PMB MOISTURE ANALYSER APPLICATIONS rev. A

GETTING STARTED WITH THE MOISTURE ANALYSER

The PMB moisture analyser depends upon the user understanding the analyser, knowing about the material to be tested, having an idea of the results expected and preparing the sample correctly.

While the analysers are called moisture analysers, it should be stressed that it is not only water that is evaporated by the heat, it may be oils, alcohol, flavourings or other components that are changed by the heat.

Refer to the PMB Operators Manual for details of the operation of the analyser.

PMB MOISTURE ANALYSER

The PMB Moisture analyser will dry samples using heat from halogen lamps mounted above the sample. The user can set parameters for drying the sample that will affect the results. The parameters used for drying the sample are described in detail in the operators manual.

The initial parameters are concerned with the temperature profile, That is if the heat is slowly ramped up to a target temperature, or allowed to change more quickly to reach the target or if the STEP function is used a first temperature is used for a target followed by a different temperature after a period of time.
The STEP function could allow the temperature to increase to a value greater than the final target temperature initially then settle at the final target temperature as the test progresses.

The user can set the interval time, that is the time interval the results are checked, printed (or downloaded) and stored in memory. If the analyser is set to automatically end the test, the test will stop when the results measured at the selected interval time no longer change more than a preset amount.

If automatic stop is not selected then the test will run a preset time or until the user stops the test.

During any test the results are output to the RS232 and USB interface and also stored in internal memory at the interval time. The results from the memory can be transferred to a USB memory stick for downloading to a PC.

SAMPLE PREPARATION

Sample preparation is the single most important consideration to obtaining accurate results. The sample must be prepared so the whole of the sample is heated uniformly and the moisture is near the surface of the material.

For powders no further preparation is necessary. For most other materials the sample should be ground, chopped, grated or otherwise made as fine as possible. Liquids or paste may need to be spread onto glass fibre pads to distribute them evenly and thinly. Some materials that may splatter as they are heated (oils, butter) may need to be spread on the glass fibre pads or mixed with dry sand.

Trial and error is often the only method to find the best method for the material.

When the sample is placed on the weighing pan it should be as thin as possible, however enough material should be used to ensure good repeatability of the results. Typically samples of 3 to 10 grams are used.

Some materials will require special preparation. For example when testing cheese, if the cheese is very soft it may be necessary to use dry sand as a buffer material so it does not splatter or form a skin. To do this it would be necessary to prepare the sand by drying it in an oven until you were certain no moisture remains. Put the sand on the sample pan and tare the analyser. Mix the sand with the cheese so you have smooth mixture, spread this mixture on the sample pan and then do the test.

An alternative to this preparation is to spread the cheese on dry spun glass gauze to assist in spreading the heat and preventing splatter or skins forming. Remember to tare the analyser with the gauze in the weighing pan for accurate results.

Some materials can hold moisture within them in a way that is not suitable for this type of test. For example sugar will bind water to the sugar molecules so strongly that heat will not remove the water before the sugar is burned.

Some plastics may also not be suitable for this type of method due to the very low percent moisture and the heat required to extract this moisture.

PMB PARAMETERS

When initially setting the parameters for a material often it is a matter of trial and error to find the most suitable settings.

The PMB uses a default setting for drying test that is suitable for many applications. It is suggested this default setting is used for the first test then the user can adjust the settings as required to try alternate test programs.

If you have some experience with an oven method or other moisture analysers the temperature should be set to these same values. However if you do not have any experience then the initial temperature setting is a guess at first. Try using 110ºC initially and then increase it if there are no signs that the material is burned , or decrease it if the material burns or goes excessively brown. Some material need to be dried at lower temperatures if they form a skin over the surface during drying.

It may be helpful to have the analyser connected to a PC for data collection or to a printer during these tests to help determine the best settings for test.

If you set the parameters for a test to run a maximum time instead of an automatic stop you can observe the results during the test. Begin the test and watch the output from the analyser. After a few minutes the moisture should increase. After some time the %moisture will become stable for a long period of time. Terminate the test at this time.

Repeat the test at other temperatures, generally try to use the highest temperature possible that does not damage the material.

After you are getting consistent results with 5-10g samples you can try reducing the size of the samples. Often good results are obtained using samples of 2-5g.

By observing the results the time and temperatures needed to finish test it is possible to determine the typical time of a test, the typical %moisture and the interval time that will be needed to determine the automatic stopping point.

KNOW THE MATERIAL

As described above some materials are not well suited for this method of moisture determination.

In addition it is important to know enough about the materials so that you do not endanger or inconvenience others. For example some solvents have very low flash points that are not suitable for drying with heat sources that can reach 100ºC. Other materials will cause odour or fumes that can be dangerous or objectionable. Care must be taken to ensure that heating of the sample is not dangerous or likely to cause damage to the environment.

TEMPERATURE CONTROL within the PMB ANALYSERS

The temperature of the weighing chamber is measured by a sensor just above the samples. As the temperature approaches the final value the lamp will be cycled on/off to maintain the temperature at the set point.

When set for Single or Step heating the initial increase in temperature will happen quickly, it will usually take about 1 minute to gain the first 90% of the final temperature and then another 30 seconds to reach the final temperature. This method helps avoid the temperature overshooting the set point and thus avoids damaging the sample.

If the Rapid function is enabled the heat in the chamber is allowed to overshoot the target for a short period of time then will settle at the target value. This allows quicker heating of the sample.

RS-232 DATA FROM THE PMB ANALYSERS

The PMB Analysers will output the current results using the interval time set for the test. These results can be used to plot the progress of a test or to keep records of a test. The data can be collected via the RS-232 and displayed using AdamDU ™, Adam Equipments own data collection software. Contact the Sales Department at Adam Equipment or your Dealer for more details.

EFFECT OF CALIBRATION ON MOISTURE DETERMINATION

The PMB moisture analyser can be used as a laboratory balance if it is calibrated with a mass standard of OIML Class F2 or better. The results of a moisture determination test are not dependent upon the accuracy of the weight values as the results are a ratio of 2 weights.

The temperature accuracy of the drying chamber can be calibrated using the built in temperature calibration program and an external thermometer designed for the PMB. Contact Adam Equipment or your supplier for more details.

APPENDIX

GUIDANCE NOTES

The following guide notes are offered as examples of temperature, interval time and expected results when drying various substances. The preparation, distribution and amount of product can all significantly effect the results. It is important to find suitable procedures to process the material, usually by trial and error.

In general it is recommended the default settings of the PMB are suitable for the initial test using a sample size of 5g to 10g. After a number of tests with these conditions this will provide a basis for comparing other times, temperatures or sample preparations.

Default settings of the PMB are:

% Moisture
Single Temperature = 110ºC
Rapid = Off
Interval Time = 5 seconds
End Point Determination = Time and stable result
Time 60 minutes, and
Stable PMB 53 = 0.002g/15 seconds or Stable PMB 202 = 0.02g/15 seconds
Start Criteria = manual start.

The items in the following table are taken from actual test results. Results for similar items may vary. The user of the PMB analyser will need to determine the best procedures for their samples.

MOISTURE ANALYSER EXAMPLES

MATERIAL	SAMPLE MASS (g)	DRYING TEMPERA-TURE.(° C)	INTERVAL TIME(s)	AVERAGE MOISTURE CONTENT	DRYING TIME(min)
ALMOND	4-6	100	15	5.4	7
APPLE, WET	5-8	100	10	7.5	5-10
BARLEY SEED	2-3	130	10	12.7	12
BRAZIL NUTS	4-6	105	30	2.6	14
BUTTER	2-5	138	15	16.3	4.5
CASHEW NUTS	8-9	105	20	4.7	14
CEMENT	8-12	138	15	0.8	4-5
CHARCOAL	8-10	120	10	3.8	8-10
CHEESE, SOFT	2-3	110	20	83.8	11
CHOCOLATE POWDER	2-4	100	5	1.9	4
COCOA POWDER	5-8	106	20	0.1	2
COFFEE CREAMER POWDER	2-3	130	15	78.5	6-8
COFFEE	4-5	100	10	1.8	9
CORNFLAKES	2-4	120	15	9.7	5-7
DRY APPLE PULP	5-8	100	10	76.5	10-15
DUST	5-10	104	10	7.3	8-15
FLOUR	8-10	130	10	12.5	4-5
FLOUR, RYE	5	130	5	12	7
FLOUR, WHEAT	5	130	5	14.5	7
GRASS SEED	2-3	135	25	15.6	15
GROUND COFFEE	2-3	106	5	2.8	4
HAZEL NUT	4-6	100	15	5.6	10
ICE CREAM, TOFFEE	2-5	115	10	35	13
LUBRICATING CREAM	3-5	105	10	99	22
MARGARINE	3-4	138	20	16	10
MAYONNAISE	1-2	138	20	56	10
MEDICAL CREAM	3-4	105	10	98	15
MILK	2-3	120	15	88	6-8
MILK CHOCOLATE	2-5	106	15	1.3	3.5
MILK POWDER	2-4	90	15	5	6
MUSTARD	2-3	130	20	76.4	10
NOODLES	3-4	130	25	9.8	20
PAPER	2-4	106	20	6.4	10
PEA, SEED	2-3	130	10	16.3	8
PEANUT	4-6	100	15	2.6	9
PISTACHIOS, RAW	4-6	105	25	8.3	8
PISTACHIOS, ROASTED	4-6	100	25	1.3	10
POLYAMIDE	2-5	138	20	2	75
POLYETHYLENE BEADS	10-15	105	10	0.1	3
POLYVINYL BEADS	15-20	105	10	0.1	4
POPCORN	6-7	120	5	9.9	20
POPPY SEED	4-5	95	25	6.2	18
PORRIDGE OATS	3-4	120	10	12.1	9
PORRIDGE OATS, QUICK	3-5	120	10	11.4	10

POTATO FLAKES	3-4	106	15	6.9	7.5
POWDERED SOUP	2-3	80	15	3	4.5-7
PUMPKIN SEED	6-7	110	15	6.5	12
RED WINE	3-5	100	15	97.4	15-20
SLUDGE	3-5	130	15	80	90
SUNFLOWER OIL	10-14	138	20	0.1	2
SUNFLOWER SEED	3-4	80	15	3.85	10
WALNUT	4-6	100	15	4.6	12
WHEAT	4-5	130	10	14	15
WHITE GLUE	2-5	136	15	54.3	6-8
YOGHURT	2-3	110	15	86.5	4.5-6.5

This list will be extended as information becomes available. If you wish to supply any information that may help others, please contact Adam Equipment or your dealer.