UNIVERSIDAD POLITÉCNICA DE CARTAGENA

OTRI Oficina de Transferencia de Resultados de Investigación UPCT - Universidad Politécnica de Cartagena

DESCRIPCIÓN DE LA TECNOLOGÍA/TECHNOLOGY DESCRIPTION

Título / Title

Thermoresistometer "Mastia" for microbial heat resistance determinations under controlled conditions of temperature.

Resumen / Abstract

The thermoresistometer Mastia enables to estimate heat resistance under isothermal and non-isothermal heating conditions as well as more complex heating profiles, like those usually applied in the food industry. Its design allows to work with liquid heating media such as buffers, liquid foods or foods containing small particles. It also allows to inoculate microorganisms or compounds and to obtain samples in order to study the changes on the quantity or the quality of these substances along with the thermal treatment. In this way, the intensity of the thermal treatments applied can be calculated and, as a consequence, the microbiological safety and nutritional quality of the food produces obtained can be estimated. With this technological offer we try to collaborate with licence agreement and comercial agreement with technical assistance.

Descripción y características fundamentales / Description and special features

The thermoresistometer Mastia consists of a main vessel in which thermal treatments are applied, a motor to enable the homogenisation of the heating medium, a main control unit to control heating, sampling and agitation, an external pressure source and a fraction collector to allow for sampling in short duration experiments. The main control unit consists in a program logic controller (PLC).

The main vessel, of 400 ml capacity, is built in stainless steel (8,5 cm outer diameter × 12 cm high) with a screw cap with O-ring. This cap has an agitation shaft with a teflon (PTFE) friction bearing with a propeller, and 8 ports with screw caps to hold: the pressure source (N_2); the inoculum injection port with a gas chromatography septum; the sampling tube; a thermocouple (Pt 100) to monitor the temperature during heat treatment; two ports to hold the two branches of the electric heating element; and another two ports to hold the two branches of the coil of the cooling system. Inside the vessel, attached to the removable cap there is also a deflector screen to improve turbulence. The agitation shaft is powered by a variable speed agitation motor, wired to the PLC. The sampling tube is also built in stainless steel. There are interchangeable tubes of different inner diameter, from 0.5 to 2 mm. The sampling tube is prolonged on its end by a silicone tube, that is closed in the outer extreme by means of a solenoid valve, that was also wired to the PLC. The opening time of the sampling valve can be controlled by a timer through the PLC. Keeping a constant pressure inside the vessel and a constant opening time of the sampling tube along an experiment, enables to get samples of the same volume through all the experiment The control of the temperature inside the thermoresistometer is also done by the PLC, by means of a proportional-integral-derivative (PID) connected to the electric heating element, to a solenoid valve that regulates the flow of water through the cooling system, and to the Pt 100. When the PID detects that the temperature is below the setpoint, the PLC powers the electric heating element; when is above the setpoint, the PLC acts on the solenoid valve to control the flow of cold water through the coil. The instrument can be programmed to perform isothermal experiments, non-isothermal experiments at a linearly increasing or decreasing temperature and more complex, industry-like experiments, composed of several steps combining isothermal and non-isothermal periods. The PLC is connected to a tactile screen, that allows communication with the PLC and can be connected to a computer provided with Scada software that enables to program and/or register temperature profiles. The main vessel may be pressurised to permit sample extraction at low internal pressure (below 100ºC) or when medium is too viscous. To overcome the pressure when the microorganisms are injected inside the vessel, a Hamilton-type syringe may be used. The fraction collector enables to take samples at time intervals lower than 2 seconds. Collector speed can be adjusted, allowing for up to 32 samples per second.

On normal use, the instrument operates as follows. Once the initial heat treatment temperature has attained stability, the medium is inoculated with the microbial suspension. At preset intervals, samples

Descripción y características fundamentales / Description and special features

for each treatment time are collected (by pressing a switch in the tactile screen) manually into sterile test tubes. The timer in the PLC has been previously set at an appropriate aperture time of the sampling valve (according to the pressure into the main vessel and the required sample volume). Samples are then appropriately diluted and immediately plated and incubated. The instrument can also be operated in continuous. This operating mode consistes in preheating the thermoresistometer with water at a preset temperature and circulating the microbial suspension through the coil, by means of a peristaltic pump at a controlled flow. For this purpose the coil is sterilised *in situ* previously. Temperature of the sample is taken at the end of the coil. In this way, very rapid heating ramps, and heating ramps followed by a holding period, similar to those on continuous food sterilisation and pasterisation treatments, can be performed. In this mode only end-point determinations can be performed. The thermoresistometer Mastia has been developed in the laboratories of the Food Technology group at the Technical University of Cartagena.

Origen de la Tecnología: Fuente de financiación / Financial source of the technology

Financiación privada / Private funding

Ventajas competitivas / Competitive advantages

Improvements in the thermoresistometer Mastia enable simulation of complex heating and cooling profiles, continuous and in batch, with monitoring of the temperature. It enables to estimate heat resistance of other components of foods or additives, apart from microorganisms. The main application of this technology is for the food industry, to study the heat resistance of microorganisms involved in the spoilage of heat treated foods, such as canned foods, fruit juices, milk, baby products, ect. In this sense, it can be used to test if heat treatments applied to foods are sufficient to ensure their stability and safety. It can also be used to test nutritive quality of heat treated foods. Eventually, it could be of interest for other industries that deal with liquid media exposed to thermal treatment.

Estado de la propiedad industrial e intelectual / Current state of intellectual property

Patente concedida / Patent granted

Palabras clave / Keywords

microbial heat resistance, controlled of temperature.

Disciplinas científicas en las que se encuadra la tecnología / Scientific domains

Industria de la Agroalimentación

Grado de desarrollo de la tecnología / Current stage of development of the technology

Desarrollada, lista para demostración / Developed, available for demonstration

Tipo de colaboración solicitada / Type of collaboration sought

Cooperación técnica / Technical cooperation
Acuerdo de joint venture / Joint venture agreement
Acuerdo de fabricación / Manufacturing agreement
X Acuerdo comercial con asistencia técnica / Commercial agreement with technical assistance
X Acuerdo de licencia / License agreement

Comments:
The main application of this technology is for the food industry, to study the heat resistance of microorganisms involved in the spoilage of heat treated foods, such as canned foods, fruit juices, milk, baby products, ect. In this sense, it can be used to test if heat treatments applied to foods are sufficient to ensure their stability and safety. It can also be used to test nutritive quality of heat treated foods.
Eventually, it could be of interest for other industries that deal with liquid media exposed to thermal treatment.

Sectores empresariales de los potenciales clientes / Industrial sectors of the potential users

Producción agrícola (CNAE 011)

Información adicional / Additional information
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