THE WORLD'S PREMIER CULINARY COLLEGE

TECHNIQUE OF THE QUARTER : THE SMOKING PROCESS

The smoking process allows cured meats, poultry, game and seafood to be subjected to smoke in a controlled environment. The smoke is produced by smoldering hardwood chips, vines, herbs, fruit skins, or spices. This smoke influences the flavor, aroma, texture, appearance and shelf life of foods. The process can be performed at temperatures that range generally from 65°F to 250°F. The food merely retains the flavor of the smoke at lower ranges (cold-smoke), while the food actually cooks at the higher end of the scale (hot-smoke).

SELECTING FOODS TO BE SMOKED

Virtually any meat, poultry, game or seafood can be smoked, as can hard cheeses, nuts, vegetables, and sausages.

1. Prepare items

- Trim excess fat
- Fish should be gutted and cleaned of gills and all blood; large fish are often filleted
- Poultry should be trussed
- Larger cuts of meat should be boned and cut into smaller pieces
- The rind should be removed from cheese

2. Cure items (optional)

- Dehydrates - low moisture prevents bacteria growth and allows smoke to penetrate the item
- Adds flavor
- Prevents botulism
- Enhances color
- Smaller, thinner pieces cured; larger pieces brined

3. **Rinsing**
   - Stops the curing process
   - Removes excess saltiness and excess surface fat

4. **Dry Foods Well**
   - Removes excess surface moisture to form a skin (pellicle)
   - A wet surface will not readily absorb smoke
   - Removes excess surface fat
   - Forms the Pellicle

5. **Smoking Process**
   - Smoke is a seasoning - don't overdo it

Smoke is the complex production of very complicated compounds that occur during the thermal decomposition of wood (chips or sawdust). This process primarily occurs between a temperature range of 390°F and 750°F. Although at the point of generation smoke is a gas, it rapidly separates into a vapor and a particle state. It is the vapor phase that contains the components largely responsible for the flavor and aroma that smoke imparts to foods. More than 300 different compounds have been isolated from wood smoke, but not all of these compounds occur in smoked meat products. The components most commonly found are phenols, organic acids, alcohols, carbonyls, hydrocarbons, and some gaseous components such as carbon dioxide, carbon monoxide, oxygen, nitrogen, and nitrous oxide.

SMOKE IS APPLIED TO MEAT FOR THE FOLLOWING REASONS

- **For preservation:** Phenolic compounds and formaldehyde have anti-microbial action; this affects only the surface of the meat as smoke does not penetrate deeply into items.
- **Acids:** smoke emits a number of acids which cling to the meat and form an outside layer or skin. The acids help the coagulation of the surface meat, and also help preserve the meat by preventing the growth of surface mold and bacteria.
- **Add aroma & flavor:** Phenols, carbonyl compounds and organic acids contribute the smoky taste. Excessive smoke flavor can become bitter.
- **Develop appealing color**: Carbonyl compounds combine with free amino groups combined with meat protein to form furfural compounds that are dirty brown in color and translucent; when added with the reddish color of the cooked cured meat, you see a reddish brown color that is characteristic of smoked products.

- **Creation of new food products:** The addition of a smoky taste results in a product with a longer shelf life and pleasing color.
- **Protection from oxidation:** Smoke will protect the food from lipid oxidation and eliminate any stale fat tastes.
- **Formation of a protective skin on meats and emulsion-type sausages:** Acids in smoke help coagulate the protein on the surface of the meat.

SMOKING METHODS

Cold Smoking	Hot Smoking
Temperature of Smokehouse • 70°F and 100°F • (80°F) is average temperature	**Temperature of Smokehouse** • 160°F for all sausage (casings) • 185°F for all solid meats
Result of Cold Smoking • Product does not cook • Slight dehydration of overall texture	**Result of Hot Smoking** • Product cooks during the smoking process
	Final internal temperature of cured hot smoked products • All poultry 165°F internal • All meats 155°F internal • Final internal temperature of uncured hot smoked items • Beef (suitable cuts) 130 - 135°F for rare
Uses • Sausage in the uncooked smoked category • Smoked salmon • Addition of smoke to an item that will be finished by some other cooking method	**Uses** • To produce a fully cooked, smoked item • Sausage in the smoked cooked category

PREPARATION AND SMOKING PROCESS (HOT OR COLD)

Cold Smoke	Hot Smoke
Preparation before smoking • Trim item, truss, net or tie as necessary • Cure item by desired method • When cure is done, rinse item • Form pellicle	**Preparation before smoking** • Trim item, truss, net or tie as necessary • Cure item by desired method (optional) • If item is cured, rinse when done • Form pellicle
Smokehouse preparation • Place items on racks or hang from sticks	**Smokehouse preparation** • Place items on racks or hang from sticks
Smoke process • Smoke foods until desired color/flavor is achieved • Product can be air-dried further if drier product is desired • Refrigerate	**Smoke process** • Solid meat (185°F) smoke until proper internal temperature • Sausage (160°F) smoke until 140°F internal finish by poaching in 170°F water until proper internal temperature • Refrigerate

Note: It is recommended to cure all items that are to be cold-smoked because of possibility of botulism. Items that are hot-smoked can be left uncured if desired.

WOODS AND OTHER ITEMS USED FOR SMOKING

SMOKY FIRES ARE CREATED BY CONTROLLING:

- **Oxygen**: decrease in oxygen causes wood to smolder and smoke.
- **Moisture**: damp products smolder rather than burn.

WOODS FOR SMOKING

Hard, fruit or nut woods are preferred. All woods impart a slightly different flavor of their own. Wood is available in sawdust, chip/nugget and chunk form (use the form recommended by the manufacturer of the smokehouse).

Hickory is the most common type used and provides good color and flavor. Apple, cherry, mesquite and alder wood are other commonly used woods.

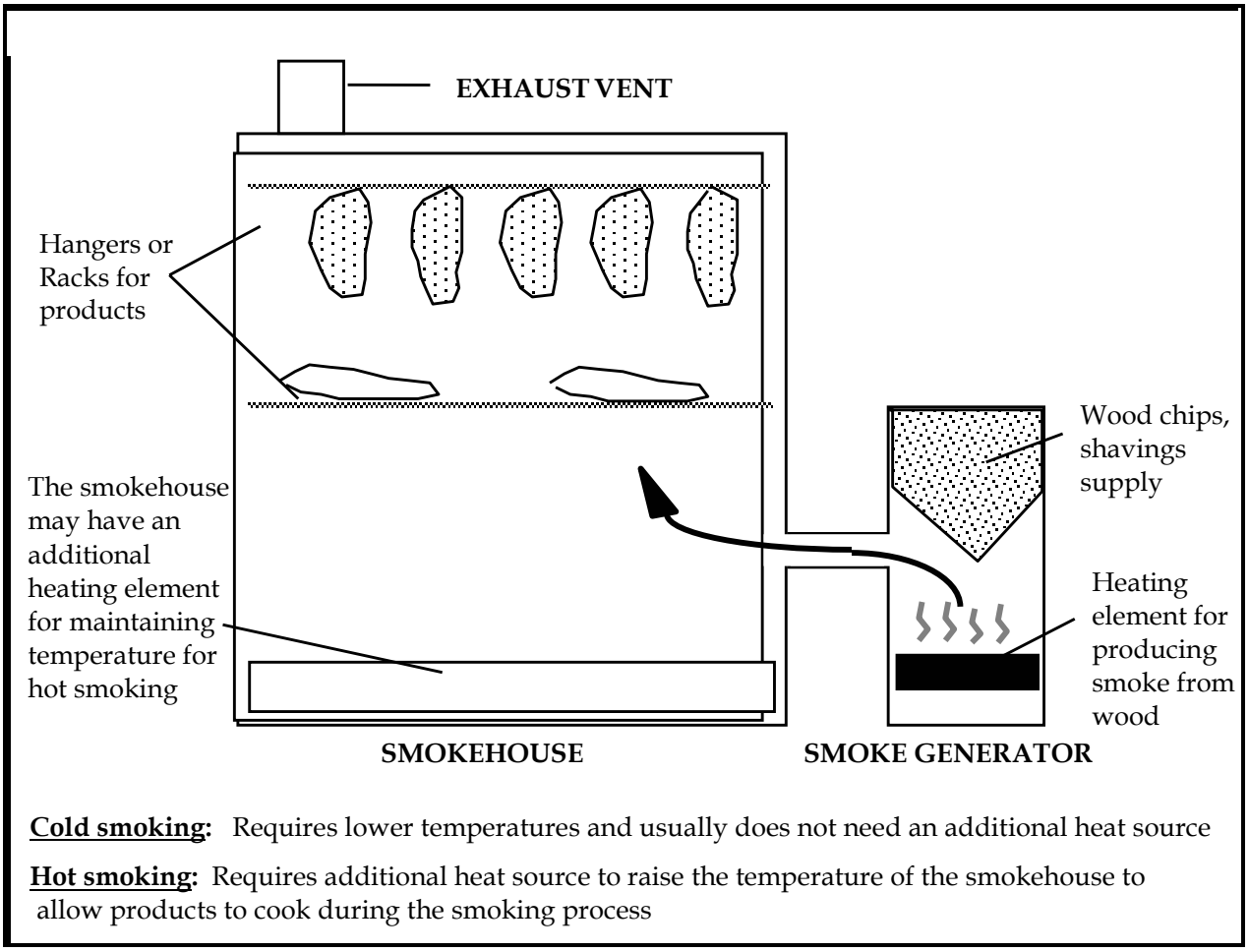
Note: Soft or resinous woods should never be used; they will either flare up and burn (produce no smoke) or add too much color to the product, imparting a bitter taste. They are high in creosote resin which may cause cancer. Woods should be purchased from a reputable purveyor to insure they are free of contaminants such as oil or chemicals. Never use pressure-treated wood; may contain arsenic or other toxic compounds.

OTHER ITEMS USED FOR SMOKING

- Dry herbs and spices can be used
- Jasmine and other teas; also peanut shells are used by the Chinese

HOW A SMOKEHOUSE WORKS

Below is a simplified diagram of how a smokehouse works. Many of the larger smokehouses are computer programmed as to time and temperature.

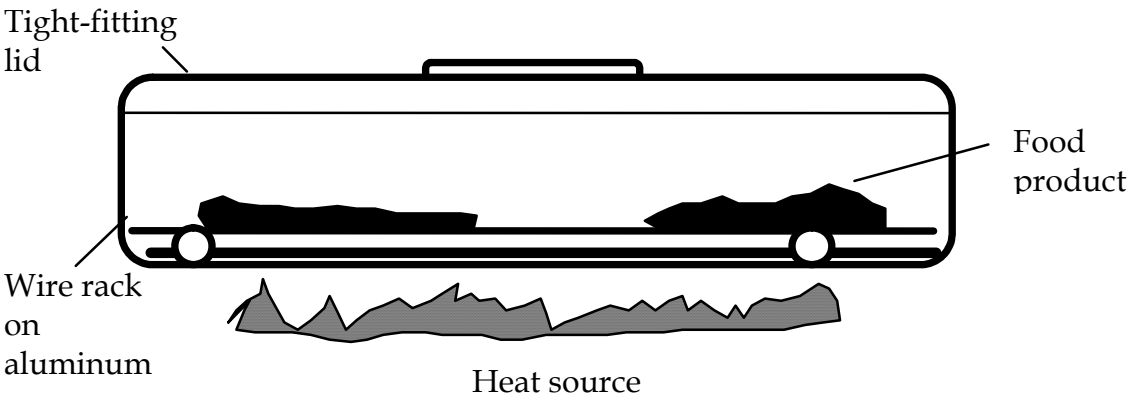


Cold smoking: Requires lower temperatures and usually does not need an additional heat source

Hot smoking: Requires additional heat source to raise the temperature of the smokehouse to allow products to cook during the smoking process

Smoke Roasting (Foil Pan Method)

Setup for Smoke Roasting



Method:

1. Use an aluminum foil disposable hotel pan for top and bottom
2. Place 1/4 inch of hickory chips on the bottom of the pan.
3. Make four 1-inch balls out of aluminum foil and place one in each corner of the pan.
4. Place a wire rack on top of the foil, arrange your product to be smoked on the rack.
5. Cover the pan with the second foil pan and secure with a weight.
6. Place the pan on the stove and smoke the desired amount of time with high heat; when done, allow the pan to cool slightly before opening.

PROCESS SCHEDULE FOR HOT AND COLD SMOKED FISH

FISH (SALMON)
Raw material must be fresh with no signs of detectable spoilage and must be maintained at 33°F or less.

Thawing
Thawing of frozen food must be done at a temperature no greater than 45°F.

Evisceration
Fish must be eviscerated in a separate area and washed thoroughly.

Brining
Mixing of fish species in brine is not allowed. Brining or dry salting, in excess of 4 hours, must take place at a temperature of 38°F or less. Salt concentration and period of time must be adequate to ensure salt penetration to give a water phase salt (WPS) of 2.5%. The determination of water phase salt must be done on the thickest piece of fish, sufficient times to meet requirements.

Hot Smoking
The fish should be so arranged as to facilitate complete smoking of all product surfaces. Fish temperature in the smoker must reach a minimum of 145°F and be held for at least thirty (30) minutes. Temperature probes are to be inserted in the thickest portion of at least three (3) fish with the lowest temperature reading being recorded on the process record. The temperature will be recorded at least three (3) times during smoking.

Cold Smoking
The fish should be so arranged as to facilitate complete smoking of all product surfaces. Smokehouse temperature should be maintained at a temperature not to exceed 50°F for a time not to exceed 24 hours; or not more than 90°F for not more than 20 hours. The smokehouse temperature should be recorded at least three (3) times during smoking.

Cooling
Fish shall be cooled to 50°F within five (5) hours and to 33°F within 12 hours and maintained at that temperature until sold.

Packaging
This fish can only be sold air-packaged and must be labeled in bold print "Keep Refrigerated at 38°F or below".

Records
Production records must be kept on each batch of fish showing the name of the product, a lot code, date processed, and container size and number of containers if applicable. A record must be kept in ink on the temperature of thawing, brining, smoking, cooling and storage of each batch of fish processed. The record must also show the duration of smoking. Records must also show the name(s), address (es), and lot code(s) of initial sale.

TYPES OF SMOKING

- **Cold Smoke**
  - ✓ 70-100°F - imparts the flavor but doesn't firm proteins
  - ✓ Items may be cold smoked, then finished in the oven
- **Hot Smoke**
  - ✓ 160 - 225°F - imparts flavor and cooks the product

THREE SMOKING METHODS

- **Conventional:**
  - ✓ More smoke flavor, air does not circulate as much
  - ✓ Product must be dry
- **Convection:**
  - ✓ Less smoke flavor because the air is being circulated
  - ✓ Product does not have to be dry because of the air circulation
- **Pan smoking:**
  - ✓ Pan smoking gives a lot of flavor in short period of time
  - ✓ Can be done with no special equipment

IMPORTANT TEMPERATURES TO REMEMBER

- ✓ 103°F: Proteins begin to set or denature
- ✓ 137.5°F: Trichinosis bacteria is killed
- ✓ 155°F: Federal requirement for cooking pork
- ✓ 160°F: All proteins are coagulated
- ✓ 165°F: Federal requirement for cooking all poultry

SUGGESTIONS FOR USE OF WOOD CHIPS IN SMOKING

Alder: This has quite a mild taste, ideal to use with vegetables and fish.

Apple: This has a unique fruity flavor, ideal to use with fresh ham, frog legs, pork chops, sweet sausages, Cornish hens and salmon.

Cherry: This is similar to the characteristics of apple, but with a slight tart aftertaste, ideal to use with lamb, pheasant, duck, venison and steak.

Maple: This has a universal subtle hint of sweet flavor, ideal to use with turkey, ham Canadian bacon, tenderloin of beef and pork, poultry, most kinds of game and vegetables.

Hickory: This has a strong heavy bacon flavor, ideal for use with ribs, barbecue items, steaks, chops, and spicy food, broiled chicken.

Oak: This is a mellow version of mesquite, ideal to use with steaks, duck, and hamburgers.

Mesquite: This has authentic Southwest twang, leaving a little bit of a hot burning sensation as an aftertaste, ideal to use with pork, spare ribs, steaks, and most red meats. If used with great care it can also be used across the whole ingredient spectrum.

Sweet Birch: This leaves a sweet delicate taste on the palate, ideal to use with chicken, swordfish, tuna, salmon, lamb, barbecued pork items, all vegetables especially members of the lily family.

Pecan: This has quite a mellow flavor to it similar to hickory; cool burning is one of its major characteristics, ideal to use with chicken and duck and most game that is of the winged variety.

SMOKED PORK CHOPS

Yield: 6 Portions

Ingredients	Amounts
Pork chops, one-inch thick	6 ea.
Wood chips	2 cup
Cilantro, fresh chopped	
Salt and Pepper	½ cup
Olive Oil	1 oz

Method

1. Fabricate 1-inch thick pork chops and remove excess fat.
2. Moisten the wood chips in cold water.
3. Marinate pork chops with spices, herbs and pepper for 1 hour.
4. Pan-smoke the chops, for 3 to 5 minutes until they reach a light yellow color. Grill the chops, finishing on a rack in the oven at 375°F if needed.
5. Repeat twice, using different woods for smoking.

HOT-SMOKED SWORDFISH

Yield: 6 Portions

Ingredients	Amounts
Sword or tuna fish, thick steaks	1½ lb.
Marinade	
Lemon juice	1 ea.
Salt	1½ tsp.
Worcestershire sauce	1 oz.

Method

1. Combine all ingredients for the marinade.
2. Rub marinade over half of the fish, refrigerate for 1 - 2 hours. Leave the other half of the fish plain.
3. Blot-dry with paper towels and hot-smoke until desired doneness.
4. Repeat twice, using different woods for smoking.

TEA AND SPICE SMOKED CHICKEN

Yield: 1 Chicken

Ingredients	Amounts
Chicken, whole	1 ea.
For Smoking the Chicken	
Dry black tea leaves	¼ cup
Brown sugar	¼ cup
Raw rice	1/3 cup
Szechwan brown peppercorns	1 Tbsp.
Star anise	3 ea.
Cinnamon sticks, broken into small bits	2 ea.
Brown sugar, for smoking the second side of the chicken	¼ cup
Sesame oil	2 Tbsp.

Method

1. Combine the smoking ingredients and spread evenly in the bottom of the pan.
2. Pan-smoke the chicken for 10-15 minutes. Turn the chicken over and continue to pan smoke the chicken for an additional 5-8 minutes. If necessary, finish the chicken in 375°F oven until an internal temperature of 170°F has been reached. Rub the outside of the chicken with the sesame oil.
3. Repeat the process twice, using different tea (e.g. orange pekoe or green tea) for smoking.

PAN-SMOKED CHICKEN BREAST WITH ARTICHOKE AND MUSTARD SAUCE

Yield: 10 servings

Ingredients	Amounts
Chicken breast; boneless, skinless	2 ¼ lb.
Olive oil	2 tsp.
Shallots, diced	1 oz.
Chicken Stock	10 oz.
Fond de Veau Lié	10 oz.
Mustard, whole-grain	2 oz.
Mustard, Dijon	1 oz.
Balsamic vinegar	3 Tbsp.
Artichoke hearts, cooked, quartered	10 ea.
Kalamata olives, pitted, halved	3 oz.
Tarragon, chopped	2 Tbsp.

Method

1. Trim and cut the chicken into ten 3 ½ oz portions. Lightly pound the chicken to an even thickness.
2. Place the chicken on a rack in a roasting pan containing a thin layer of hardwood chips. Cover with a tight-fitting lid and place over low direct heat. Pan smoke for 6 to 8 minutes. Remove the breasts form the pan and cool. Refrigerate until needed.
3. To make the sauce, heat the oil in a small saucepan. Add the shallots and sauté until translucent. Add the stock and reduce by half. Stir in the fond de veau lié, mustards, and vinegar. Simmer until reduced to a sauce consistency. Add the remaining ingredients and heat thoroughly. Keep warm.
4. *For each serving:* Place 1 portion of smoked chicken on a rack in a roasting pan in a 375° F oven and bake until internal temperature of 165°F is reached, about 10 minutes. Slice the chicken on a bias and serve on a pool of 3 fluid oz of the sauce.

SMOKE-ROASTED CHICKEN BREAST WITH BBQ SAUCE

Yield: 10 servings

Ingredients	Amounts
Chicken breast portions	10 (6 oz.)
Salt	as req.
Pepper	as req.
Marinade	
Vegetable oil	10 fl. oz.
Cider vinegar	5 fl. oz
Worcestershire sauce	1 fl. oz.
Brown sugar	1 Tbsp.
Dry mustard	2 tsp.
Tabasco sauce	1 tsp.
Garlic powder	1 tsp.
Onion powder	1 tsp.
Garlic, minced	¼ oz.

Method

1. Rinse chicken, pat dry, season with salt and pepper, and place in shallow hotel pan.
2. Combine the ingredients for the marinade and pour over the chicken, turning to coat evenly. Marinate under refrigeration for 3 hours or up to overnight.
3. Place the chicken on a rack and set it in a pan over lightly dampened hardwood chips. Cover tightly and heat in a 450°F oven until the smell of the smoke is apparent. Smoke for 3 minutes from that point. Transfer the chicken to a baking pan and finish baking (without smoke) in a 350°F oven until done, about 8 to 10 minutes more (170°F for breast meat).
4. Serve at once with additional barbecue sauce if desired.

SMOKE ROASTED STRIP LOIN OF BEEF

Yield: 6 Portions

Ingredients	Amounts
Sirloin	4 lbs.
Dry Rub	
Garlic powder	1 Tbsp.
Onion powder	1 Tbsp.
Salt, kosher	3 Tbsp.
Sugar	4 Tbsp.
Cumin, ground	2 Tbsp.
Black pepper, fresh cracked	2 Tbsp.
Cayenne	1 Tbsp.
Paprika	4 Tbsp.
Chili powder	2 Tbsp.

Method

1. Combine all and mix well to evenly distribute the spices.
2. Trim the sirloin of excess fat and connective tissue.
3. Rub the dry spice mixture all around the sirloin strip and allow to sit for 15 minutes before smoke roasting.
4. Smoke roast the sirloin strip over low heat as instructed by the manufacturer of the gas or charcoal grill.
5. Cook to an internal temperature of 120 – 125 degrees for medium rare.
6. Remove from the grill and allow to rest for 20 minutes to allow the juices to settle.
7. Slice and serve.

SMOKE ROASTED PORK LOIN WITH GRILLED APPLES

Yield: 6 Portions

Ingredients	Amounts
Pork loin, boneless	3 lb.
Brine	2 qt.
Apples, granny smith	6 ea.
Apple cider or apple juice	½ cup
Sugar	¼ cup
Cinnamon	to taste
Nutmeg	to taste
Vinegar, apple cider	1 Tbsp.

Method for the Pork

1. Set-up a gas or charcoal grill to medium heat following the manufactures instructions. For a gas grill, follow manufactures instructions regarding the use of wood chips. For a charcoal grill, bank the charcoal to two sides. Clean and preheat the grill racks.
2. Cure the pork loin for 8 – 12 hours in the brine. Remove, rinse and allow to air dry under refrigeration for several hours, until the surface is very dry.
3. Smoke roast over medium heat to an internal temperature of 155°F. Remove and allow to sit for 20 minutes before slicing.

Method for the Apples

1. Peel and core the apples. Slice them into rings ¾" thick. Season a section the grill racks with oil over the charcoal. Allow to reheat and grill the apples covered until almost tender turning occasionally. Remove and allow to cool.
2. In a food processor puree ½ of the apples with the apple cider vinegar to desired consistency. If a thicker applesauce consistency is desired use less apple juice. For a sauce like consistency add more apple juice or cider. Add the sugar and season to taste with the cinnamon, nutmeg and vinegar.
3. Slice the remaining apples ¼ inch thick, across the ring and add to the sauce.
4. Heat and serve with the pork loin.