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Almond Board of California

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Guidelines for Validation of Oil Roasting Processes

Overview

Oil roasting is one of the thermal processes that are used by the almond industry and manufacturers to make roasted almond products. Dr. Linda Harris of the University of California at Davis (UCD) studied the efficacy of hot oil on the reduction of *Salmonella* on almonds in a hot oil bath (*ABC Supporting Document DOC003*). Based upon the information from that study, the ABC Technical Expert Review Panel (TERP) determined that a minimum process of 2.0 minutes of exposure to hot oil at 260°F or above will provide a 5-log reduction of *Salmonella* on the surfaces of whole almonds.

Subsequently, the US Food and Drug Administration (FDA) reviewed the information and issued a Letter of Determination to acknowledge this process as a pasteurization process for almonds (*ABC Supporting Document DOC005*). Almond products processed under those conditions ***may be labeled as pasteurized***.

Since the mandatory treatment criterion is a minimum 4-log reduction of *Salmonella* on almonds (*Federal Register/Vol. 72, No. 61/Friday, March 30, 2007/Rules and Regulations, Pages 15021-15036*), a handler or Direct Verifiable (DV) user may choose to have their process validated to achieve a minimum 4-log reduction. Please note, that while this will satisfy the mandatory treatment criterion, the products processed under such conditions may not be labeled as “pasteurized”. The purpose of this document is to provide guidance to process authorities for validating lethality of almond oil roasting processes in terms of 4-log reduction and 5-log reduction.

Understanding the Oil Roasting Process

Oil roasting is one of the processes that are used by the industry to obtain crunchy and roasted flavor almond products. A commercial oil roast is often carried out in a pre-heated oil tank equipped with a continuous conveyor that carries almond kernels through the tank where the kernels are roasted while they are submerged in the hot oil. Since some of the oil is absorbed or carried away by almond kernels, the oil level is maintained by continuous circulation from an oil reservoir.

The duration of the roast is controlled by the conveyor speed dial setting, and the oil temperature is controlled by a thermocouple submerged in the oil tank. The temperature setting for the oil tank and temperature uniformity of hot oil may be affected by the length of the tank, temperature of almonds introduced into the oil, loading capacity (throughput), etc. Oil roasting is often combined with salting and flavoring processes.

In general, oil roasting is a much faster process than dry (hot air) roasting. Oil roasting parameters (oil temperature and time) are dictated by the desired degree of roast, throughput rate, initial temperature and

initial moisture level of the almonds, volume of the heated oil, etc. The temperatures commonly used in commercial oil roast processes are 280 to 350°F. Normally under these temperatures, 3 to 15 minutes of roasting time is needed to achieve crunchy and crispy oil-roasted almond products.

Validation of PPO Oil Roast Process

Objectives of Validation Testing:

- To verify if the temperature at the coldest spot in the oil tank is above 260°F when the oil roaster is operating under a maximum throughput capacity
- To verify if the duration when almond kernels are submerged in the hot oil is greater than 1.6 minutes for a 4-log reduction or 2.0 minutes for a 5-log reduction of *Salmonella*

Oil Roast Line Description to Include:

- Flow chart to illustrate line configuration.
- Oil heating and circulation, and temperature control mechanism, temperature recording device calibration document
- Maximum throughput
- Raw input and roasted product segregation procedure
- Line sanitation procedure

Products Covered Under this Validation:

- List all products made on the line to be validated
- List all products to be validated or covered by the same parameters
- Maximum throughput of each product that has been validated
- Worst case scenario parameters

Validation Methodology:

- Temperature distribution measurement of hot oil: Temperature measurements of hot oil need to cover many locations within the tank to determine temperature distribution and to identify the coldest spot during production. If a portable temperature tracer or a thermocouple is used to monitor oil temperature, it must have an accuracy of +/- 1.0° and calibration of the thermocouple or tracer must be current. Since the minimum time is only 2.0 minutes, the recording interval of a tracer or thermocouple should be not more than 2 seconds.
- Duration measurement of hot oil immersion: The time is counted from when individual kernels are completely submerged in oil until when the kernel emerges from the oil. The time measurement can be achieved by calibrating conveyor movement with speed dial setting or by using a portable tracer carried by a full product load through the oil tank. Attention should be paid to verifying that all kernels, under a maximum throughput run, are completely covered by the hot oil.
- Replication of validation runs: For each set of parameters to be validated, a minimum of three (3) validation runs will be conducted. The lowest temperature and shortest time recorded from these runs will be used for validation.
- Minimum input almond temperature: Cold input (cold storage product or winter production run) may cause oil temperature to fluctuate. Validation testing is needed to verify a minimal

input temperature which does not cause the temperature of the hot oil to fall below the minimum temperature requirement.

- Process validation: In almost all instances, common commercial oil roasting is carried out at temperatures higher than 260°F and for longer than 2.0 minutes. Thus, the heat exposure under these conditions is much greater than the minimum process of 2.0 minutes exposed to hot oil at or above 260°F to achieve a 5-log reduction. However, if there is a need for a shorter process, the minimum process parameters for a 4-log reduction are 1.6 minutes at a minimum oil temperature of 260°F.

Validation Report:

For each process or product that has been validated, the process authority must submit a written report to ABC for review and evaluation. The validation report, at a minimum, should include detailed information on the following:

- Handler or manufacturer information:
  - Contact information
  - Background information
  - General information for almond usage and handling
- Production line(s) validated:
  - General description of the production line
  - Temperature control mechanism
  - Procedures for identifying process deviations
- Product(s) validated:
  - Validation methodology
  - Thermal validation method
    - TDT data used. If not ABC TDT data, a detailed research report should be included that demonstrates the validity of the TDT data used
    - Temperature data acquisition; replication of data collections
    - Cold spot or zone identification
- Results summary
- Handling procedures for products produced during process deviations
- Date(s) validation conducted
- Product(s) containing almonds not validated or not achieving a 4-log reduction
- Conclusions and recommendations
- Process authority: contact information; ABC approval # and date