627	•	0.769	
xxxxx % Lactose	1		8.91	6	7.48	7.96	8.56	9.16	9.30	8.50	0.828	•	0.423	
	2		8.94	6	7.32	8.01	8.44	8.94	9.24	8.41	0.781	•	0.399	
xxxxx % Galactose	1		Not tested	2	•						•	•		
	2		Not tested	2	•						•	•		
xxxxx % Phosphorus	1		1.11	5	0.97	1.01	1.03	1.11	1.46	1.06	0.089	•	0.050	
	2		1.09	5	1.00	1.01	1.01	1.09	1.27	1.02	0.017	•	0.009	
xxxxx % Saturated Fat	1		3.57	5	3.57	4.80	4.99	5.19	5.26	4.96	0.331	•	0.185	
	2		3.57	5	3.57	4.69	5.02	5.17	5.21	4.94	0.317	•	0.177	
xxxxx % Monounsaturated Fat	1		4.23	5	2.38	2.56	2.61	2.98	4.23	2.73	0.350		0.196	
	2		4.42	5	2.30	2.51	2.59	2.98	4.42	2.72	0.428		0.239	

Appendix A C02 Quantitative Results 06/04/2019

Number of									Standard uncertainty of the					
Site ID_Test	Sample Method	Reported result	reported results	Minimum result	Lower quartile	Median	Upper quartile	Maximum result	value (Mean)	Standard deviation	Z-score	assigned value	Notes	
xxxxx % Polyunsaturated Fat	1	1.35	5	0.47	0.56	0.58	0.64	1.35	0.57	0.074		0.042	2	
	2	1.38	5	0.46	0.55	0.57	0.63	1.38	0.56	0.074		0.042	0.042	
xxxxx % Trans Fatty Acids	1	0.06	5	0.06	0.25	0.27	0.28	0.33	0.28	0.028		0.015	0.015	
	2	0.06	5	0.06	0.24	0.27	0.27	0.32	0.27	0.029		0.016	5	
ххххх рН	1	Not tested	12	5.69	5.75	5.89	5.94	6.31	5.87	0.160		0.058	0.058	
	2	Not tested	12	5.72	5.76	5.79	5.94	6.30	5.82	0.092		0.033	3	

C02 06/04/2019 Z-score distribution analysis 07/09/2019 21:55:33 Site ID=xxxxx Test=% Moisture Method=A



Sample Number

Your results (dot) compared with all reported results

21:55 Tuesday, July 9, 2019

C02 06/04/2019 Z-score distribution analysis 07/09/2019 21:55:33 Site ID=xxxxx Test=% Gravimetric Fat Method=OF 07/09/2019 21:55:33



Sample Number

Your results (dot) compared with all reported results



Sample Number

Your results (dot) compared with all reported results



Sample Number

Your results (dot) compared with all reported results



Sample Number

Your results (dot) compared with all reported results

07/09/2019 21:55:33

C02 06/04/2019

Site ID=xxxxx Test=% Moisture Method=A



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C02 06/04/2019 07/09/2019 21:55:33 Site ID=xxxxx Test=% Gravimetric Fat Method=OF



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Site ID=xxxxx Test=% Gas Chromatography Fat Method=' '



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07/09/2019 21:55:33

Site ID=xxxxx Test=% Protein Method=OP



C02 06/04/2019 07/09/2019 21:55:33

Site ID=xxxxx Test=% Ash Method=' '



C02 06/04/2019 07/09/2019 21:55:33

Site ID=xxxxx Test=% Carbohydrate Method=' '



C02 06/04/2019 07/09/2019 21:55:33 Site ID= xxxxx Test=mg/100 g Cholesterol Method=' '



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Site ID=xxxxx Test=% Sodium Method=' '









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Site ID= xxxxx Test=ppm Potassium Method=' '



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Site ID= xxxxx Test=ppm Magnesium Method=' '



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Site ID=xxxxx Test=ppm Iron Method=' '



C02 06/04/2019 07/09/2019 21:55:33

Site ID= xxxxx Test=% Calcium Method=' '



C02 06/04/2019

07/09/2019 21:55:33

Site ID= xxxxx Test=Number of Calories Method=' '



C02 06/04/2019 07/09/2019 21:55:33

Site ID=xxxxx Test=% Lactose Method=' '



C02 06/04/2019

07/09/2019 21:55:33

Site ID=xxxxx Test=% Phosphorus Method=' '



C02 06/04/2019 07/09/2019 21:55:33

Site ID=xxxxx Test=% Saturated Fat Method=' '

C02 06/04/2019

07/09/2019 21:55:33

Site ID=xxxxx Test=% Monounsaturated Fat Method=' '

C02 06/04/2019

07/09/2019 21:55:33

Site ID=xxxxx Test=% Polyunsaturated Fat Method=' '

C02 06/04/2019 07/09/2019 21:55:33

Site ID=xxxxx Test=% Trans Fatty Acids Method=' '

