



WHITE PAPER



Food Degradation Analysis

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Over time, food products will begin to deteriorate. One critical aspect of this process is to monitor the degradation processes using a variety of analyses including peroxide value, iodine number, p-anisidine value, biogenic amines, thiobarbituric acid (TBA), and free fatty acids.

The two significant chemical classes that undergo validation are the lipids/fats and proteins. These two chemical classes deteriorate differently. The proteins generally degrade to form biogenic amines while fats/lipids deteriorate and form volatile organic acids and aldehydes.

Biogenic amines include molecules such as putrescence, cadaverine, histamine, spermidine, and others. These molecules are produced when certain amino acids have their carbonyl groups removed. Analysis of biogenic amines is carried out using liquid chromatography (LC). Generally, the biogenic amines are not toxic if ingested, but they do give certain foods, such as seafood, a putrid odor.

Fats/lipids can undergo a variety of deterioration processes and tend to give products a rancid odor and flavor. There are a number of analysis that monitor the process. Two initial screening methods include iodine value and free fatty acids.

The iodine value is used to measure the number of double-bonded carbon (or unsaturated) molecules as these bonds are the locations where a number of degradation processes can occur. The greater the number of unsaturated molecules, the higher the iodine value and the greater the potential of deterioration. The free fatty acid analysis is a titrimetric measurement of the number of carbonyl groups that form when triglycerides break down to glycol and fatty acids. The breakdown of triglycerides into fatty acids and glycol is the initial step to further degradation processes.

The peroxide value (PV) is one of the mostly commonly requested tests that is used to measure fat/lipid deterioration. Through a process of auto-oxidation, the double-bonded (unsaturated) fatty acids form peroxides, and as more double-bonded fatty acids undergo oxidation, the peroxide value increases. Once the double-bonded molecules have reacted, the peroxide value will level off and begin to decrease.

The p-anisidine test is used to measure the breakdown products that are formed during the auto-oxidation and peroxide formation steps. It is recommended the both peroxide value and the p-anisidine tests be run on the same sample. PV would indicate the increase in oxidation while the p-anisidine would monitor the byproducts of that oxidation.

The TBA test also measures the products of oxidation (usually aldehydes) but the test is non-specific and can display a positive bias due to interferences with other aldehyde moieties such as DNA or sugar.

