

**EVALUATION OF THE INSTRUMENT « MOPLANT »**

Moplant, manufactured by Hettich Benelux (Netherlands), is an instrument which allows the carrying out of some steps of the fat by extraction according to RG or SBR methods determination procedures in milk and dairy products.

This instrument combines a Mojonnier centrifuge (16 places), 2 compartments with heating plates for the evaporation of solvents, 2 drying chambers and 2 cooling chambers at room temperature. A vacuum system allows capture of vapours and removes them outside through an evacuation pipe put under a solvent fume chamber. A vacuum pump allows reduction of the pressure inside the chambers.

The objective of this study is to evaluate the possibility to replace the evaporation and drying (at constant weight) steps of the RG and SBR methods by the Moplant, becoming an alternative method.

**The tests**

The evaluation tests were carried out in ACTALIA Cecalait physico-chemistry laboratory (reference and instrumental analyses) in October and November 2016. The repeatability and the accuracy of the alternative method were evaluated for the determination of fat in milk (according to ISO 1211), in cream (ISO 2450), in dried milk (ISO 1736) and in cheese (ISO 1735).

**1-MATERIALS AND METHODS USED****1.1- Material**

The material used for the reference method is in accordance with the ISO standards. The laboratory uses glass tubes for the extraction and the tests were performed using 90 x 30 mm aluminium dishes with lids to collect the solvent.

Any specific consumable is necessary for the « Mo Plant » method. The extractions were performed using glass tubes, so the Mojonnier centrifuge was not used for these tests.

**1.2- Procedure**

General principle: Each sample was analysed in duplicate for each method (alternative and reference).

The 2 methods were performed in parallel for each sample: in the same set, 4 tubes for each sample; 2 tubes followed the end of the reference method procedure, and the 2 other one followed the alternative method procedure.

Please note, the beginning of the procedure (extraction and test portion) was the same for the both methods.

Evaporation process – drying of the alternative method using Mo-Plant:

- Place the empty dishes in the chamber at 110°C at reduced pressure (-0.8 bars) for 5 minutes.
- Place the dishes in the chamber at room temperature and let cool for 7 minutes.
- Weigh the dishes to the nearest 0.1mg.
- After transfer of the solvents in the dishes, place them on the heating plates at 110°C for the necessary time of complete evaporation of the solvent in the dish (about 10-15 mn). Proceed by progressive contact with the plate to avoid potential splashes. Proceed identically for the 3 extractions.
- Place the dishes in the chamber at 110°C at reduced pressure (-0.8 bars) for 5 minutes.
- Place the dishes in the chamber at temperature room and let cool for 7 minutes.
- Weigh the dishes to the nearest 0.1mg (1 blank sample per set was also performed according to this principle).

Calculate the fat content according to the following formula:

$$\text{Fat (\%)} = 100 \times [(M2_e - M0_e) - (M2_b - M0_b)] / M1$$

M0<sub>e</sub> and M0<sub>b</sub>: mass of the empty dish after respectively drying of the sample and the blank sample (to the nearest 0.1 mg)

M1: mass of the test portion (to the nearest 0.1 mg)

M2<sub>e</sub> and M2<sub>b</sub>: mass of the dish with the residue after respectively drying of the sample and the blank sample (to the nearest 0.1 mg).

**2-RESULTS**

The tests were performed on 8 samples of raw and UHT milk, 8 samples of raw and UHT cream, 9 samples of dried milk and 9 samples of cheese

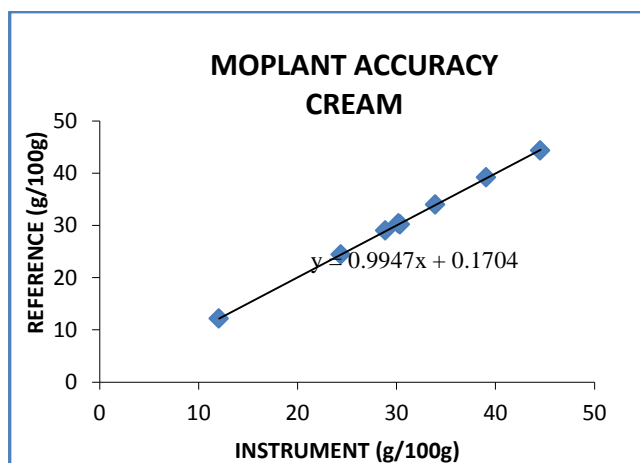
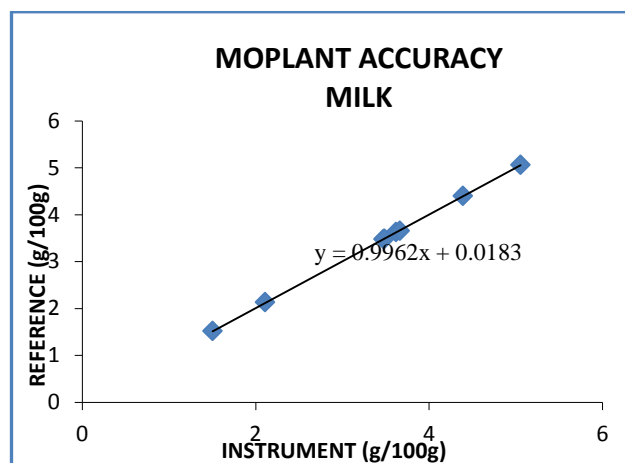
The following table presents the results obtained:

Criterion	MILK		CREAM		DRIED MILK		CHEESE	
	Instrument	Reference	Instrument	Reference	Instrument	Reference	Instrument	Reference
<b>n</b>	8		8		9		9	
<b>M (g/100g)</b>	3.41	3.42	30.43	30.44	16.47	16.49	22.34	22.14
<b>Sx (g/100g)</b>	1.14	1.14	9.73	9.68	10.18	10.22	11.35	11.35
<b>Sr (g/100g)</b>	0.007	0.009	0.23	0.23	0.05	0.08	0.08	0.06
<b>d (g/100g)</b>	-0.005*		-0.01*		-0.02*		0.20*	
<b>Sd (g/100g)</b>	0.009		0.15		0.07		0.13	

Table 1: Moplant repeatability and accuracy criteria in milk, cream, dried milk and cheese samples

*n*: number of results, *M* and *Sx*: mean and standard deviation of the results, *Sr*: standard deviation of repeatability, *d* and *Sd*: mean and standard deviation of deviations (instrumental vs reference).

\*Non significant difference within 5%



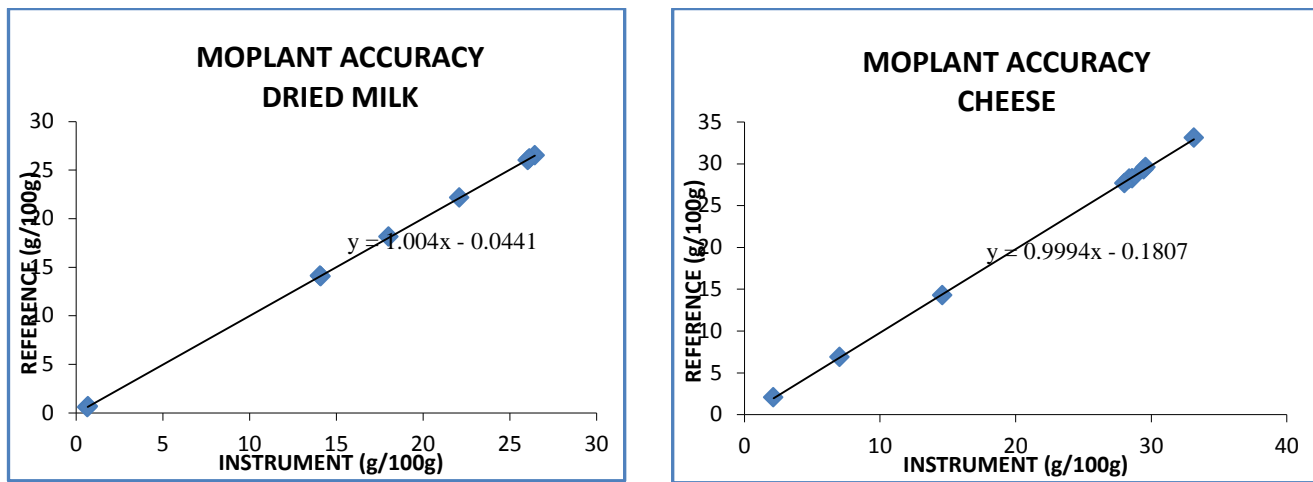


Figure 1: Relation between the « Moplant » and « reference » results on milk, cream, dried milk and cheese samples

For milk, the standard deviation of repeatability observed for the alternative method is lower than the ISO 1211 method limit value ( $S_r \leq 0.015$  g/100g). The mean deviation between the both sets of results is very weak (-0.005 g/100g) and non significant.

For cream, the relative standard deviation of repeatability observed for the alternative method is lower than the ISO 2450 method limit value ( $S_r \leq 0.5$  %). The mean deviation between the both sets of results is very weak (-0.01 g/100g) and non significant.

For dried milk, the standard deviation of repeatability observed for the alternative method is lower than the ISO 1736 method limit value ( $S_r \leq 0.20$  g/100g). The mean deviation between the both sets of results is very weak (-0.02 g/100g) and non significant.

For cheese, the standard deviation of repeatability observed for the alternative method is lower than ISO 1735 method limit value ( $S_r \leq 0.30$  g/100g). The mean deviation between the both sets of results is of 0.20 g/100g (no significant difference at 5 % threshold).

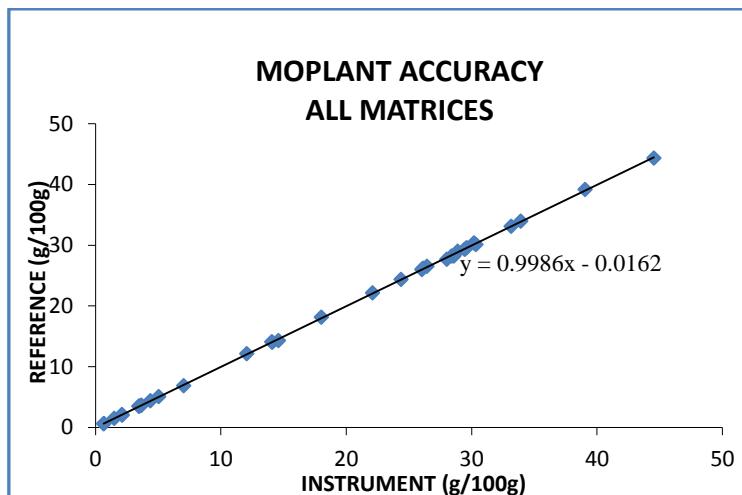
**Overall treatment**

The following table presents the results obtained for all matrices dropped:

Criterion	Instrument	Reference
n	34	
M (g/100g)	18.24	18.19
Sx (g/100g)	13.09	13.08
d (g/100g)	0.04	
Sd (g/100g)	0.14	
Sy,x (g/100g)	0.14	
Sy,x (%)	0.75	

Table 2: Moplant accuracy criteria in milk and dairy products

n: number of results, M and Sx: mean and standard deviation of the results, Sr: standard deviation of repeatability, d and Sd: mean and standard deviation of deviations (instrumental-reference), Sy,x and Sy,x(%): absolute and relative residual standard deviation of the reference linear regression = f(instrument).



**Figure 2:** Relation between the « Moplant » and « reference » results in milk and dairy products samples.

It can be noted that the mean and the standard deviation of deviations are respectively 0.04 and 0.14 g/100g. The slope (0.999) and the intercept (-0.02) of regression are respectively not significantly different from 1 and 0 (P=5%). The residual standard deviation is 0.14 g/100g.

## CONCLUSION

We can conclude that the results obtained for the tests performed in milk, cream, dried milk and cheese are not significantly different from the reference values obtained using the standardised methods.

This alternative method gives equivalent results compared to reference methods on milk and dairy products.

The use of Moplant can be an interesting possibility to gain time thanks to the dishes drying and the solvent evaporation steps.

For safety reason, the Moplants exhaust pipe must be placed either in a fume cupboard or through an external window.

