nmisa
National Metrology Institute of South Africa

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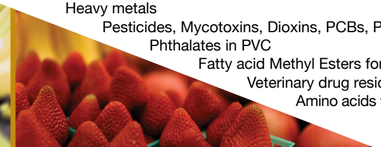

Chemical Contaminants

As consumers, two thoughts will cross our minds on a daily basis:
1) Did we get what we paid for?
2) Is it safe?

When it comes to the food we eat, we need to be confident that it is authentic, nutritious and safe. Regrettably, recent scandals such as melamine in milk, aflatoxins in dog food, Sudan red in spices, cadmium in our pineapples, the “donkey-and-not-beef” issue and plasticizers in sports drinks have all shown how mistaken we can be.

Consumer confidence comes from knowing that testing laboratories are competently and accurately testing the nutritional and contaminant content of our food and feed at regulated levels, and that these measurement results are reliable and internationally comparable.

Accreditation to ISO 17025 Guide for the competence of testing and calibration laboratories allows for the demonstration of competence as evidenced through regular participation in relevant proficiency testing schemes; the use of validated methods; establishing measurement traceability and reporting measurement uncertainty. Part of the validation process involves the use of a certified matrix reference material to verify the accuracy of the measurement result obtained using the analytical procedure. Additionally, a lab must demonstrate continued method performance through participation in relevant proficiency testing schemes for the target analytes in specific matrices and appropriate use of quality control materials. Poor access and limited availability of the relevant reference material and PT scheme has often prevented laboratories from demonstrating the necessary competence of their measurement results and achieving the coveted ISO 17025 accreditation.

The NMISA Chemistry division supports industry with the provision of reference measurements, reference materials and proficiency testing schemes. Our measurements are internationally benchmarked against other National Metrology Institutes to ensure the highest levels of accuracy and measurement confidence.

SOME OF THE AREAS NMISA IS CURRENTLY WORKING ON IN FOOD INCLUDE:

Heavy metals
Pesticides, Mycotoxins, Dioxins, PCBs, Polyaromatic Hydrocarbons
Phthalates in PVC
Fatty acid Methyl Esters for Meat profiling
Veterinary drug residues
Amino acids for protein quality determination

Food Packaging Film Thickness

Packaging does not just play a key role in marketing and providing key nutritional information about the enclosed food, but it also plays a vital role in the assurance of quality. Packaging protects the enclosed food against environmental effects such as contamination, shock and temperature. Barrier protection is another factor of packaging that is especially important in protecting food against dust, oxygen, water vapour, etc.

Thin film coatings of special materials onto the original packaging material have been industrially proven to provide excellent flexible barrier protection for food.

Key structural factors (thickness, density, roughness, etc.), chemical composition and mechanical properties are crucial to the correct application of thin films as barrier coatings. New types of advanced materials such as biomaterials and nanomaterials are showing promise for use as thin films for barrier coatings within food packaging. Regardless of the material type, a detailed understanding of the thin film’s chemical composition and structural information is necessary to determine the performance of the coating.

Through the Materials Characterisation Section, the NMISA has established internationally comparable thin film measurement expertise for chemical composition and thickness. Materials Characterisation not only assisted in developing new measurement methods for thin film analysis, but is actively collaborating with national (e.g. CSIR Nano Centre, UWC) and international research institutes (NMIs) in developing and characterising thin films. Other areas of current development include the optical response and surface texture analysis of thin films.

We measure what matters in more ways than one...

How NMISA proudly supports the South African Food and Feed Industry

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Mass and Volume

Consumers purchase food and feed products based on their mass or volume and nutritional content as stated on the food label. To ensure fair trade these measurements have to be accurate and comparable.

Nutrition Facts

Serving Size 1 package (43g)

Amount Per Serving

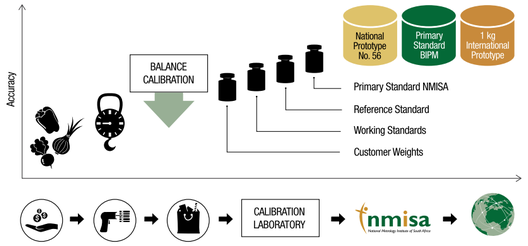
Calories 210	Calories from Fat 126
	% Daily Values*
Total Fat 14g	22%
Saturated Fat 2g	10%
Cholesterol 0mg	0%
Sodium 10mg	0%
Total Carbohydrate 16g	5%
Dietary Fiber 3g	12%
Sugars 7g	
Protein 7g	
Vitamin A - • Vitamin C -	
Calcium - • Iron -	

* Percent Daily Values are based on a 2000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

There are four units for mass commonly used in everyday transactions: The milligram (mg), gram (g), kilogram (kg) and tonne. The measurement quantity can range from trace nutritional amounts to truckloads of feed. All these measurements are performed using the appropriate scale or mass balance, verified for accurate weighing by inspectors, through calibrated mass pieces obtained from accredited laboratories. These mass pieces must be traceable to the South African national standard for mass (the kilogram prototype No 56 based at the NMISA).

The figure below shows the link from measurements done on a scale in a supermarket, factory or production house in South Africa to an international prototype through to copy number 56.

NMISA calibrates mass pieces for calibration laboratories. The balances are calibrated by SANAS accredited calibration laboratories using these NMISA-calibrated mass pieces.



Liquids are typically purchased by volume for example 500 ml milk, or 5 L of cooking oil. The amount in the container has to be quantified through calibrated and certified volume measures or by weighing the product on a scale or mass balance where the density of the product is known.

Temperature and Humidity

Temperature and Humidity are important factors in Hazard Analysis Critical Control Point (HACCP) implementation for ensuring the safety and quality of food products. There is a variety of commercial temperature and humidity monitoring devices available. Whether monitoring temperatures at receiving, throughout production or final product storage and distribution, thermometer calibration is essential and imperative. Instruments used for monitoring critical control points must be calibrated. The food industry is generally aware of the importance of temperature and humidity control requirements during the food production processes.

Instrument calibration is not only a food safety issue, but also an economic consideration since accuracy of temperature monitoring devices also affects product yields.

NMISA Temperature and Humidity laboratory has been serving the South African food and feed industry for many years either directly or indirectly through commercial calibration laboratories. The temperature and humidity sensors that are used in the industry get calibrated by NMISA or commercial calibration laboratories. NMISA is the only institute in the country that can provide traceability and high accuracy calibrations for temperature to commercial laboratories.

The Colour of Food

A human being's sense of taste is often fooled by the sense of sight, because humans have certain expectations of how food should look. When the food colour is different than what we expect, our brain tells us that it will also taste different or there is something wrong with the food. Humans begin to associate certain colours with certain types of food from birth, and equate these colours to certain tastes and flavours throughout life.

Colour is often the first characteristic noticed in the appearance of a food product. For example, we may expect yellow pudding to have a banana or lemon flavour and red jelly babies to have a cherry or strawberry flavour. In fruits and vegetables, we rely on the colour to determine their level of ripeness or freshness.

Whether you always opt for your favourite brand or shop for the best price when buying peanut butter, for example, you will notice that the colour of peanut butter from jar to jar and from producer to producer does not differ much. Standards for grading peanut butter, established by the United States Department of Agriculture (USDA), have been used for the past 50 years and peanut butter colour is an essential factor in the ultimate determination of its final grade.

Colour measurements play a very important role in the quality control process during the manufacture of certain food products.

Two principal colour measurement techniques are used in the food industry: Colorimetry and Spectrophotometry. The Photometry and Radiometry laboratory of NMISA provides a calibration service traceable to national standards for both these measurement techniques. These services include the calibration of colorimeters or neutral density filters and wavelength filters used for the calibration of spectrophotometers.

Radioactivity

Radioactivity is, and always has been, present in all food and feed to a certain degree. Following the recent nuclear reactor disaster in Japan, public awareness and concern about the impact of radioactive contamination has increased. This will lead to new regulations concerning the import, export, and manufacture of foodstuffs in many countries. Most countries monitor imported food and reject shipments exceeding regulation limits. Some countries will require a certificate of actual radioactivity level to accompany shipments.

The main sources of radioactivity include:

1) Natural radioactivity
2) Industrial Radioactivity,
3) Weapons Testing &
4) Accidents Involving Radioactivity.

FROM THE RADIOACTIVE SOURCE TO THE FOOD:

Vegetation and soil can be contaminated through contact with radioactive dust and gases. Different plants concentrate different nuclides because of their varying chemistry. Radioactivity is transferred to animals through the consumption of contaminated vegetation/ silage. Lactating animals produce radioactive milk. Milk products (e.g., dried milk, whey) will contain higher concentrations of activity simply because of moisture removal.
Reactor accidents cause radioactive material to be released from reactor containment into the surrounding earth and groundwater. In a coastal facility, contamination might leak into the ocean contaminating fish and other seafood.

WHAT NUCLIDES ARE FOUND IN FOOD?

The most important nuclides to be assessed following the release of radionuclides from a uranium-fuelled reactor to the environment are: Cs-134, Cs-137, I-131 and other gamma emitters, the beta emitters: Sr-89, Sr-90 and tritium, and the alpha emitters: Pu-238, Pu-239, Pu-240, Am-241, and Cm-242.

THE FUTURE:

NMISA, in conjunction with the National Nuclear Regulator (NNR), have set up a measurement facility that can provide low level radioactivity measurements for the most important radionuclides found in foodstuff and feed around a nuclear reactor.

This service can be expanded to assist the food and feed industry where needed.