Meat Smoking Technology

Meat smoking is the addition of either traditional vapors or liquid smoke to the mat for the purpose of preservation.

Smoking is a process of flavoring, browning, cooking, or preserving food by exposing it to smoke.

Smoking involves using smoke, drying and/or heating to develop desirable sensory properties and prolong the shelf-life of meat.

Wood types

The woods used for smoking of meats are in the group referred to as **hardwoods**. Oak, hickory, pecan, cherry, and maple are a few of the more frequently used hardwoods. As civilization developed its smoking processes, it was determined that the hard wood varieties produced better smoke than the soft wood varieties. This can be attributed to the higher level of resin acids in softwood as compared to hard wood. Although the smoke from pyrolysis of softwood produces good color, the resin acids in the smoke produce an unacceptable flavor in meat and other food products.

Major constituents of wood

The three major constituents of wood are cellulose, hemicellulose, and lignin, in a respective ratio of 2:1:1.

The pyrolysis of **hemicellulose** portion takes place at 200-260^{o}C and produces carboxylic acids and carbonyls of which the carbonyls are very important in smoke color. Twenty (20) different carbonyls from the pyrolysis of hemicellulose are produce. Some of the major carbonyls are glycolic aldehyde, methylglyoxal, formaldehyde and acetol.

The burning or pyrolysis of the **cellulose** portion takes place at 260-310^{o}C and produces primarily organic acids and carbonyl compounds. Major acids found are acetic, proprionic, iso-caproic, iso-valeric, n-caproic, butyric and n-valeric.

The pyrolysis of **lignin** potion takes place at 310-500^{o}C and produces phenols and phenolic compounds, which are integral elements of smoke flavor. The three major phenolics attributed to smoky flavor and odor are guaiacol, 4-methyl guiacol, syringol.

There are many minor compounds such as volatile oils, terpenes, fatty acids, carbohydrates, and alcohols that are referred to as **wood extractives**. These extractives play an important role in smoke generation in that they contribute to the characteristic odor and color of certain woods.

When wood is burned and smoke is generated, there are two phases of the smoke: **gaseous and particulate phase**. About 90% of the total volume of smoke is in the particulate phase, which contains many of the undesirable characteristics components of smoke and gives smoke its cloudy appearance. The remaining 10% of smoke volume is made up of the gaseous phase and contains the desirable components for flavor and color.

Because the major components of wood thermally decompose at significantly different temperature, the quality of the smoke varies with the temperature at which the wood is burned. Therefore, it is important to note the dryness of the wood to be burned and also the temperature at which it is burned.

Smoke effects

The effects of smoke application to meat can be primarily categorized as flavor, color, antimicrobial and antioxidant.

- The pyrolysis of cellulose and hemicellulose produces carbonyls. These carbonyl compounds play an important role in color development of meat when smoke is applied. The process of color development in smoked meat begins with the carbonyls being absorbed into the surface of the meat. The carbonyls then react with amino groups in the meat and follow a similar path of reactions as in the Maillard browning reaction. This reaction is enhanced as the temperature and dryness of the product are increased.
- The pyrolysis of lignin produces phenols responsible for flavor development of smoked product.
- These phenols also have an antioxidant effect on meat preventing rancidity.
- Growth and toxin production of *Clostridium botulinum* is prevented by smoke and NaCl.
- Smoke treatment also inhibits aflatoxin production.