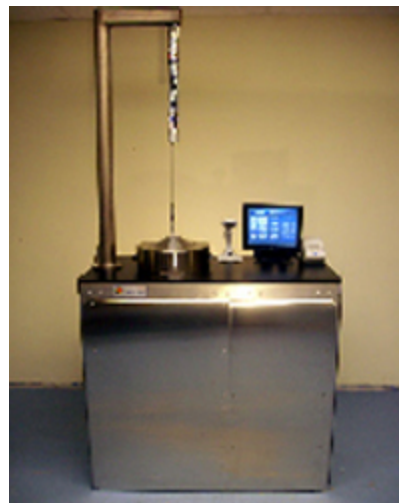


Supercritical Carbon Dioxide Technology Improves Food Safety

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Recent food recalls involving bacterial contamination, together with the threat of viral, bacterial or fungal disease transmission through contaminated products, have caught the attention of the news media. The resulting product recalls and adverse publicity have negatively impacted both corporate profits and reputations (1, 2). A 2007 Consumer Reports study showed that 83 percent of whole broiler chickens purchased nationwide were contaminated with salmonella or campylobacter, emphasizing the seriousness of the problem (3). NovaSterilis, a Lansing, N.Y. firm, has developed a terminal biomedical sterilization technology with potential applications in the commercial food processing industry.



Many modern medical and biological products contain advanced polymers or materials that cannot tolerate the harsh conditions of typical industrial sterilization processes (steam, gamma radiation, ethylene oxide). NovaSterilis has developed a “green” sterilization technology that harnesses the unique properties of supercritical CO₂ in combination with a small quantity of a proprietary additive to achieve a device industry Sterility Assurance Level of 10⁻⁶ (SAL₆) while maintaining the structural integrity of delicate component materials. The high SALs combined with the minimal product impact are ideal for the food industry, which currently has few options for pathogen reduction.

The use of supercritical CO₂ (SCCO₂) and high pressure processing is not new to the food industry; SCCO₂ is currently used to decaffeinate coffee, extract botanicals from plants and inactivate enzymes. SCCO₂ is also widely used in separation technologies. Numerous academic research programs are developing additional applications for SCCO₂.

As shown in Figure 1, the supercritical or fluid phase of carbon dioxide is achieved at low pressure (1099 psi/73 Atm) and moderate temperature (31.1° C). In its supercritical state, CO₂ maintains ideal properties of the liquid and gas phases; liquid CO₂ is an excellent organic non-polar solvent and gaseous CFO₂ has no surface tension, providing unsurpassed penetration.

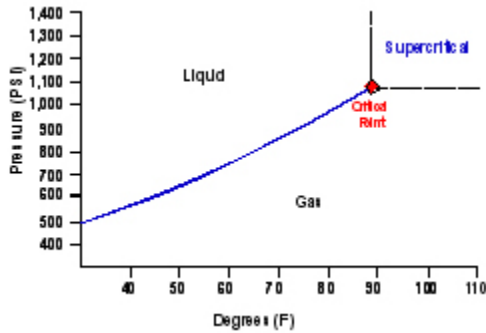


Figure 1

NovaSterilis SCCO₂ sterilization process relies critically on the proprietary Novakill™ additive (peracetic acid, PAA), which boosts the inactivation of bacterial, viral and fungal pathogens using commercially acceptable cycle times. PAA degrades quickly to harmless acetic acid and water, making them suitable for this application.

Because of its safety, ease of use, and harmless residual profile, PAA continues to gain widespread acceptance for wash applications in food processing using concentrations higher than those adopted in the NovaSterilis sterilization process. Notably, PAA is not subject to residual tolerances by the FDA or EPA at normal usage levels. No rinsing is required at levels up to 100 ppm for fruits and vegetables, and up to 500 ppm when sanitizing equipment.

In contrast to washing and rinsing, the NovaSterilis process introduces very low levels of additive into the sterilization chamber. Residual additive is removed during depressurization, producing a finished product ready for immediate use or inventory. Testing for residual chemicals on biomedical products sterilized using the NovaSterilis process has demonstrated no measurable chemical contaminants.

NovaSterilis is actively pursuing additional opportunities to adapt the SCCO₂ platform to a range of food processing applications, including sterilization of contaminated grains, powdered ingredients and other dry products. The solvent and penetration properties make SCCO₂ an ideal platform for many commercial processes. NovaSterilis envisions the development of SCCO₂ processes for enzyme inactivation, extraction technologies, and the infusion of flavors, colors or preservatives.

- (1) <http://www.attorneyatlaw.com/2010/01/fda-issues-baby-food-bacterial-contamination-warning/>
- (2) <http://www.foodsafetynews.com/2010/06/bacterial-contamination-caused-blue-mozzarella/>
- (3) http://www.consumerreports.org/cro/food/food-safety/chicken-safety/chicken-safety-1-07/overview/0107_chick_ov.htm

The company's highly skilled technical staff is experienced in the commercialization of SCCO₂ technologies, with particular expertise in pathogen inactivation and engineering design. NovaSterilis seeks a corporate partner for co-development of large scale, high throughput continuous flow supercritical CO₂ sterilization/cold pasteurization equipment that would enable fluid sterilization.

NovaSterilis manufactures 20 and 80 liter fully automated, computerized, and network capable sterilization units (Figure 2). With their compact footprints, these units are ideal for biomedical

material companies that require high value and flexibility. Since SCCO₂ is easily scaled, adaptation of the technology for food applications could easily be achieved. NovaSterilis provides supportive technical services, assisting customers to determine if this process is appropriate for specific products, establishing cycle times and developing validation and regulatory plans. For more information, visit www.novasterilis.com or call 607-330-2772.
