

## **Joule-Thomson cooling for cryogenic applications in food processing**

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Cryogenics engineering includes cooling and freezing of materials to very low temperatures using highly condensed gases like nitrogen, carbon dioxide helium, etc. In the food industry, liquid nitrogen is used to freeze foods quickly. In its liquid form, nitrogen, at  $-196^{\circ}\text{C}$ , is one of the coldest substances that is often used to flash freeze fresh foods. As cryogenic freezing is much faster than mechanical freezing, products frozen with cryogenic technologies show a higher retention of water with a matrix of small ice crystals and retain their natural quality better. Our current focus in this area involves Joule-Thomson expansion via adiabatic throttling which eliminates the need for elaborate mechanical refrigeration system and simplifies the equipment necessary. As the demand for value-added food product accelerates, there are many opportunities to further develop cryogenic technologies for food freezing and chilling applications. In particular, our group is engaged in designing and modeling a novel system that achieves instant freezing of products like ice cream and sorbet. Students working on this project need to be proficient in process modeling in ASPEN.