

Applications Note

FAT IN CHOCOLATE AND COCOA PRODUCTS

Introduction

The wide measuring range of the GPR 12-70 or PTR 46 Automatic Refractometers (1.32 to 1.68 RI) combined with their speed and ability to measure dark samples with ease make the instruments ideal for the determination of total fat content in chocolate and cocoa liquors. The following method is based on the official IOCCC method* and is being used by leading producers of chocolate and cocoa products worldwide. We acknowledge the help of users such as Barry Callebaut (UK) Ltd for their permission to reproduce it here.

Health & Safety

Always work for a safe environment, taking note of hazard warnings, etc. on reagent containers and equipment as appropriate. If in doubt consult your Laboratory supervisor or Safety Officer before starting.

Application

This method applies to the determination of fat content in chocolate and cocoa liquor.

Equipment required

- Small metal crucible
- Weighing balance (accuracy 0.0001gm)
- Burette of suitable volume for dispensing 1-Bromonaphthalene
- Glass rod
- Small glass funnel
- Filter paper (Whatman No 2 or equivalent) of appropriate size
- Small beaker for collecting filtrate
- Thermocirculator
- GPR 12-70 Automatic Refractometer fitted with FC1 hinged sample cover **OR**
- PTR 46 with Peltier cell internal temperature control

Reagents

- 1-Bromonaphthalene (General Purpose Reagent grade)

When using this reagent follow the Health and Safety advice given by the supplier.

Method

a) Preparation

Connect the refractometer to the thermocirculator and place in a draught free position. Ensure the instrument has been switched on for long enough to come to a stable operating temperature. See Operators Handbook for more information if required.

Adjust the temperature so that the refractometer display indicates a temperature of $25^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$

Ensure that the instrument prism is scrupulously clean and that it is zeroed correctly. Ensure that the 'One Shot and Lock' delay has been set to 10 seconds. See Operators Handbook for more information if required.

Weigh approximately 2 gms (± 0.2 gm) of liquid sample in the crucible and note the exact weight: **W1**.

Add 3ml of 1-Bromonaphthalene from the burette and note exact weight: **W2**.

Disperse the total sample into the solvent, missing with the glass rod. This must remain in the crucible. No sample particles must remain on the side. Crush any lumps using the glass rod to ensure they are dispersed.

Leave for at least 15 minutes.

Prepare a funnel with a paper filter above a suitable beaker or another empty crucible.

Mix the dispersion again with glass rod and pour the total mix into the filter.

Collect the filtrate in the second container.

Using a plastic pipette apply approximately 0.5 ml of the filtrate onto the refractometer prism, close the hinged cover carefully to avoid air bubbles being trapped. Press PRINT on the display. The timer on the screen will count down to zero before measuring the sample and displaying the result and measuring temperature.

NB. If the message UNABLE TO READ appears on the display during the countdown period, lift the hinged cover, check there is sufficient sample on the prism and that there are no trapped air bubbles. On closing the lid the countdown will continue.

Repeat the measurement to confirm the result (**= a**)

b) Reference value for calculation

Ensure the prism is clean and apply approximately 0.5ml of 1-Bromonaphthalene, measure in the same way as the sample and note the value. (**= b**)

Calculation

Calculate: (**b - a**) \times 10,000

This will give a three figure number. (**= c**)

From the table, find (in column **n**) the nearest lower number to c.

Read the number in the adjacent % column and note it. (**= d**)

Example: Calculate (**c**) - 368. Nearest lower number = 360, Adjacent % column (**d**) - 31.3
Note the number immediately below **d**, in this case 11 (**e**)

To calculate the total fat content

Find difference between c and the nearest lower number,.

Multiply difference \times (**e**), divide by 100 and add to (**d**)

Example: if c—368, nearest lower number equals 360, difference = 8
 $8 \times 11 = 88$, divide by 10 = 0.88
 $0.88 + 31.3 = 32.18$

This gives the result in case of analysis with exactly 2 gms of sample and 3ml of Bromonaphthalene.

If not:

$$\text{Fat content (\%)} = \text{approximate fat content} \times \frac{2}{44.4742} \times \frac{W2}{W1}$$

W2 = weight of 1-Bromonaphthalene dispensed
W1 = exact weight of sample (say 1.9587 gm)
4.4742 = exact weight of 3ml-Bromonaphthalene at 20°C

Example: **W2** = 4.5124
W1 = 1.9587

$$\text{Fat content (\%)} = 32.18 \times \frac{2}{4.4742} \times \frac{4.5124}{1.9587}$$

Fat content (%) = 33.14%

See next page for look up table.

*OICCC - Office International du Cacao, du Chocolat et de la Confiserie, Brussels.
"Determination of Fat in Cocoa Products", page 8/a, 1972 edition.

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For further information on the use of Index Instruments refractometers or applications advice please contact us direct or through your local appointed distributor.

n	%	n	%	n	%	n	%
1	0.07	200	15.89	400	35.711	600	61.515
10	0.77	210	16.79	410	36.811	610	63.015
20	1.47	220	17.69	420	37.912	620	64.515
30	2.17	230	18.59	430	39.112	630	66.016
40	2.98	240	19.49	440	40.312	640	67.616
50	3.68	250	20.39	450	41.512	650	69.216
60	4.47	260	21.210	460	42.712	660	70.817
70	5.18	270	22.210	470	43.912	670	72.517
80	5.98	280	23.39	480	45.113	680	74.217
90	6.78	290	24.110	490	45.413	690	75.917
100	7.57	300	25.110	500	47.713	700	77.617
110	8.28	310	26.110	510	49.013	710	79.317
120	9.09	320	27.110	520	50.313	720	81.018
130	9.98	330	28.111	530	51.614	730	82.819
140	10.78	340	29.210	540	53.014	740	84.719
150	11.58	350	30.211	550	54.414	750	86.619
160	12.39	360	31.311	560	55.814	760	88.519
170	13.28	370	32.410	570	57.214	770	90.420
180	14.09	380	33.411	580	58.614	780	92.420
190	14.99	390	34.512	590	60.015	790	94.4

Source: Cacao Barry (UK) Ltd