Moisture content

Moisture content is the amount of moisture per unit weight of the product.

Moisture content wet basis and moisture content dry basis.

Mwb is the weight of water in a product per unit weight of the wet material, expressed in percentage.

Mdb is the weight of water in a product per unit weight of the dry matter, expressed in percentage.

The relationship between *M*w*b* and *Mdb* is as follows:

$$Mwb = \frac{Mdb(100)}{100 + Mdb}$$

$$Mdb = \frac{Mwb(100)}{100 - Mdb}$$

*M*w*b* is usually used in commerce, *Mdb* in engineering calculations.

EXAMPLES

1a) You are supplied with two bags of maize each weighing 1.0tonne. One bag has maize of 25% dry basis and the other contains maize of 25% wet basis. Which bag contains more dry matter? Show your calculations.

Solution

a) 1tonne of maize = 1000kg

i) *M*w*b*= *M*w/ *M*w*p*

*M*w/*1000* = 0.25

*M*w = 250kg; *M*dm= 750kg

ii) *M*d*b*= *M*w/*(M*w*p* – *M*w) ; *M*w/*1000* – *M*w) = 0.25

*M*w = 250 – 0.25M *M*w; *M*dm= 750kg

*M*w = 200kg; *M*dm= 800kg

The bag of 25% dry basis contains more dry matter:

b) For storage, two bags of maize in (b) are dried to moisture content of 13% wet basis. How much water or moisture will each loose? Show all calculations.

For the first bag, $\frac{Mw}{750 + Mw} = 0.13$

*M*w = 97.5 + 0.13M *M*w;

Mw = 112.07kg

Water lost = 250 – 112.07 = 137.93kg

For the second bag, $\frac{Mw}{800 + Mw} = 0.13$

Mw = 104+ 0.13M Mw;

Mw = 119.54kg

Water lost = 200 – 119.54 = 80.46kg

(2) A biscuit factory obtained maize from two sources (20 tonnes each), one has 12% moisture content (mc) dry basis and the other 12% mc wet basis. Which one has more dry matter? Justify your answer with calculations.

Both bags have same weight, hence wet weight (original weight) are same

MD = 0.12, MW = 0.12, WW = 20000Kg

Dry Basis

$$MD = \frac{WW - DWd}{DWd}$$

$$WW = DWd(MD + 1)$$

$$DWd = \frac{WW}{MD + 1}$$

$$= 20000\ (1.12)^{-1}$$

$$= 17{,}860 \text{ kg}$$

Wet Basis

$$MW = \frac{WW - DWw}{WW}$$

$$WW = \frac{DWw}{1 - MW}$$

$$DWw = WW(1\text{-}MW)$$

$$= 20000(0.88)$$

$$= 17{,}600\text{kg}$$

Bag with MC dry basis is heavier in dry matter

(b) In (i) above, the company paid ₦60000.00 per tonne for the maize at 12% mc dry basis. How much should a tonne cost at 12% mc wet basis. If the materials has to be dried to 5% mc dry basis, what quantity of water will be lost from the material from each source per tonne.

Since both will have the same dry matter content i.e. if material in the bag with dry basis was to have been at wet basis

1 Tonne of dry basis costs ₦ 60,000.00

Dry weight for the MD bag = DWd = $\frac{WW}{MD + 1}$ = 1000((1.12)$^{-1}$ = 893kg

The actual wet weight of the MW bag will be $WW = \frac{DWw}{1-MW} = 893(0.88)^{-1} =$ 1014kg

Therefore 1 Tonne of wet will cost $\frac{60{,}000(1000)}{1014}$) = ₦59,171.59

Drying to 5% mc for dry basis ***(This can be done for either 1 or 20 Tonnes)***

WW = DW(MD + 1) = 17860(1.05) = 18753

Weight of water lost = 20,000 – 18753 = 1247kg

Drying to 5% mc for wet basis

$WW = \frac{DWw}{1-MW} = 17600(1.-0.05)^{-1} = 19{,}555$

Weight of water lost = 20,000 – 19555 = 444.44kg