Determination of ideal water activity and powder temperature after spray drying to reduce Lactococcus lactis cell viability loss

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ABSTRACT

Spray drying presents a promising technology for preserving bacteria despite a low survival rate of heat-sensitive cultures when subjected to the drying process. The aim of this study was to determine the ideal powder parameters [water activity (Aw) and temperature (T°C)powder] needed to produce dehydrated Lactococcus lactis ssp. lactis with a high viability after drying. Cell concentrates injected into a spray dryer using varying cell concentrate flow rates (Fconcentrate = 0.3 to 1.0 kg/h), inlet air temperatures (T°Cinlet air = 115 to 160°C), and outlet air temperatures (T°Coutlet air = 70 to 115°C) resulted in powders with different values of Aw and T°Cpowder and levels of cell viability loss. Lower cell viability reduction (∼0.43 log cycles) was obtained in conditions of Aw = 0.198 and T°Cpowder = 52°C, which can be met by using T°Cinlet air ~126°C and T°Coutlet air = 88.9°C regardless of Fconcentrate values. After 60 d of storage at room temperature, cell population varied from 7.0 × 10⁵ to 1.1 × 10⁸ cfu/g. The initial powder Aw had no influence on cell death rate, but T°Cpowder influence was observed. The approach adopted in this study can be applied to other bacteria or spray dryer equipment to determine optimal drying conditions.
starter culture; water activity; powder temperature; drying conditions; storage