November 2002

Near Infrared (NIR) Device Inspection and Moisture Basis

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At the 87th NCWM Annual Meeting in 2002, the Conference voted to move the NIR Code from a tentative status to a permanent status, which will become effective January 1, 2003. To adequately inspect NIR devices, a field inspector must know the moisture basis of the NIR device under inspection. If the moisture basis of the device is different from the moisture basis of the inspector's grain sample, the constituent value reading of the device must be converted so that it represents the same moisture basis as the inspector's grain sample. This article provides background information on the NIR code of NIST Handbook 44, an explanation of moisture basis, and an example and equation to convert the constituent value reading on an NIR device.

Background

Prior to moving the code to a permanent status, the National Type Evaluation Technical Committee (NTETC) NIR sector conducted a study of the code to determine if the code was ready to move to a permanent status and to determine if the tolerances were acceptable. The study revealed that the tolerances were acceptable and also that additional language was needed to address moisture basis. During discussions of the study, grain industry representatives of the Sector expressed the need for industry to have the flexibility to use different moisture bases on NIR devices. NIR devices have varying moisture bases.

Moisture Basis and Converting from One Moisture Basis to Another

When constituent values (protein, oil or starch) of a grain are measured, the values depend on the amount of moisture in the grain or the moisture basis (i.e., 14% protein at 12% moisture). Without knowing the moisture basis of the device, it is not possible to accurately compare the results of the device to the known value of your grain sample. For example, if a wheat sample used to test an NIR device is 13% protein at 12% moisture and the NIR device determines protein on an "as-is" moisture basis, the test results must be converted to a 12% moisture basis to adequately compare it to the wheat sample. The constituent values of the grain samples used to test NIR devices are determined by the Grain Inspection Packers and Stockyards Administration. These constituent values are at a constant moisture basis of 12% for wheat protein, 13% for soybeans protein and oil, 0% for barley protein, and 0% for corn protein, oil and starch (see Table N.1.1. of NIST Handbook 44 Section 5.57). The following is an example and equation for converting the meter constituent result to the same moisture basis as the grain sample:

An inspector has a wheat sample that is 13% protein at a 12% moisture basis. The wheat sample is used to test an NIR device that gives an "as-is" protein reading of 13.7% at a moisture reading of 11.1%. Because the moisture basis of the meter is different from the

inspector's grain sample, the protein results of the meter will need to be converted so that it represents protein at a 12% moisture basis.

The equation below should be used to convert the results.

$$C_{newmb} = C_{native} \frac{100 - M_{newmb}}{100 - M_{native}}$$

where

C_{newmb} = constituent value at the new moisture basis
C_{native} = constituent value at native moisture basis (device constituent value reading)
M_{newmb} = moisture basis for C_{newmb} (moisture basis you are converting to)
M_{native} = moisture basis for C_{native} (device moisture basis)

Note: The "native" moisture basis is the default moisture basis of the sealable constituent calibration (the moisture basis of the device).

$$C_{newmb} = 13.7 \frac{100 - 12}{100 - 11.1} = \quad 13.7 \frac{88}{88.9} = 13.56\%$$

Therefore, the equivalent meter protein value for field inspection purposes is 13.56% protein at 12% moisture, which is within the 0.60 tolerance for individual samples of wheat (see Table T.2. of NIST Handbook 44 Section 5.57).

It is essential that inspectors know the moisture basis of an NIR device under test and as necessary convert the meter constituent value reading so that it represents the same moisture basis as the inspector's grain sample. If you have any questions or need assistance with inspecting NIR devices, please contact Diane Lee by phone at 301-975-4405 by fax at 301-926-0647 or by e-mail phone at diane.lee@nist.gov.