Moisture content analysis of flours

ASSIGN BUSTER

This laboratory exercise was performed to study the moisture assays. The moisture content of wheat, whole grain and plain flour, milk and honey were determined by using the methods of dry air oven, vacuum oven, two stage drying method, toluene distillation abberefeactometer and moisture balance.

Drying is a process of food in which water is removed to slow down the growth of spoilage microorganisms such as bacteria, yeast and mold and then extend its shelf life (Fellows. 1997). The process of drying foods not only affects the water content of the products, but also other physical and chemical characteristics such as colour, flavour and texture (Rahman. 1999). In addition to preservation, drying is used to reduce the cost or difficulty of processing, packaging, handling, storage and transporting by converting the saw food to a dry solid. This reduces the weight and sometimes the volume (Barbosa-Canovas and Vega-Mercado. 1996).

Moisture assays can be one of the most important analyses performed on a food product and yet one of the most difficult from which to obtain accurate and precise data. Moisture is used as a quality factor, reduced and it is used for convenience in packaging or shipping. Moisture (or solid) content is often specified in composition standards, computation of the nutritional value of foods require that customers know the moisture content, The data of moisture are used to express results of other analytical determination on a uniform basis (i. e., dry weight basis)

The moisture content of foods varies greatly. Water is a major constituent of most food products. The approximate, expected moisture content of a food can affect the choice of the method of measurement. It also can guide the

analyst in determining the practical level of accuracy required when measuring moisture content, relative to other food constituent.

In oven drying method, the sample is heated under specified condition, and the loss of weight is used to calculate the moisture content of the sample. The amount of moisture determined is highly dependent on the type of oven used, condition within oven, and the time and temperature of drying.

Dry air oven method uses as the capacity of air to remove moisture from a food depends on the temperature and the amount of water vapour already by the air. The content of water vapour in air is expressed as either absolute humidity or related humidity. Products such as bread and field dried grain are often air dried, then ground and oven dried. The temperature of the air, measured by a thermometer bulb, is termed the dry bulb temperature.

Air-dry oven method rely on solvent evaporation into the surrounding atmosphere. The disadvantage is the temperature and humidity will have a profound impact on the drying time. Low temperature and/or high humidity will not provide sufficient atmospheric heat to rapidly dry the paint. Anther disadvantage is dry air oven method requires long exposure times to effectively achieve sterility therefore cost more money.

The advantages of dry air oven are dry heat can sterilize items that can not be sterilized in steam or chemical sterilizers, such as powders and oils, or those that are prone to rust. Ovens or dehumidification equipment can be used to speed up the drying time and make it more predictable. One of the common air oven is Chopin oven, which uses drying temperatures up to 200â„ ƒ.

Vacuum oven is drying under reduced pressure (25-100mmHg), one is able to obtain a more complete removal of water and volatiles without decomposition within a 3-6hr drying time. Vacuum oven needs a dry air purge in addition to temperature and vacuum controls to operate within method definition.

Vacuum drying oven temperature used depends on the product, such as 70â„ ƒ for fruits and other high-sugar products. Even with reduced temperature, there can be some decomposition. If the product to be assayed has a high concentration of volatiles, the correction factor needs to be considered to compensate for the loss. In a vacuum, heat is not conduct well; therefore, pans must be placed directly on the metal shelves to conduct heat.

The disadvantage of vacuum drying oven is that hard to handle and maintain, and the decomposition and oxidation might occurs. It can be difficult to refill cartridges without them overflowing: the closed cells will not accept new ink.

The advantages of vacuum drying are opens the cell structure of the sponge. As the cartridge delivers ink in use, the cell structure of the sponge closes. Vacuum drying removes the final moisture from cartridges that have been centrifuged. Vacuum drying of cartridges can remove 3-4ml of fluid from a cartridge: quite a large amount considering that many cartridges today contain little more than twice this volume of ink.

One of the main types of toluene distillation method is distilled from an immiscible liquid of high boiling point. The second main type is the mixture

of water and immiscible solvent distils off, and is collected in a suitable measuring apparatus in which water separates and its volume can be measured. The advantages of toluene distillation method are water is removed rapidly during heat transfer, and the test is made in an inert atmosphere that minimizes danger oxidation. The disadvantage is toluene distillation causes less decomposition in some food then drying at elevated temperatures. Although chemical reactions produced by heat are reduced, they are not eliminated.

AIMS and HYPPOTHESIS:

The objectives of this experiment are to prepare wholegrain wheat for moisture adjudication by using of the hammer mill. Observing techniques demonstrated for homogenising and reducing grain samples. In addition, the aim is to measure the moisture content of appropriate foods by using different method, and to recognise factors for determination in selection of a moisture determination method. On the other hand, the objective is to compare estimates of moisture content with expected commercial valued based on published data and total solid for all samples. Lastly, it is aim to consider the moisture content of wholegrain flours and wheat by using effective method.

The hypothesis is there is a significant difference between percentage of moisture and types of the flours.

MATERIALS AND METHODS

Materials:

Dry air oven method for flours and ground wheat.

The large moisture dishes for flours were used. Handle moisture dishes with gloves. Checked that the number engraved on the lid is the same as on the base, and recorded these numbers and used them to identify the samples.

The principle is that the sample is heated under certain conditions of temperature and time, and the loss of weight is used to calculate the moisture content of the sample. The principle of moisture determination by drying to constant weight applies.

The notifications of this dry air oven method were each student completes a moisture determination on flour, by one of the oven methods. There should be one moisture dish for flour per student in the class.

The gloves were used to handle predried aluminium moisture dishes.

The engraved identifier on the dish and lid (should match), and record in the data table were noted.

Weigh base and lid accurately. Recorded in data table. (Ensure that the base and lid have matching numbers)

Placed 2-3 g flour in the pan and weigh accurately. Recorded in data Table

Placed flour in a fan forced draft oven at 130°C for 90 mins. Distribute samples with consideration for effects of oven position. Ensure metal covers are ajar, to allow water to evapourate.

Worn gloves. Closed dishes with lids. Removed from oven using tongs or gloves

Placed in a dessicator until cool for weighing. Weigh closed dish with dried specimen accurately. Recorded in data table.

Repeated oven drying for a further 30 min interval until dried to constant weight. Recorded weights after each drying.

The % moisture (wt/wt) were calculated

2. Vacuum oven method applied to flours and ground wheat

The large moisture dishes for flours were used. The principle is that the sample is heated under conditions of reduced pressure to remove water, and loss of weight is used to calculate the moisture content of the sample.

Worn gloves. The matching moisture dish and lids (same number id) were identified. Noted and recorded numbers, and assign samples to numbered dishes. Weighted dishes plus lids accurately. Record in data table

Placed 2-3g of sample in pan and weigh dish plus lid with sample accurately. Recorded in data table.

Dry at 70 °C at 60 mm Hg for 24 hours. Pull vacuum slowly. Ensure lids are ajar

Slowly release vacuum. The gloves were used to transfer closed dishes to dessicator to cool

Weighted closed dish with dried specimen accurately when cool. Recorded in data table

The % Moisture were calculated.

3. Two stage drying method applied to Milk in this laboratory

The small moisture dishes were used. Gloves were used when handling all moisture dishes. Use tongs to handle hot moisture dishes.

The engraved number on the lid and base (same) of your moisture dishes were noted and recorded

The weight of dish and lid were recorded and weighted.

Placed 5 g of sample in the dish and weigh accurately. Recorded as weight of sample + dish + lid before drying.

Gently evaporate most of the water gently on a waterbath. Do not completely dry the sample.

Proceed by DRY AIR OVEN method for flour above, but at 100 ‘ C. initially for 2 hours, cool, weight and redry to constant weight.

4. Moisture Balance – a rapid method to determine the moisture content of flour

The temperature was set to 200ËšC for 30 minutes. The readings at zero after every 2 minutes were recorded. Ploted data. Estimated the moisture content of the sample.

5. Abberefeactometer

The Abbe refractometer was used to determine the refractive index of one sample. Refered to the AOAC official Method 969. 38 Moisture in Honey to

estimate the moisture content of the honey based on the refractive index reading.

6. Toluene Distillation

The demonstration was observed. This is the Official method AOAc969. 19 to determine moisture in cheese. Prepared by bringing information summary and diagram from text titled Reflux Distillation with Immiscible Solvent.

Method:

The weight of flask, flask and sample, and deduce sample weight were recorded.

Placed boiling chips and sample in clean distillation flask and cover completely with solvent.

Poured solvent through the top of the condenser to fill the receiving tube.

The tube was bring to boiland distill slowly at first, then increase rate

After distilling for 1 hr dislodge the moisture droplets from the condenser and top part of the Bidwell -Stirling trap by using a brush. Rinsed brush with solvent

If water has adhered to the sides of the calibration tube, used a straight wire to dislodge the water so it collects in the calibrated section. Rinsed wire with solvent.

Continue until no further water is distilled over, ending with final rinses for wire and brush. If water level does not stabilise, carbohydrate decomposition and discontinue method were considered

Leaved emulsion to cool and break, usually until following lab session

Read volume of water and calculate %water (wet basis) (v/w)

RESULTS:

Graph 1 shows the drying curves of plain white flour, wholemeal flour and wheat flour. The

Graph 1: Infrared moisture balance-drying curves.

Table 1 show the mean of wheat in air drying is 7. 9775 and 8. 0395 in vacuum drying. The variance of wheat by use of air drying is much higher than vacuum drying, which means wheat flour in air drying is more variable than in the vacuum. In addition, the p-value of this t-test is 0. 8738 which is a large p-value, and this p-value shows there might be some errors during the experiment.

Table 2 show the mean of plain white flour in air drying is 10. 0563 and 9. 3417 in vacuum drying. The variance of plain flour in vacuum is 7. 43418E-06 which is a extreme small number Therefore, the plain flour in the air drying is more variable than in the vacuum. In addition, the p-value of this t-test is 0. 0559 which shows there is no significant difference between them.

Table 3 show the mean of wholemeal flour in air drying is 10. 2767 and 10. 1143 in vacuum drying. The variance of wholemeal flour in vacuum is 0. 4

and 0. 1 in the vacuum. Even though the number is close to each other, the wholemeal flour in air drying is still more variable than in the vacuum. The p-value is 0. 6618 which is a very large number, therefore there might be some errors during experiment.

Table 1: Two sample t-Test about wheat flour under air and vacuum drying method.

Table 2: Two sample t-Test about plain white flour under air and vacuum drying method.

Table 3: Two sample t-Test about wholemeal flour under air and vacuum drying method.

Table 4 and 5 both have very large p-value, thus there might be some errors during the experiment. In table 4, the mean of skim milk and full cream milk is 90. 7397 and 87. 8458. In table 5, the mean of opened honey and closed honey is 17. 9767 and 1. 4928.

Table 4: Two sample t-Test by comparing skim and full cream milk.

t-Test: Two-Sample Assuming Unequal Variances

The p-value which shows in the figure 1 is 0. 0007, which stands for there is a significant difference between plain white, wholemeal and wheat flours in air drying method. Figure 2 reflects the p-value in the vacuum dryer between is 0. 0001, this small p-value shows there is a significant difference between plain white, wholemeal and wheat flours in vocuum drying method.