Available online at www.sciencedirect.com

ScienceDirect

Procedia Food Science 7 (2016) 117 – 120

Procedia Food Science

9th International Conference on Predictive Modelling in Food

F-value calculator – a tool for calculation of acceptable F-value in canned luncheon meat reduced in NaCl.

Flemming Hansen[a]*, Annemarie Gunvig[a], Claus Borggaard[a]

[a]*Danish Technological Institute, DMRI, 9 Gregersensvej, DK2630 Taastrup, Denmark*

Abstract

Canned meat products are usually protected against *C. botulinum* by combinations of heat, NaCl and $NaNO_2$. When meat products are reduced in NaCl for health reasons, they need a higher heat treatment to maintain same level of protection against *C. botulinum*. We describe a new tool for calculating the F-value, necessary to obtain equivalent safety for canned meat when reduced in NaCl, compared to the original combination of aqueous salt and F–value. The tool is valid for combinations of F–values between 0.51 and 3.25 and aqueous salt between 1.66 and 3.54 %. The tool is available at http://dmripredict.dk.

Peer-review under responsibility of Department of Food Science, Faculty of Food Engineering, University of Campinas.

Keywords: Canned luncheon meat; F-value; aqueous salt, *C. botulinum*;; predictive model

1. Introduction

Canned meat products are usually preserved against growth of *C. botulinum* by combinations of heat, sodium chloride and sodium nitrite. In a few cases, other preservatives as lactates or acetates are used, often as sodium compounds. However, during the last decade, customers and Health Authorities request a lower amount of NaCl in meat products, due to the negative health effects of sodium chloride, especially sodium ion.

For 2012 and onwards, The UK authorities have set new targets for maximum levels of sodium chloride in canned meat at less than 2.0 % sodium chloride (Anon[1]). Further, they request that % NaCl is analyzed as Na^+ instead of measuring Cl^-. This means that other chemical additives containing Na^+ will contribute to the measured Na^+. Thus, an incorrect, higher value for percent NaCl will be measured, compared to the actual concentration of NaCl. Taking that into consideration, the maximum concentration of added NaCl is around 1.7 – 1.8 % in the products, equaling around 2.2 – 2.3% salt in the aqueous phase (aq. salt). In Codex Alimentarius Guidelines (Anon[2]) it is recommended, that canned meat products having aq. salt ≤ 2.5% should be given a heat treatment at least equal to $F_{121.1} = 3.0$. However, from a quality point of view, this rather high heat treatment, may

* Corresponding author. Tel.: +45 7220 2603; fax: +45 7220 2744.
E-mail address: fh@teknologisk.dk

Peer-review under responsibility of Department of Food Science, Faculty of Food Engineering, University of Campinas.
doi:10.1016/j.profoo.2016.02.101

negatively affect the eating quality of the meat product. In this study, a tool for calculating the necessary heat treatment expressed as $F_{121.1}$ (F-value) for canned luncheon meat, reduced in NaCl was developed.

2. Materials & Methods

2.1. Bacterial strains and preparation of spore cocktail

As *Clostridium botulinum* produces a very potent toxin, these bacteria cannot be used for studies comprising real canned meat products produced in the DMRI pilot plant facility. Instead, three surrogate gas-producing strains of the closely related species *Clostridium sporogenes* (*C. sporogenes* putrefactive 93R, *C. sporogenes* putrefactive 3679 and *C. sporogenes* putrefactive 1075) were used for spiking the chopped meat during production of the canned luncheon meat.

The strains were taken from ÷18°C and spiked into 10 ml of TPGY (Tryptone 50 g/l Merck, 211705; Peptone 5 g/l, Merck 211677; Glucose 4 g/l, Merck 1.08337; Yeast extract 20 g/l, Oxoid LP0021; Na-thioglycollate 1 g/l, Merck 1.06691) and grown for 3 - 4 days at 30°C in an anaerobic Jar (Anaerocult A; Merck). Afterwards 1 ml was transferred to a Cooked Meat Medium (CMM). Meat pills 30.0 g, Oxoid CM0081; agar 2.24 g, Merck 214010; glucose 0.15 g, Merck 1.08337 was soaked in 150 ml of distilled water for 30 minutes at ambient temperature and afterwards autoclaved at 121.0°C for 15 minutes. Immediately prior to inoculation, the CMM was covered with 20 ml of sterile distilled water.

The inoculated CMM was incubated for 12-13 days at 30°C in an anaerobic jar (Anaerocult A, Merck) in order to produce spores. Before harvesting the spores, the CMM was examined for spore production by microscopy. The 20 ml was transferred to a sterile centrifuge tube and centrifuged at 4°C at 4800 G for 20 minutes. The supernatant was carefully removed, and the pellet resuspended in 20 ml of 4°C sterile water (Peck et al[3]).

The inoculation cocktail contained 17 ml of spore-suspension from each of the three *C. sporogenes* strains. After mixing, the cocktail was further diluted in 4°C sterile water until the requested number of spores (corresponding to 5.000 or 100 per gram product) was obtained in 10 ml of cold sterile water. In order to ensure a homogeneous uptake of spores, the 10 ml of spore cocktail was added to the meat mixture during tumbling.

2.2. P*reparation of luncheon meat inoculated with C. sporogenes for challenge test*

The luncheon meat was prepared from ham (83%) and a brine consisting of the following: water (13.1-14.6%), gelatine AP15 (0.35%), glucose (0.17%), sodium ascorbate (0.04%), Sodium *penta*-Phosphate (0.64%), Sodium nitrite (144 ppm) and NaCl (15 different levels from 1.2% to 2.7%) corresponding to aqueous salt from 1.66 to 3.54%. The meat was chopped through a kidney plate cut with one set of knifes and subsequently passed through a kidney plate on a Wolf chopper. Brine, meat and 10 ml spore cocktail were tumbled at maximum vacuum for 3 hours at 6 rpm with 5 min. rotation and 5 min. rest intervals in a Fomaco tumbler.

Afterwards 210 g meat was filled into cans (93 x 47 x 57 mm), sealed and autoclaved in a steam autoclave (Phoenix) at 112°C until the requested F-values were obtained (13 different F-values from 0.51 to 3.25). After cooling, the cans were incubated at 37°C (calibration series) or 25°C (validation series) and visually examined for blown cans at regular intervals for up to 120 days. For each combination of aqueous salt and F-value 70 cans were produced.

2.3. Measuring of temperature and calculation of the actual F value

The temperature was measured using the Tracksense® Pro system (ELLAB A/S, DK) with probes mounted in the center of the canned meat product. Four or five probes were used for each autoclave batch dispersed in the four different layers of cans in the autoclave. The time in which the temperature was above 98°C was used to calculate the total heat (F-value) for each autoclave batch.

2.4. Microbiological determination of spore count/inoculum

One ml of the spore cocktail was 10 fold diluted in 0.85% saline with 0.1% peptone and 1.00 ml of relevant dilutions were pour plated (petri dishes) into RCM agar (Oxoid CM0151) and SFP agar base (Oxoid CM0587) added 50 ml per liter egg yolk (Oxoid SR0047). After the agar had solidified, the plates were incubated for 4 and 3 days, respectively, at 30°C in an anaerobic jar (Anaerocult A, Merck). The *C. sporogenes* count was carried out both with a spore-activation step (20 min at 75°C) and without this step.

2.5. Chemical analyses.

For control of the produced luncheon meat products, samples from the raw, cured meat respectively from the autoclaved cans were analyzed for NaCl (measured as Cl^-), water, sodium nitrite and pH as described in Gunvig et al (4).