Fat-Scale

(Program Number 130.1AK)

The ATR-W2 can determine the fat content directly using the method of LEITHE. The proceeding is, that the sample is reduced to small pieces (perhaps using sea sand) and mixed with bromonaphthalene. The mixture of this solvent and the fat is extracted (filtered) and measured on the refractometer.

Consider a mixture of two samples with refractive index r_1 and r_2, respectively. The quantities of the components are m_1 and m_2. The refractive index r_3 of this mixture can be calculated using the following formula, which is somewhat simplified, but sufficiently accurate for the fat - bromonaphtalene system:

$$m_1 \cdot r_1 + m_2 \cdot r_2 = (m_1 + m_2) \cdot r_3$$

In this special case the formula can be written as

$$m_{Fat} = m_{Bromn.} \cdot (r_{Bromn.} - r_{Mix.}) / (r_{Mix.} - r_{Fat})$$

The formula used in the ATR-W2 is:

$$Scale\_Value = (C1 - RI) / (RI - C2) \cdot C3$$

Where as:

RI	refractive index of bromonaphtalene - fat filtrate
C1	refractive index of bromonaphtalene (about **1.6583**)
C2	refractive index of pure fat (about **1.4647** for cacao butter)
C3	a scaling factor

If the Fat Scale is intended to give the per cent content of fat, the scaling factor is determined as follows:

$$C3 = Volume_{Bromn.} \cdot Density_{Fat} / Weight_{Sample} \cdot 100.0$$

The density of cacao butter is about 0.913. If the customer takes 2 g of sample per 3 ml of bromonaphthalene, the scaling factor would thus be **136.95**.

Using the Fat Scale in the ATR-W2 is very simple. With function key „4-Calibrate“ the measurement of the refractive index of pure bromonaphtalene is started. This value (which is C1 of the formula above) is automatically stored. The other two values can be changed in the Menu under “Scales”. To simplify the procedure, a linear temperature correction factor C4 is defined. A change in the temperature will affect the refractive index of the mixture in a similar way than the pure bromonaphtalene, so that a change in the temperature during the measurements will not require a new measurement of the solvent. Those deviations can not occurre
If a customer has two alternative procedures, differing in the quantity of sample for example, he has to use two sets of factors of course. But it is not necessary to give in the new factors whenever changing between the procedures. The customer can define an own fat scale (Modules „Fat[1]“, „Fat[2]“ etc.) with an own display configuration (Module „Display[1]“, „Display[2]“ etc.) for every procedure. With the function key „Display“ he can then change between those scales by switching between the display configurations.

The following example spreadsheet indicates some refractive index (RI) for fat at different relative concentration (%).
These values apply for a temperature of 20°C and a weighted sample of 2 g relative to 3 ml Bromnaphtalin.

Fett	RI
0.0 %	1.65830
5.0 %	1.65148
10.0 %	1.64512
15.0 %	1.63919
20.0 %	1.63363
25.0 %	1.62841
30.0 %	1.62351
35.0 %	1.61889
40.0 %	1.61454
45.0 %	1.61042
50.0 %	1.60652
55.0 %	1.60283
60.0 %	1.59932
65.0 %	1.59599
70.0 %	1.59282
75.0 %	1.58979
80.0 %	1.58691
85.0 %	1.58416
90.0 %	1.58153
95.0 %	1.57901
100.0 %	1.57659

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