
High Pressure Thermal Processing (HPTP) Systems

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High pressure thermal processing (HPTP), defined as the combination of pressure (400-600 MPa) and above ambient temperature levels (40-130°C), can reduce the negative impacts of thermal processing by minimizing the exposure of products to high-temperature levels. However, HPTP systems are not widely available, with most of these systems being laboratory-scale units and only a handful of pilot-scale units worldwide. Laboratory-scale units have vertical vessels with a small volume (0.1-4 L) and/or narrow vessel diameter. Consequently, many of these machines are unable to process food products in packaging formats used by industry processors. HPTP machines share most of their fundamental components, configuration, and operation with industrial high pressure processing (HPP) units (55-525 L) operating at chilled or room temperature (4-25 °C). There are pilot plant units (35-135 L) reaching up to 700 MPa and 130°C. Still, some technical and operational limitations hold back the commercialization and industrial implementation of HPHT such as accurately controlling and monitoring temperature under pressure, scaling-up issues, validation challenges, productivity, and high capital and/or operational costs. Progress has been made in recent years to facilitate the adoption of this technology, thanks to the use of standard HPP machines with insulated carriers/baskets. These carriers contain the preheated products and carry them into the high pressure vessel. They minimize heat loss of the heated product with the pressurizing fluid, vessel wall, or plugs during the pressurization cycle. The insulated carriers also protect the components of high pressure equipment from high-temperature levels, allowing HPTP processing in existing nonthermal high pressure machines for the commercial development of foods, and other applications in the pharmaceutical and biomedical industry.