DNA Testing for Food Authenticity in the Meat Sector

In 2013, in the wake of the mislabelled beef issue, a coordinated EU-wide testing for horsemeat DNA was launched. Currently, the majority of the DNA-based methods for determining the authenticity of food make use of PCR (polymerase chain reaction). However, it is important to note that limitations associated with DNA detection techniques exist.

DNA carries the genetic code of an organism. Eukaryotic organisms e.g. animals & plants, store most of their DNA inside the cell nucleus and in some organelles, such as the mitochondria. Many related organisms have similar DNA, but there are small differences in the DNA sequence that are unique to each organism.

DNA detection techniques: There are many DNA detection approaches e.g. ELISA and Real-Time PCR whereby the final results may vary considerably as a result of different practices employed. Thus, harmonisation of the methodologies across Europe is key in order to be able to compare the results accurately and reliably.

What is Real-Time PCR Test? This is a frequently used method for detection of species DNA, based on the PCR test. It amplifies the species specific DNA via the addition of highly specific primer DNA sequences (short lengths of DNA) which pair with the complementary DNA of that particular species. The test acts like a biological "photocopier", and these copies can be counted in real time as they are produced.

Real-Time PCR Test sensitivity: The analysis is extremely sensitive and is able to detect very tiny amounts of meat originating from different species in a sample. For this reason, it can be used to show the deliberate mixing of meat from different species such as beef, pork and chicken. Although this technique enables both detection and quantification of DNA, the interpretation of the results is hampered by several limitations.

DNA Testing Limitations

The methodology - Is "semi-quantitative", and as such the results are estimates. The literature illustrates poor reliability of the analytical testing in determining the exact quantity of the proportion of meat species found in the sample. This is because the species DNA is expressed as a percentage of the total meat DNA rather than an accurate quantification of the proportions in terms of weight.

This also because the amount of PCR product does not increase in a linear fashion as a plateau is reached, which affects the results.

Sampling differences in DNA extraction - This may significantly impinge on the results generated, which could lead to misinterpretation of the results. For example, the more processed a product, the trickier the DNA extraction will be. Also, different types of tissues and cells possess differing quantities of DNA e.g. muscle contains a higher degree of mitochondria compared to fat, and as such DNA detection is more accurate if muscle tissue is isolated from fat.

Sensitivity - Due to the sensitiveness of PCR analysis it may generate positive results indicative of a **violation**, when in reality the contamination may have been **unintentional.** This creates an environment where **false positives** could be generated. Therefore, **precaution** should be exercised when **interpreting** the results of species identification by PCR.

DISTINGUISHING BETWEEN FRAUD AND UNAVOIDABLE CROSSOVER:

There is a need to distinguish between fraud-related issues and unavoidable crossover between meat species during meat handling and processing.

Processing procedures are strictly regulated to meet high safety and quality standards. However, some production lines process more than one type of meat, which means it is normal to find minute residual traces of these differing meat types in the end product, despite best-practice manufacturing.

Last updated July 2013

81A rue de la Loi (bte 9) - 1040 BRUXELLES, Belgique Tel: 32 (0) 2 230 46 03 - Fax: 32 (0) 2 230 94 00
E-mail: info@uecbv.eu – Web: www.uecbv.eu