

Smoking Meat And Sausages

Smoking meats and sausages is one of the oldest methods of meat preservation. Climactic differences were a significant factor in the development of different methods of smoking, drying, and preserving meat products. The best air-dried hams originated in the South (Spanish Serrano, Italian Parma). The best known smoked sausages came to be known in the North (German and Polish Smoked Sausages). In early times, meat preservation was the primary concern and internal moisture was the enemy. Before 2200 B.C., the Chinese discovered that salting meat was an effective way of preserving it. By 1500 B.C., the Egyptians were using this technique and the Greeks and Romans were curing meats before the Christ era. The Italian name for sausage was “salsus” which was derived from the Latin word “sal” for salt. The Nomadic tribes of North and Central Europe suffered harsh winters. Fire was their way of coping; it provided warmth and was the center of social activities. Those regions became famous for the smoking art they developed and even today 60 % of all meats sold in Germany and Poland are smoked.



XVIII century smokehouses in Virginia. Those smokehouses doubled up as storage facilities where meats after being smoked for two weeks were kept inside for up to two years

Checking hams for quality.
Photos courtesy The Colonial Williamsburgh Foundation

Smoking - reasons

Smoking offers many improvements for meat. Besides enhancing the taste and look, it also increases its longevity, and helps preserve the meat by slowing down the spoilage of fat and growth of bacteria. Smoking meat longer leads to more water loss, and results in a saltier and drier product, which naturally increases its shelf life. Man discovered that in addition to salting and curing meat with nitrates, smoking was a very effective tool in preserving meats..

The advantages of smoking meat are numerous. Smoking:

- Kills certain bacteria and slows down the growth of others
- Prevents fats from developing a rancid taste
- Extends shelf life of the product
- Improves the taste and flavor
- Changes the color; they shine and simply look better

Smoked fish develops a beautiful golden color. The meat on the outside becomes a light brown, red, or almost black depending on the type of wood used, heating temperatures, and total time smoking. Originally, curing and smoking was used solely for preservation purposes; today it's done for the love of its flavor.

The smell in an ethnic meat store specializing in smoked products can be overwhelming. This experience is not shared with our supermarkets since their products are rarely properly smoked and they are vacuum-sealed to prolong shelf life. Certain classical sausages are smoked for up to 3 days and in today's era it is hard to imagine a manufacturer that will do that. It would be economical suicide. To survive the frantic pace of today's market, water is pumped into the meat, chemicals are added for aesthetic and preservation reasons, and smoking is virtually eliminated by adding liquid smoke. As long as the ingredients are not on the list of chemicals that present danger to us, the Food and Drug Administration does not care what goes into the meat. Taste plays a secondary role, as long as the price is good people will buy the product and supermarkets will keep renewing orders.

Smoking to preserve meat's keeping qualities is of less importance today because we can keep the product in a refrigerator or almost indefinitely in a freezer. We smoke meats because:

- We control what goes inside
- We can achieve much better quality

Smoking temperatures

Smoking temperature is one of the most important factors in deciding quality. When smoking, the inside temperature of the smoker cannot exceed 170° F (78° C) for any extended time. At this temperature, fat starts to melt quickly. It acts like glue, holding the meat fragments together, giving them a proper consistency and taste. Once it melts, the sausage inside will be a mass of bread crumbs, greasy outside, will lose its shine, and will have an inferior taste.

If your sausage:

- Is greasy on the outside
- Contains spots of grease under the sausage
- Is too shriveled and wrinkled
- Has lost its shine and looks opaque
- Is crumbly inside with little empty pockets

It means that the internal temperature of the sausage was too high during smoking or cooking.

The inside temperature of the smoker is of utmost importance; it has a direct effect on the quality and appearance of the finished product. Determining temperate is as easy as inserting a stem thermometer

through the wall or the door of the smoker, but unfortunately many smoke meats without it. Estimating the temperature by touching the smoker or inserting a hand is lucky at best. And of course when things go wrong we start looking for the culprits because it wasn't our fault.

Another significant factor is the high temperature of smoking, and it should be kept below 160° F (72° C). In most cases we don't exceed 140° F (60° C), even when hot smoking. Once when the smoking is complete, we can cook the product to a safe temperature of 152° – 160° F (66° - 72° C). To do so, we raise the temperature to about 170° F (76° C) and hold it there.

Pork	82° – 104° F (28° – 40° C)
Melting temperatures of some fats	
Beef	104° – 122° F (40° – 50° C)
Lamb	110° – 130° F (44° – 55° C)

The fats start to melt at very low temperatures and we don't want them to boil and leak through the casings. When faced with excessive temperatures, it begins to melt, and there is no way to undo the damage.

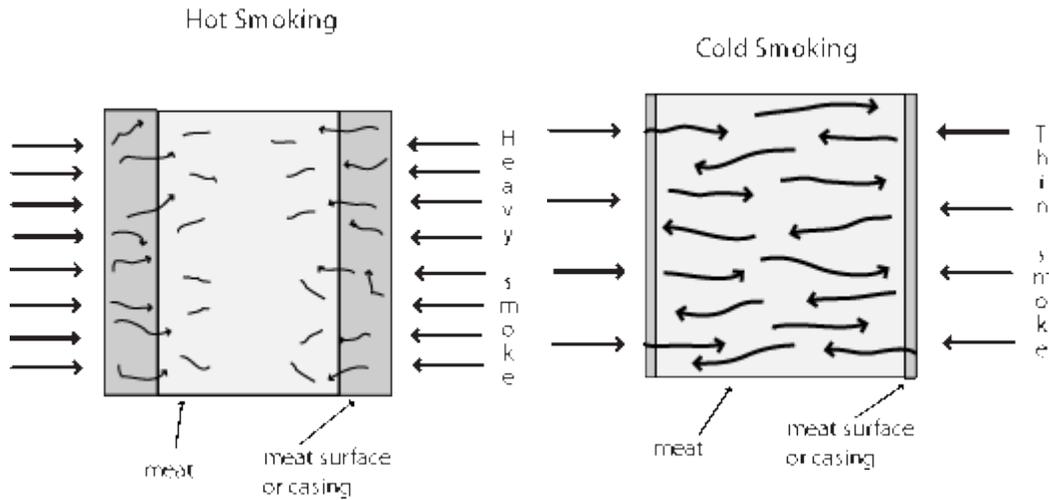
Types of Smoking

Cold smoking – 52° - 72° F (12° - 22° C), from 1 - 14 days, applying **thin smoke** with occasional breaks in between, is the oldest and still the best smoking method. It is obvious that you cannot produce cold smoke if the outside temperature is 90° F (32° C), unless you can cool it down, which is what some industrial smokers do. Cold smoking assures us of total smoke penetration inside of the meat. The loss of moisture also is uniform in all areas and the total weight loss falls within **5 – 20 %** depending largely on the smoking time. Cold smoking is not a continuous process, it is stopped (no smoke) a few times to allow fresh air into the smoker. In XVIII century brick built smokehouses a fire was started every morning. It smoldered as long as it could and nobody cared if it stopped altogether; it would be restarted again the following morning.

Cold smoked meats prevent or slow down the spoilage of fats, which increases their shelf life. The product is drier, saltier, with a more pronounced smoky flavor and very long shelf life. The color varies from yellow to dark brown on the surface and dark red inside. **Cold smoked products are not submitted to the cooking process.** If you want to cold smoke your meats bear in mind that with the exception of people living in Alaska, it will have to be done in the winter months just as it was done 500 years ago. In most areas of the USA it is limited to months with the letter “r” in its name : October, November, December, January, February, March, and April.

Ideally, the meat should be smoked at 80 % relative humidity. If the humidity were increased, the intense smoke penetration would bring extra moisture inside. Extra moisture in the meat causes bacterial growth, which is exactly what we are trying to avoid. Extremely low humidity, such as in Arizona and New Mexico will cause excessive drying of the sausage casing or the surface of the ham. This will prevent internal moisture from escaping the meat. This humidity control plays an important role when making products that

cure very slowly in open air. Not having humidity will produce meat that is still moist and raw on the inside and dry outside. Once the meat is cut, there will be two different noticeable shades.



Hot smoking dries out the surface of the meat or sausage barrier for smoke penetration

Cold smoking allows us total smoke penetration inside of the meat. Very little hardening of the outside surface of the meat or casing occurs and smoke penetrates the meat easily.

Using dry wood is of utmost importance when cold smoking . We recommend keeping wood chips in a well defined single pile as they will have less contact with air and will smoke better without creating unnecessary flames and heat. By following these rules we achieve 75 – 85 % humidity, creating the best conditions for moisture removal. This in turn prevents the growth of bacteria. Once the moisture content drops low enough the salt present in meat will further inhibit the development of bacteria and the products can hang in the air for months losing more moisture as time goes by.

This is how we solved our refrigeration problem hundreds of years ago. What is even more significant is that the taste of these products is superior. Our favorite smoked salmon is prepared with cold smoke for an extended period of time. Applying hotter smoke (over 84° F, 28° C) will just cook the fish, the flavor will change and we will not be able to slice it so thin anymore. Cold smoking is a slow process and the hams, which lend themselves perfectly to this type of smoking, can be smoked from 2 to even 6 weeks. During smoking they will slowly be acquiring a golden color along with a smoky flavor. Cold smoking invites total smoke penetration for all parts of the meat.



Cold smoking at its best. No matter how many million dollars one could invest in the latest smokehouses and equipment, it would still be impossible to compete qualitywise with Waldemar Kozik who makes and smokes his products in the Catskill Mountains of New York.

Warm smoking - 73° – 104° F (23° – 40° C), continuous smoking from 4 – 48 hours depending on the diameter of the meat, humidity 80%, and **medium smoke**. The weight loss varies between 2-10 %, with the difference being largely dependent on time spent smoking. The surface of the product becomes quite dry but the inside remains raw. Because of the warm smoke, the product receives more smoke in its outside layers. This dry second skin helps increase shelf life, as well as prevent the loss of those delicious juices. The color ranges from yellow to brown and has a little shine due to some fat moving outwards. Think of it like putting some fat on your shoes; they will start to shine.

Hot Smoking - Continuous smoking at 105° - 140° F (41° – 60° C), 0.5 – 2 hours, 5 – 12 % weight loss, **heavy smoke**. This is not recommended for large pieces of meat. Although it is the fastest method, there is not enough time for adequate smoke penetration. This results in higher moisture content, reducing the product's shelf life.

This type of smoking can be divided into three separate phases:

1. Drying out the surface of the meat for 10 - 40 min at 112°-130° F (45°-55° C), some very light smoke is acceptable, although not necessary. Besides drying out the surface of the meat, the temperature speeds up nitrite curing. Keep in mind that the draft controls must be fully opened to eliminate any moisture residing inside of the smoker.

Note: smoking at higher temperatures than 130° – 140° F (54 -60°C) will prematurely dry out casings or the surface of the meat and will create a barrier to smoke penetration.

2. This is the proper smoking stage at 112° - 140° F (45° - 60° C) for 30 - 90 min, using medium to heavy smoke. The color becomes a light yellow to dark brown with a shade of red. In this state, the natural casings become strong and fit snugly on the sausages.

3. About 10-20 min baking on the sausage surface at 140° - 176° F (60° - 80° C). Temperatures as high as 194° F (90° C) are permitted for a short period of time. Proteins are denatured in the outside layers of the product, but the inside remains raw with temperatures reaching only 104° F (40° C). Natural casings fit very snugly, become shiny, and develop a few wrinkles. This is a welcomed scenario; lots of smoked products are subsequently poached. Acting like a barrier, the drier and stronger casings prevent the loss of juices. This type of cooking (poaching) is more economical to baking (less weight loss).

If a smoker is used, the temperature in the last stages of the hot smoking process is increased to 167° - 194° F (75° - 90° C) until the inside of the meat reaches 152° - 160° F (66° - 72° C). This is the fastest and most common method of smoking. Because of a relatively short smoking time, hot smoked products should be kept in a refrigerator and consumed relatively quickly.

Wet smoking - any type of smoking that employs a water dish placed inside of the smoker to increase humidity levels. Dampening wood chips into water one hour before smoking will produce the same effect using any kind of smoker.

One reason small smokers need a water dish is their fuel, charcoal briquettes. When using wood, it always has about 20 % moisture, even when perfectly dried on the outside. During the first stage of combustion this wood dries out and any remaining moisture evaporates with the smoke into the chamber. Once the wood has burned out, the remaining charcoal has no water left, and in dry climates the product may be too dry. Ready made charcoal briquettes have no internal moisture, so we have to supply the water in a pan.

Another reason for the water pan is that most little factory made smokers are enclosed units that don't receive a steady supply of air. Fresh air contains moisture, which cools sausage casings or the surface of the meat. When smoking with an open fire, lots of fresh air enter the smoker and keep the meat from drying out. No matter how cute a small factory unit may be, it will not be able to perform the same duty without a little help from a water pan. As the water boils at the constant temperature of 212° F (100° C), placing water filled pan inside of a small smoker will help to control and maintain temperature **at that level**. Bear in mind that this is too high a temperature for smoking quality meats and sausages.

Summary on smoking methods

- The longer the smoking time, the bigger the loss of moisture, resulting in a higher proportion of salt. The product becomes drier and saltier, but achieves much longer shelf keeping qualities.
- A supply of fresh air is needed during smoking, which normally is controlled with a damper. Exiting smoke also needs a damper control otherwise tar and other unburned wood particles may start to accumulate, affecting the look and the taste of the product.
- The higher the smoke temperature the shorter the smoking time and the shorter its shelf life.
- The lower the smoke temperature, the better the smoke diffusion and the longest time of smoking. This directly leads to better taste and longer shelf life.

There is no steadfast rule that dictates exact temperature ranges for different types of smoking. Different books mention slightly different temperatures. A few degrees one way or the other should not create any problem as long as the hot smoking upper temperature limit is not crossed. Crossing this limit will significantly affect the look and the taste of the sausage.

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Smoke Generation

Smoke can be generated by:

- Burning firewood. Due to the danger of flames this method is limited to smokers with a separate fire pit.
- Heating wood chips or sawdust with an electrical wire (barbecue starter). Once started they will keep on smoldering and the wire starter is not needed anymore.
- Heating wood chips or sawdust over a gas flame.
- Placing wood chips over hot coals.

The preferred method to handle wood chips or sawdust is to place them in a stainless steel pan, about 8 -10” in diameter and leaving it on a hot plate, hot coals, gas burner or barbecue starter until sawdust starts to smoke. An additional amount of sawdust or wood chips should be added once in a while to maintain smoke generation.



hot plate



barbecue starter



gas burner

If smoking stops, the barbecue starter or hot plate is reconnected again. If the sawdust bursts into flames, any common spray bottle can bring it under control. The wood chips should be kept together in a conical pile so that they will smolder and not burn. The moment they spread, they make contact with more air and are more inclined to burn. The same applies when adding wood chips directly on hot coals or ashes, keep them in a pile and if the flames start to grow bigger, add more wood chips to cut off the supply of fresh air. After a while a natural rhythm of adding sawdust will be established and the whole process will go on smoothly.

All small and medium size factory made smokers use these methods to generate smoke. The bigger models employ a free standing smoke generation unit that is connected with the smoker by a short pipe. Draft control plays no role here since an electrical blower blows the smoke into the smoker. Industrial smokehouses choose still different methods of smoke generation but that does not necessarily mean that the

quality is better. One method involves pressing blocks of pressed sawdust against rotating wheels. That resistance creates high temperatures and the block of wood starts to smoke. It's like cutting a piece of wood with a dull saw blade; it starts to smoke because of the heat generated.

Dry or wet wood

Here is another question that never seems to go out of fashion: "what's better, wet or dry". Almost every book advocates using wet chips or sawdust, most likely because when wet they seem to produce more smoke. This is simply not true; the extra amount of smoke is nothing else but water vapor (steam) mixed with smoke. This does make a difference when hot smoking at 105° – 140° F and the smoke times are rather short. That extra moisture prevents the sausage casings from drying out during smoking. Besides, wet chips are not going to be wet for very long; the heat will dry them out anyhow. Wood chips produce good smoke when wet and they decrease temperatures, but the moment they become dry, they burst into flames and the temperature shoots up. The grease from the sausage drops down on the little flames, the temperature goes up, and the once little flames are now big flames and in one minute we have a raging fire inside of the smoker.

When your smoker has a separate standing fire pit, you don't care much about flames because they will never make it inside the smoker. Now you can use dry wood or put some wood chips over hot embers and your meats will have a more pronounced smoky flavor.

As you already know, we don't use wet wood for cold smoking because we want to eliminate moisture, not bring it in. Cold smoke warms the surface of the meat up very finely, just enough to allow the moisture to evaporate. Creating smoke for two days with wet wood will never dry out the meat. When hot smoking, the smoke along with the air is drying out the casings, which develop a harder surface. The surface of the meat will become drier, too. This creates the barrier for successful smoke penetration inside the piece, and also prevents moisture from escaping outside.

By using wet wood when hot smoking, we moisten the surface of the product, aiding the smoking.

To sum it all up:

- Meat smoked with dry wood has a more pronounced smoky flavor
- Wet wood is better for hot smoking
- Dry wood has to be used when cold smoking

Wood pieces, wood chips or sawdust

The type of wood used will largely depend on the smoker used, and the location of the fire pit.

If the smoker is connected with a fire pit by a pipe or a trench, it makes absolutely no difference what type of wood is burned as this design can take a lot of abuse and still provides efficient and comfortable smoke generation. Most people that use these types of smokers don't bother with chips or sawdust.



The above pictures are provided to make a point that smoking is often done with regular pieces of wood and not just chips or sawdust. Of course it is much easier accomplished when a smoker has a free standing fire pit, like in the pictures on the left.



Burning wood inside of small one-unit smokers creates the danger of fire erupting. We have to use wood chips or sawdust with a safety baffle above to prevent flames from reaching upwards. This would also prevent fat from dripping down on the wood chips and starting a big fire.

When smoking in a home made barrel smoker with a fire pit in the bottom part of the drum, it is much easier to control the smoking process by using dry chips. These smolder and burn in a more predictable manner. Wet chips are just soaked in water on the outside, even when placed in a bucket overnight. The only way to make them really wet is to cover them with boiling water and leave them in it. Hot water penetrates wood all the way through.

When preparing sawdust, do not throw it into water, but place it in a bucket and then moisten it using a spray bottle. Mix sawdust with by hand until it feels moist. This sawdust will burn longer and at lower

temperatures than other woods and will be the material of choice for smoke creation in small electrical smokers.

As previously mentioned, the smoke production method is not as important as other factors. What makes most of the difference is meat selection, its curing, and the temperatures during smoking and cooking.

Wood for smoking

Wood for smoking can influence color and even flavor of a smoked meat but only to a small degree. The wood used for smoking should be relatively new and kept in a well ventilated but covered area. A freshly cut tree contains 80 % moisture, but when it is dried properly the moisture content drops to about 25 %. That level of dryness requires about 6 – 9 months of drying. Wet wood can be recognized immediately because of the hissing sound it creates when burned. This is escaping vapor and billowing particles of water.

Any hard wood is fine, but evergreen trees like fir, spruce, pine, or others cause problems. They contain too much resin and the finished product has a turpentine flavor to it. It also develops a black color due to the extra soot from the smoke, which in turn makes the smoker dirtier too. However, there is a region in Germany called Bavaria where they have been using evergreen for centuries. They have acquired this taste in childhood and they are very fond of it; most people don't like it.

To achieve moisture contents of less than 20%, the wood must be oven dried. This wood will burn quickly and cleanly, but will not be suitable for smoking that calls for some moisture. And of course you cannot use any wood that was previously pressure treated, painted, or commercially manufactured. All wood must be natural. The type of wood used is responsible for the final color of the sausage and it can also influence its taste.

The following woods are great for smoking:

Acacia – the same family as mesquite, though not as heavy. A very hot burning wood. Smoked color : yellow, lemon type

Alder – light flavor that works well with fish and poultry. Contains a hint of sweetness, good with poultry and light – meat game birds. Traditionally used for smoking salmon. Northwest.

Almond – a nutty, sweet flavor

Apple – mild, fruity flavor, slightly sweet. Good for poultry, pork. Northwest.

Apricot – mild, sweet flavor. Good on fish, poultry, pork

Birch – medium hard wood, flavor similar to maple. Good with poultry, pork,

Black Walnut – heavy flavor, can impart bitter taste if not monitored carefully

Cherry – mild, fruity. Good with poultry, pork, beef.

Citrus – lemon, grapefruit, orange, nectarine – light fruity flavor, good with fish, poultry, pork and beef.

Fruit trees – apple, cherry, apricot – sweet mild flavor

Hickory – strong flavor, good with beef and lamb. Smoked products develop reddish color. Southern regions.

Maple – like fruit, sweet flavor. Northeast.

Mulberry – sweet, similar to apple

Mesquite – very strong flavor, burns hot and fast. Good for hot short smoking, better for grilling.

Oak – probably best all around wood for meat smoking. Strong but not overpowering, good for sausages, beef or lamb. Smoked products develop light brown to brown color, depending on the length of smoking.

Peach - mild, sweet flavor. Good on fish, poultry, pork

Pear – light and sweet, smoked color dark – red. Excellent with poultry and pork.

Pecan – milder version of hickory. Burns cool. Southwest region.

Plum - mild, sweet flavor. Good on fish, poultry, pork

Walnut – heavy smoke flavor. Can impart bitter taste if not monitored. Good with red meats and game.

All fruit and citrus trees have a light to medium sweet flavor and are excellent with poultry and ham. The Royal Couple of woods : The King Hickory and the Queen Oak can be used with poultry, pork, beef and lamb. Heavy smoke flavor woods (oak, hickory) lead themselves better for smoking red meats : beef, lamb than other types.

The oak is probably most commonly used wood as it grows all over the world and is so easy to recognize. Wood types can be mixed to create custom flavor for instance Walnut which has heavy smoke flavor can be mixed with apple wood to create a milder version.

For practical reasons a home sausagemaker will probably use oak or hickory most of the time. Mesquite will be better for grilling.

Some sausages like German or Polish Hunter Sausages develop characteristic flavor and aroma by using juniper branches or berries that are added to fire. Juniper is the ingredient we add for making gin, so we know it has to be good.

To simplify the matter :

fish and poultry - alder and fruit trees

meats - oak and hickory

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