L.21.- Inactivation efficiency of the TSE agent in rendering processes

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In 1990 and 1991 inactivation trials of both the BSE or the scapie agent in spiked rendering raw material in pilot rendering plants (100 kg scale) have been performed in England in order to demonstrate the inactivation efficiency of thermal inactivation of the TSE agent in all the different rendering processes operating in the EU at that time. The results of these trials available in 1994 and 1996 became the guideline for the EU legislation on process conditions in animal by-product processing.

In 1993 until 1995 inactivation trials in small vials (20 g scale) of sterilized rendering raw material spiked with both the BSE or the scrapie agent were performed for different temperature/time ranges in the Netherlands. The results obtained in 1997 led to the removal of SRM from the rendering raw material in the Netherlands.

The results of both trials, however, did not fit simple first order inactivation kinetics as used for bacterial inactivation description.

In 1996 a programme was developed in the Netherlands to approach mathemetically the temperature/time history of a raw material particle entering a rendering process. Two years later epidemiological calculations based on the reproduction number of the proliferation of BSE has been performed in Lelystad to show what efficiency a reduction of the infectivity in a rendering process would have on the proliferation of BSE.

In 2000 new inactivation studies were performed with the 301V strain of BSE in Edinburgh and with BSE in Lelystad using a stirred autoclave (70 g scale). The results together with the known results from literature led to the development of a kinetic model for the thermal inactivation of a TSE agent including a competition between a protecting and an inactivating reaction as a function of temperature. This model explains the existing data for TSE inactivation by heat but with thermodynamically different parameters for the different TSE-strains. The 22C scrapie strain appears to be the most thermolabile and BSE the most thermostable strain.

Introduction of this kinetic model into the improved simulation programme for the time/temperature history of a particle in a rendering process using the technical data for heat supply and water loss within the process as auxillary parameters lead to satisfactory explanation of the inactivation data obtained in the pilot plant inactivation experiments done in 1990/1991 in England together with the experiments done in the Netherlands.

This kinetic model, however, has some important consequences: (1) fast heating is much more efficient than slow heating, (2) prolongated heating has no additional effect, (3) adding a second heating step to a first heating step has no additional effect, (4) heating of the bulk through a superheated wall is especially efficient in rendering processes even at atmospheric pressure or below atmospheric pressure.

Keywords

TSE inactivation, rendering processes, inactivation kinetics, technical process simulation, inactivation prediction for rendering processes