What is the Smoke Ring and Why Is It There!

How to Get That Coveted Pink Ring With Your Cooking

by Joe Cordray

Slow cooked barbecue meats often exhibit a pink ring around the outside edge of the product. This pink ring may range from 1/8 inch to 1/2 inch thick. In beef the ring is a reddish-pink and in pork, chicken and turkey it is bright pink. This pink ring is often referred to as a "smoke ring" and is considered a prized attribute in many barbecue meats, especially barbecue beef briskets. Barbecue connoiseurs feel the presence of a smoke ring indicates the item was slow smoked for a long period of time. Occasionally consumers have mistakenly felt that the pink color of the smoke ring meant the meat was undercooked. To understand smoke ring formation you must first understand muscle pigment.

Myoglobin is the pigment that gives muscle its color. Beef muscle has more pigment than pork muscle thus beef has a darker color than pork. Chicken thighs have a darker color than chicken breast thus chicken thigh muscle has more muscle pigment (myoglobin) than chicken breast tissue. A greater myoglobin concentration yields a more intense color. When you first cut into a muscle you expose the muscle pigment in its native state, myoglobin. In the case of beef, myoglobin has a purplish-red color. After the myoglobin has been exposed to oxygen for a short time, it becomes oxygenated and oxymyoglobin is formed. Oxymyoglobin is the color we associate with fresh meat. The optimum fresh meat color in beef is bright cherry red and in pork bright grayish pink. If a cut of meat is held under refrigeration for several days, the myoglobin on the surface becomes oxidized. When oxymyoglobin is oxidized it becomes metmyoglobin. Metmyoglobin has a brown color and is associated with a piece of meat that has been cut for several days. When we produce cured products we also alter the state of the pigment myoglobin. Cured products are defined as products to which we add sodium nitrate and/or sodium nitrite during processing. Examples of cured products are ham, bacon, bologna and hotdogs. All of these products have a pink color, which is typical of cured products. When sodium nitrite is combined with meat the pigment myoglobin is converted to nitric oxide myoglobin which is a very dark red color. This state of the pigment myoglobin is not very stable. Upon heating, nitric oxide myoglobin is converted to nitrosylhemochrome, which is the typical pink color of cured meats.

When a smoke ring develops in barbecue meats it is not because smoke has penetrated and colored the muscle, but rather because gases in the smoke interact with the pigment myoglobin. Two phenomenon provide evidence that it is not the smoke itself that causes the smoke ring. First, it is possible to have a smoke ring develop in a product that has not been smoked and second, it is also possible to heavily smoke a product without smoke ring development.

Most barbecuers use either wood chips or logs to generate smoke when cooking. Wood contains large amounts of nitrogen (N). During burning the nitrogen in the logs combines with oxygen (O) in the air to form nitrogen dioxide (NO_2). Nitrogen dioxide is highly water-soluble. The pink ring is created when NO_2 is absorbed into the moist meat surface and reacts to form nitrous acid. The nitrous acid then diffuses inward creating a pink ring via the classic meat curing reaction of sodium nitrite. The end result is a "smoke ring" that has the pink color of cured meat. Smoke ring also frequently develops in smokehouses and cookers that are gas-fired because NO_2 is a combustion by-product when natural gas or propane is burned.

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