

Steam Pasteurization of Almonds



Pasteurization —The Possibilities ...

What it is, How it works, Why it works every time.

What is it?

The process of pasteurization was named after **Louis Pasteur** who discovered that spoilage organisms could be inactivated in wine by applying heat at temperatures below its boiling point. The process was later applied to milk and remains the most important operation in the processing of milk and other beverages.

How does it work?

Heat is lethal to microorganisms, but each species has its own particular heat tolerance. During a thermal destruction process, such as pasteurization, the rate of destruction is logarithmic, as is their rate of growth. Thus bacteria subjected to heat are

killed at a rate that is proportional to the number of organisms present. The process is dependent both on the temperature of exposure and the time required at this temperature to accomplish the desired rate of destruction. Thermal calculations thus involve the need for knowledge of the concentration of microorganisms to be destroyed, the acceptable concentration of microorganisms that can remain behind (spoilage organisms, for example, but not pathogens), the thermal resistance of the target microorganisms (the most heat tolerant ones), and the temperature time relationship required for destruction of the target organisms.

The extent of the pasteurization treatment

required is determined by the heat resistance of the most heat-resistant enzyme, microorganism, or pathogen in the food. For example, milk pasteurization historically was based on *Mycobacterium tuberculosis* and *Coxiella burnetti*, but with the recognition of each new pathogen, the required time temperature relationships are continuously being examined.

For the Almond Industry, the identified pathogen is ***Salmonella Enteritidis Phage Type 30 (SE PT30)***.

The "industry" has determined that a certain temperature and time period is required to destroy this pathogen. A 5 log reduction, or a 100,000 count reduction is the goal of any treatment of SE PT30.

Steam, PPO, Radiation ... ?

How do you choose?

To the best of our knowledge, there are only 3 choices when it comes to Pasteurizing your precious and expensive crop for salmonella that works. They are:

1. PPO - chemical treatment
2. Radiation or Irradiation - Gamma or other isotopes
3. Steam - High Temperature Short Time treatment

It is clear that almost all countries outside the USA will not accept PPO treated nuts for human consumption. The PPO process, while not conclusive, is suspected of being a cancer causing

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VENTILEX USA Inc.

8106 Beckett Center Dr.
West Chester, OH 45069
P: 513.874.4451
F: 513.870.5173
E: sales@ventilex.net

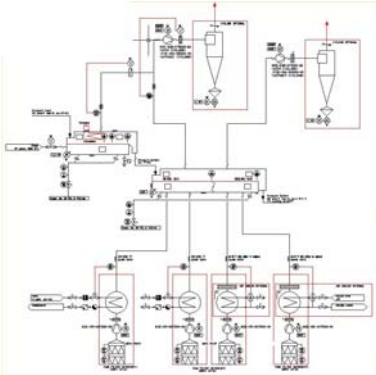
www.ventilex.net
www.nutpasteurization.com

Special points of interest:

- Using Natural Renewable Resources
- FDA/USDA Validation and acceptance.
- increase profits \$20 to \$200 or more per ton!
- Fast Payback makes VENTILEX affordable.



Steam, PPO, Radiation ...? continued



VENTILEX Pasteurizer Schematic



"... Steam is natural and a renewable resource. It is accepted by ALL countries in the world."



process because of the chemicals being used. Radiation is accepted in some countries, but is banned in many. The long term effects of *Radiation of Foods* is not known. Major countries forbid any food being treated in this manner being imported.

What is easy to understand is that **Steam** is natural and a renewable resource. It is accepted by **ALL** countries in the world. Not one country bans or even has an issue with steam treated food products. The process of steam treating for Pasteurization and Sterilization dates back 100's of years. Medical instruments are steam treated. Milk, Apple Juice, Beer and Orange Juice, among other beverages, are

steam treated. Spices, which are primarily made up of nuts (Black Pepper for example), have been steam treated for the past 20 years. To our knowledge, no-one can even point to one case or study where steam treating food has a detrimental effect on human health.

It is with this natural resource that micro organisms are killed. Dry heat can possibly do the job, but such a high temperature and time is needed for the same killing effect. The key to pasteurizing your almonds, is in the condensation power of the steam. The steam is heated to super saturation and then allowed to condense on the cool surface of the almond. It is this natural process that kills

the micro organisms. Think of being in a dry or a wet steam sauna. The temperature that you can withstand *yourself* in the dry sauna is much higher than in the wet sauna. The reason for this is that when in the steam environment, the steam condenses on your skin. It is very hot. You can only take it for a short time.

While it seems simple -- just add steam -- in practice it is somewhat difficult. In order to be sure the steam condenses on all surfaces of the nut, you need to add the second part of the process: fluidization by a gas medium. The Steam can be used as the gas medium, but you now need pressure and velocity.

The VENTILEX Proven System

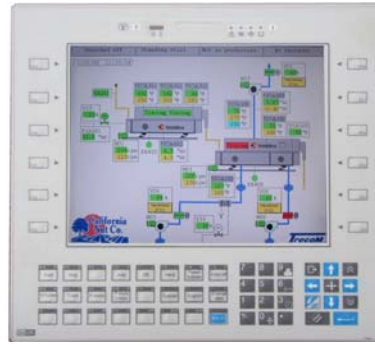
Over 50 years in the design and manufacturing of machinery

VENTILEX combines Steam with Fluidization then Drying and Cooling. This is accomplished with our exclusive and proven "shaking" mechanism. This "shaking" and fluidization assures that all surfaces are exposed and treated equally. A moving belt with your almonds does not assure you that all surfaces are exposed. Any 2 nuts touching one another will have contact points. It is at these points that the steam could possibly not condense, thus salmonella still exists in the packaged almonds.

Treatment times are critical for 5 log or above kills. In our testing (verified by the largest worldwide laboratory: SGS), we also determined that if you steam treat the almonds past a certain time, that the "natural" aspects of the almond are changed. You will kill the germ and it will no longer be alive and able to germinate.

Too long of a steaming time also leads to skin damage and a swelling of the almond. It is also clear that this time period is a short window. Too little, and the results are not

good - you do not achieve the 5 log kill rates. VENTILEX has been steam sterilizing and pasteurizing various nuts for the past 14 years. Our experience in what to do with the steam treated almonds is also important to your industry. This year's crop has come in with less moisture than usual. The steam treating of the almonds can add up to 5% moisture if you so desire to the almonds. Drying of the almonds is a precision job. VENTILEX has been in the drying business for over 5 decades.



How VENTILEX Does It

The science behind the equipment

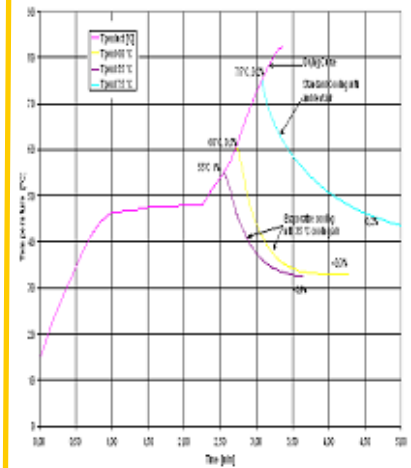
With over 50 years of experience in equipment manufacturing for the Food, Dairy and Pharmaceutical industries, VENTILEX has invested millions of dollars into R&D.

14 years ago, VENTILEX purchased Pasteurization and Sterilization technology from well known Dutch dairy equipment company Stork BV. It is with this knowledge that VENTILEX has advanced the Steam Pasteurization and many times Steriliza-

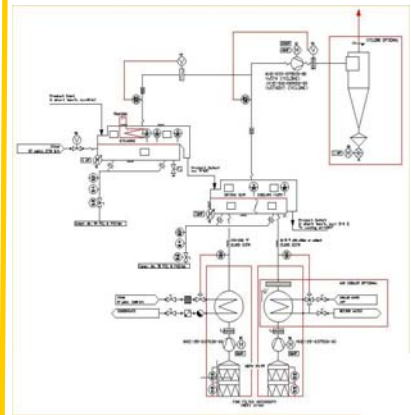
tion treatment of Nuts, Seeds, Spices and leafy products for the treatment of pathogens, spores, and enzymes. With over 30 worldwide installations, including an installation in Chicago that is FDA and USDA VALIDATED and accepted, VENTILEX has the experience to supply the almond industry with equipment that works.

In our equipment, almonds are fed into our Steam Pasteurizer where super heated steam is

released in a specially designed pressure area. The steam then "fluidizes" the nuts, with the assistance of the shaking mechanism via a specially designed distribution plate. The super saturated steam flashes and condenses on the cooler almond surface. It is with this condensation and consequent hot moisture that the pathogen SE PT30 is "killed" and the 5 log reduction occurs. Accurate time and temperature are necessary.



Accurate Drying and Cooling of Almonds



"Based on \$2.00/pound almond sell price, every 1% additional moisture adds \$40.00/ton profit"

Drying and Cooling of Almonds

VENTILEX has extensive experience with drying and cooling of various products, including nuts and spices.

The process of drying almonds to an exact moisture is a complex issue. Advanced controls, instruments and algorithms are necessary to

control the process accurately. It is with the drying process where additional profits can be realized.

Based on \$2.00/pound almond sell price, every 1% additional moisture adds \$40.00/ton profit. Adding 2.5% moisture accurately yields an additional profit of \$100./ton.

Cooling of the almond also is a precision job. Almonds that are too warm when packaged will cause condensation to occur. This results in spoilage and other problems for the packaged almonds.

VENTILEX can accurately cool your almonds.

The Economics of Adding Moisture

Ship your almonds with the maximum allowable moisture—added profits!

Added Moisture	Processing 8 hrs/day, 5 days/week, 50 weeks/yr 2,000 hrs/year				
	1 TPH	3.3 TPH	7 TPH	11 TPH	22 TPH
0.50%	\$ 40,000.00	\$ 132,000.00	\$ 280,000.00	\$ 440,000.00	\$ 880,000.00
1.00%	\$ 80,000.00	\$ 264,000.00	\$ 560,000.00	\$ 880,000.00	\$ 1,760,000.00
1.50%	\$ 120,000.00	\$ 396,000.00	\$ 840,000.00	\$ 1,320,000.00	\$ 2,640,000.00
2.00%	\$ 160,000.00	\$ 528,000.00	\$ 1,120,000.00	\$ 1,760,000.00	\$ 3,520,000.00
2.50%	\$ 200,000.00	\$ 660,000.00	\$ 1,400,000.00	\$ 2,200,000.00	\$ 4,400,000.00
3.00%	\$ 240,000.00	\$ 792,000.00	\$ 1,680,000.00	\$ 2,640,000.00	\$ 5,280,000.00

Imagine the Added Profits Possible with More Hours!



The Pasteurization, Drying, Cooling Equipment and Contacts



Steam Pasteurizer

The equipment for handling Steam must be robust and safe. Since steam is at high pressure, great care must be undertaken in the design of the equipment so that damage to human life and other equipment do not occur.

VENTILEX has extensive experience handling super saturated steam. The design must not only meet local, state and national safety regulations, but it must also be designed for continuous 24/7 operations 365 days per year. With over 50 years of experience in building Process Equipment, VENTILEX is the world leader for continuous Steam Pasteurization equipment.

The Steam Pasteurizer must allow for the pressure and fluidization of the almonds, withstand forces, and also be sanitary. Our Pasteurizer is fully CIP-able. The design is low maintenance, thus not needing a dedicated operator.

The Air Handling units are fully contained heating and cooling units, with HEPA filters that are 99.99% efficient at filtering out particulates. They are encased in 304L stainless steel housings, with easy access doors, advanced instrumentation, and fully automatic heat exchangers and high pressure/high volume fans.

The Fluid Bed Dryer and Cooler is a combination unit, that accurately dries the almonds to a desired moisture. This is accomplished by accurate control over the amount of air and heat. The Fluid Bed Dryer and Cooler is completely 304L/316L stainless steel in all process contact areas, thus allowing for complete sanitary conditions. The heavy duty exhaust fan is also manufactured from stainless steel for years of corrosion and worry free operation.

The System is not complete without the combined MCC (Motor Control Center) and world renown Allen Bradley PLC microprocessor computer controller with special algorithms, and the most advanced Data Logger and Visualization system available. This assures repeatability, and thus, the validation necessary for FDA and/or USDA acceptance.



Air Handler Heat/Cool



Fluid Bed Dryer/Cooler

VENTILEX USA Inc. can also supply any necessary ancillary equipment, installation, and if you would like, VENTILEX can handle the project as a turn-key system. Our association with Boiler, Bucket Elevator, Conveyor, and Packaging Equipment vendors, combined with local Electricians and Mechanics allows VENTILEX to offer you a complete system. You provide a building, and we can do the rest.

VENTILEX can also arrange Leasing or Financing through our third party associations. VENTILEX has local representation to answer all your questions.

VENTILEX Representatives for California are:

Golden State Food Machinery

Manufacturer's Representatives

P: 916.391.3937

F: 916.392.8551

Roger Hornsby | Ron Sharples

Please contact Roger Hornsby or Ron Sharples for all your questions and requirements, or contact our Cincinnati, Ohio corporate offices at 513.874.441 or at the toll free number below.

VENTILEX reserves the right to change any equipment or specifications as necessary

VENTILEX USA Inc. | Toll Free: 866.265.6823



Advanced PLC Data Logging

