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Steam cooking

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Steam has long been a favorite cooking method for cooks and chefs. With the squeeze on time and staff, anything that lends itself to speed and throughput while safeguarding food is an advantage. There are different ways to use steam as your cooking medium. The first is where the steam comes in direct contact with the food items, as with a convection or pressure steamer. The second is where the steam is used to heat a surface which in turn comes in contact with the food item, as with a steam jacketed kettle. Steam jacketed kettles have survived many evolutions of food equipment technology due to their relative simplicity and undying reliability. Steamers on the other hand have evolved considerably, beginning with pressure steamers which were common in institutional food service, to the modern pressureless convection steamers and now, the combination steamer oven. Water quality one of the most important issues to address when considering self-contained steam equipment. It is extremely variable and, consequently, complicated. The July issue of Closing the Gap will dive into problems associated with water and certain pieces of foodservice equipment.

The characteristics of steam

A fantastic heat transfer medium, steam is H_2O in it's gaseous form. It is a colorless and odorless gas which displaces air. Steam is extremely light, diffuse and quickly releases its energy as it cools and condenses to water. One BTU (British Thermal Unit) equals the amount of heat energy it takes to raise a pound of water 1^0F. It takes 180 BTU to raise a pound of water from 32^0F to 212^0F (at sea level, etc.). It takes another 970BTU to cause that pound of 212^0F water to become a pound of 212^0Fsteam. The additional energy (970BTU) it takes (holding the temperature constant) to cause the change in phase (liquid to gas) is called the latent heat of steam. Holding pressure constant, water expands over 1500 times to become steam. Steam is "dry" in the sense that it is not a liquid...it is a gas. The temperature at which water boils depends upon pressure. For example, we mentioned above that steam boils at 212^0F at atmospheric pressure. Roughly speaking (at low pressures anyway) the boiling point and thus steam temperature, rises about 3^0F for every pound of pressure. Conversely, the boil point (and temp of steam) is reduced about 3^0F for every inch of water column vacuum (the opposite of pressure).

Pressure cookers:

Pressure steamers came into vogue shortly after the turn of the century. Steamships, paddleboats, and buildings had an abundance of high pressurize steam which was used for locomotion and/or heat. Foodservice entrepreneurs found that they could tap this power source to cook their foods. The pressure steamer was a mainstay in most institutional kitchens from the 1940's-70's. Cooking food under pressure does impact your cooking results. Food cells exposed to pressurized steam assimilate the pressure that surrounds them. These pressure steamers would cook at pressures between 5 and 15psi, which means steam temperature of between 227^0F and 242^0F. Pressure steamers decompress very rapidly before the door is opened and food cells tend to explode, leaving the food item mushy. This is a problem for most products, but a big advantage when cooking rice. Nothing cooks rice like a pressure steamer. Vegetables like broccoli and green beans or peas "yellow" in a pressure steamer as the chlorophyll is washed away. Moreover, since pressure steamers accumulate so much condensate in the cooking pans as they steam, vitamins and other nutrients go to solution and are left behind when served. The size of the pressure steamer's compartments and the speed of cooking made them very popular. Changes in design of building heating systems has forced a change in steam cooking equipment. There was also great concern about the use of "dirty" steam, whereby hazardous boiler compounds are added to treat the boiler water. Some of these compounds is carried aloft with the steam and then would come in contact with the food. For these reasons, today's steam equipment is predominantly self-contained.

Steam jacketed kettles:

Steam jacketed kettles continue to fill a critical need in many kitchens. They can easily prepare hundreds of pounds of product in minutes, without burning or scorching. Kettles tend to stir themselves to certain extent.

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Steam bubbles rise off of the bottom and sides of the kettle lifting the liquids and solids up the sides and allowing them to fall into the center. Vegetables in a pot of boiling water get most of their heat from the steam bubbles rising off of the bottom, not the water. Air, on the other hand, is a very poor conductor of heat and has the nasty characteristic of absorbing moisture (and flavors) as the temperature rises. Kettle capacities range from small 5gal countertop units to 40, 60 and 80 gallon floor model units. Specialty units extend capacities far beyond those listed. Groen, a division of Dover Industries, Inc. pioneered self-contained steam jacketed kettles and also perfected the agitator kettle. This marvelous invention stirs the pot for you, avoiding carpal tunnel complaints. Recent models have a variable speed agitator applied to the kettle at an angle so that solids (vegetables etc.) are brought from the bottom to the top to get a homogenous cooking and blending action. Some of these units can be connected to special food pumps which will quickly pump the kettle contents into 1-3 gallon plastic pouches.

Self-contained steam jacketed kettles have a small amount of treated or distilled water, some rust inhibitor and a bit of antifreeze in their base. This water is used again and again to generate steam. Air in a steam vessel dramatically impairs the transfer of heat. In fact, one half of one percent of air in a steam environment reduces the heat transfer coefficient by 50%. This is why a self-contained steam jacketed kettle performs best when the jacket is in a vacuum. To check your self-contained steam jacketed kettle, observe the pressure gauge when the kettle is cool. The gauge needle ought to be pointing at something less than 10-15"W.C. below the 0 level. If your gauge needle is at 0 when the kettle is cool, it means that air has seeped into the jacket, which will dramatically impair your kettles speed and your ability to control temperature. Water boils at 212^0F at sea level, at atmospheric pressure. But if you pull a 15"W.C. vacuum on a steam vessel, you will find that the water will boil at roughly 160 degrees. At a 30" W.C. vacuum, it will boil at roughly 140^0F. Your kettle will work properly if it is in a 15-30"W.C. vacuum, which you can check (by looking at the pressure gauge) only when it is cool.

Convection steamers:

Pioneered in 1975 by Paul Lovejoy, then president of The Cleveland Range Company, convection steamers cook foods at atmospheric pressure. A fully loaded compartment of frozen vegetables in 12x20x2" deep cafeteria pans steam to perfection in 5-8 minutes, depending upon the vegetable. There is simply no faster way to reheat previously cooked items than a convection steamer. Since the cooking compartment is pressureless, products retain their natural crispiness and their nutrient values, unlike steaming in a pressure steamer. Convection steamers do not transfer flavors from one product to another even though the pans are never covered. Remember, steam is a conductor so covering a pan will simply trap air (an insulator) in the pan retarding the cooking process. Also, steam has very little if any capacity to absorb moisture from food items, so why bother with a cover? Items will cook far faster if the steam can physically "touch" the food item. Finally, the small amount of condensate that accumulates in the pan helps to keep food products at proper serving temperatures without drying when placed out onto the service line. No need to use perforated pans either, as to do so simply means you will have at least two pans to clean (cooking plus service), and food items will cool and dry faster anyway.

Combination steamer/ovens:

Also known as combi or combo ovens, they cook in any of three different modes: steam only, hot air only, or, superheated steam. Steam by itself at atmospheric pressure will not brown foods. To "brown" a product, higher temperatures are required to caramelize the foods sugars. During the cooking process, the foods juices and sugars rise to the surface in solution and the water is evaporated leaving the solids to "brown". When cooking in the combination mode, foods are exposed to steam, but the steam is superheated to temperatures ranging from $250\text{-}500^0$F...foods do brown and they cook very quickly with a minimal amount of shrinkage and maximum amount of flavor retention without flavor transfer. Introduced in the U.S. by Rational in 1984, Groen was the first to market with a natural gas fired combo oven in 1986. **A single compartment full size Combo oven will cook (4) 25 pound turkeys from 38 degrees to fully cooked, golden brown in roughly 75-80 minutes.** These units can be stacked to double the production

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capacity without taking anymore floor space. Given their penchant for speed, you will not be surprised that they do take a bit of power...each compartment is rated at 186M BTU. Schools use them to bake frozen pizza in about 5 minutes, with the product baked (superheated steamed actually) just the way kids like it. The cheese is fully melted and lightly browned, and the crust is just the right consistency. New models will be available with windows to allow product viewing while combo cooking. For large production needs, some manufacturers offer roll-in ovens. There will likely be a convergence between the foodservice equipment manufacturer's roll-in combo ovens, and the rotary baking oven manufacturers' steam injected ovens in the very near future. On the other end of the spectrum, steamers are getting smaller too. Emberglo was the first to market with a countertop, single pan push button steamer. A number of manufacturers' saw the advantage of being small and designed their own single pan, or less than full size pan countertop units. One manufacturer introduced a multi pan unit that cooks in a vacuum. They use distilled water which the operator needs to pour into the unit. The cook times are a bit longer than other models, and of course, distilled water is quite expensive. Nonetheless, many are attracted to the fact that these units will not have the types of problems characteristic of units hooked up to untreated house water.

Steam cooking is here to stay and the number of steamer models and features to select from will continue to expand. $369 billion dollars was spent on food in 1996, and 46% of that was spent for meals outside of the home. Of that, roughly half was for take out which includes the fast growing home meal replacement (HMR) market. Given that the average dinner in 1953 took 2 hours to prepare compared with the 15 minute average common for today's ready-heat-eat products, speed cooking is the way to go.

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