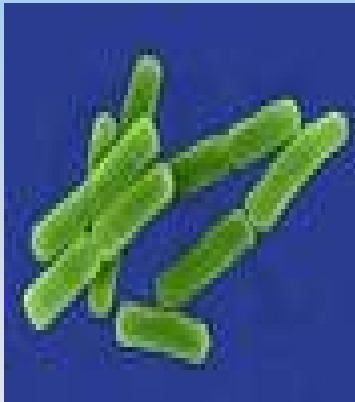




THERMAL PROCESS SURVIVAL & ENZYMIC THINNING OF CANNED SOUPS



IFTPS, Porto 30/31st Oct.

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Premier Foods

A Brief History.....



- **Soup thinning - 1st documented incident – Chicken & Mushroom Soup**
- **No outward signs of spoilage – just total starch degradation**
- **Possibly low level background issue for many years**
- **Incidences initially well spread apart with no particular pattern but after a while the frequency and volume effected started to increase**

A Brief History

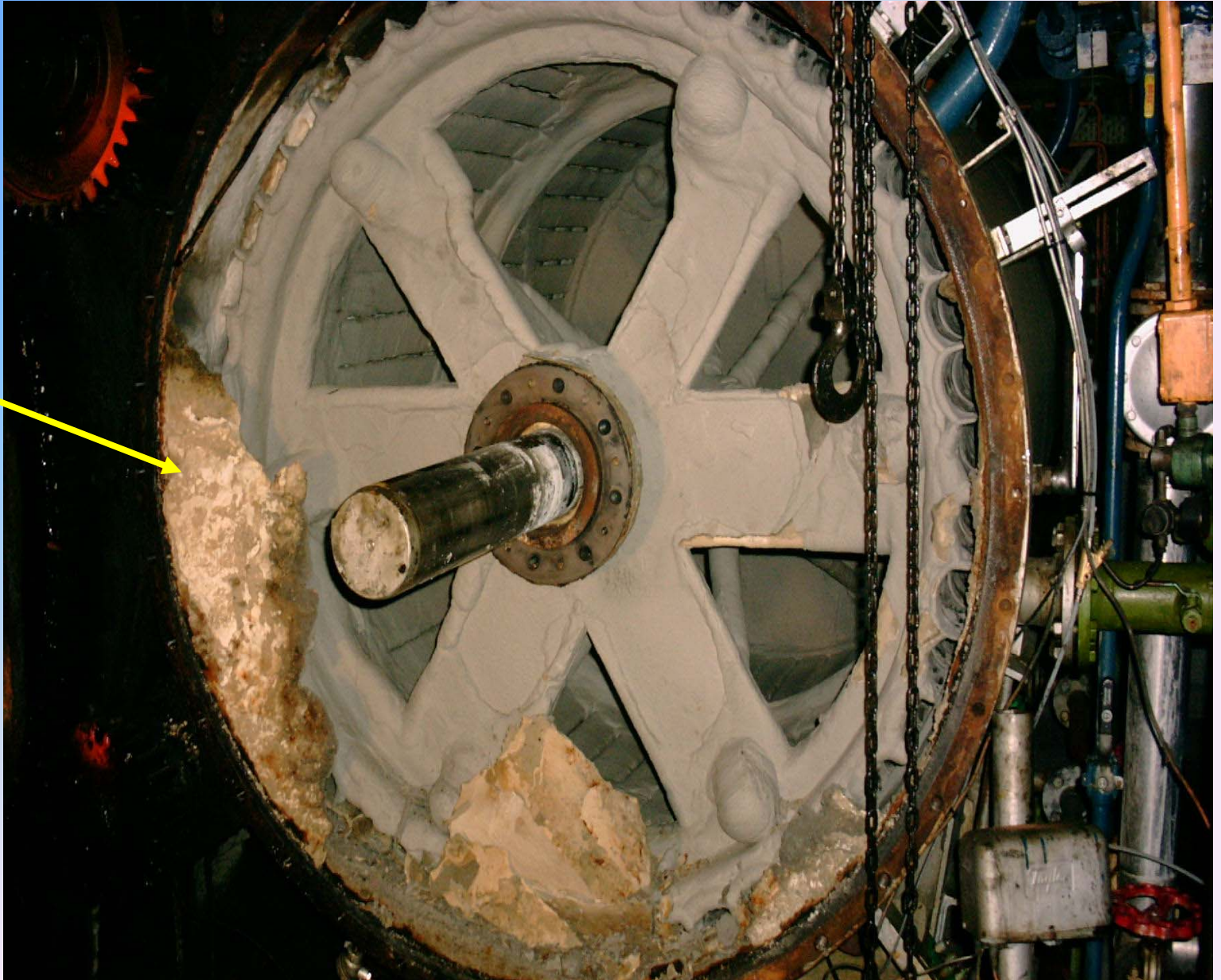
- **Investigation eventually became high profile for Premier due to losses & difficulty of identifying occurrence prior to product dispatch**
- **Alpha-amylase enzyme was identified as the cause of thinning – and was active post process**
- **The enzyme isolated was not heat stable**
- **We realised that we possibly had a microbial survival issue or post process contamination**
- **Organism identified as a *Bacillus subtilis* type (given a ref. 51717)**

Initial Theories Developed

- **Amylase enzyme process survival ?**
 - Quickly dismissed
 - Destroyed readily at 60°C

- **Post process leaker spoilage – cooling shells – considerable build up of scale deposits.**

- **“Coral Theory” / Bio-films**
 - Bacterial populations surviving in cooling shell?



Further Considerations

- **Possible process survival ??**
 - **Significant sterilisation process up to F0 10**

- **Pre-process microbial loading ?**
 - **Was the process capable**
 - **Where all possible abuses allowed for?**

- **Product rheology – behaviour in process?**
 - **In container behaviour**
 - **“Fish eye” theory**

- **Microbiology – we needed to understand more about the behaviour of 51717**

Did we have a Food Safety Issue?

- **B. subtilis now seen as emerging pathogen !!**
- **UK Environmental Health, FSA & Major Retailers all now recognise B.subtilis as a pathogen.**

Conclusions / Theories

- **Unusual thermal stability of spores of Bacillus organisms (significant non linear death kinetics) – esp. subtilis (51717)**
 - Tested in soup & pH 7 buffer
- **High D values - 2.3 + mins @ 121°C**
- **12 + mins for tail !!**

Figure 11. Graph to illustrate the D value of isolate 265083 in white soup at 121°C.
D value determined as 2.33 minutes.

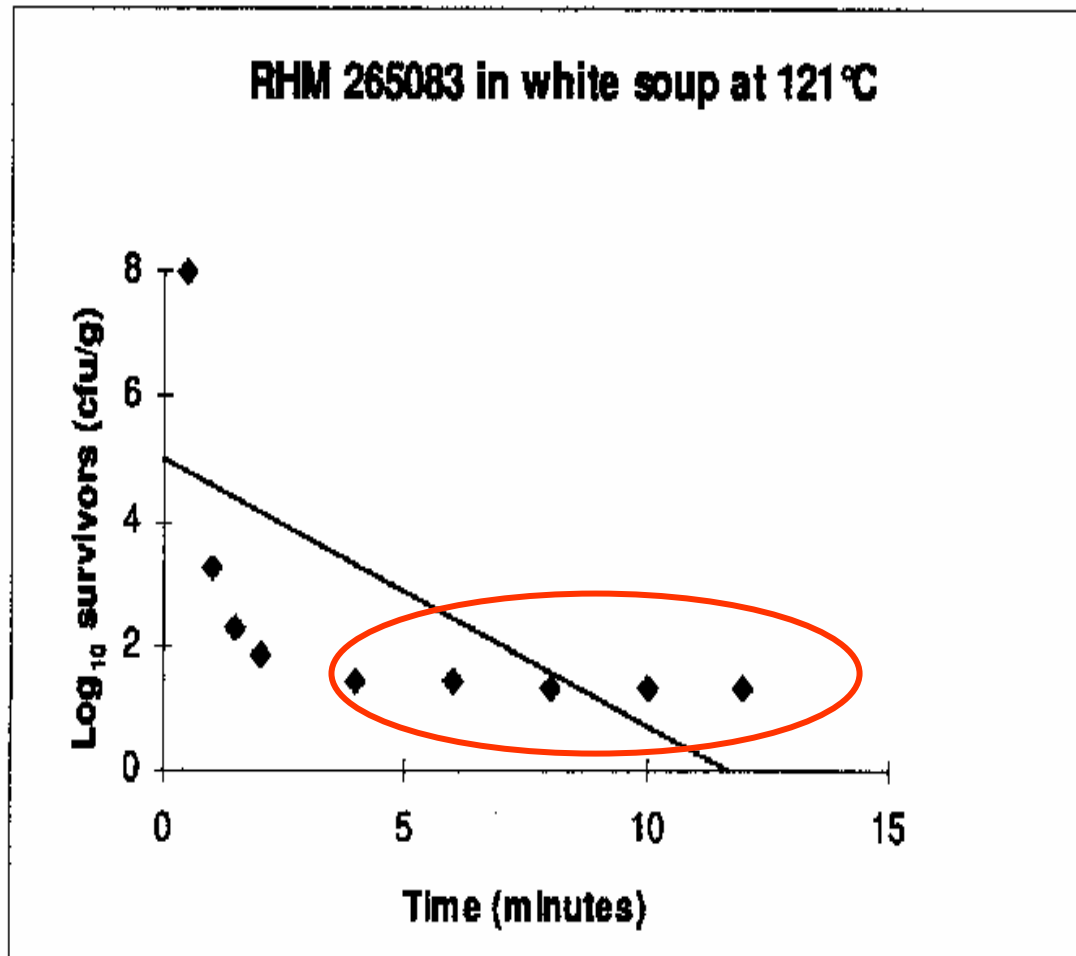
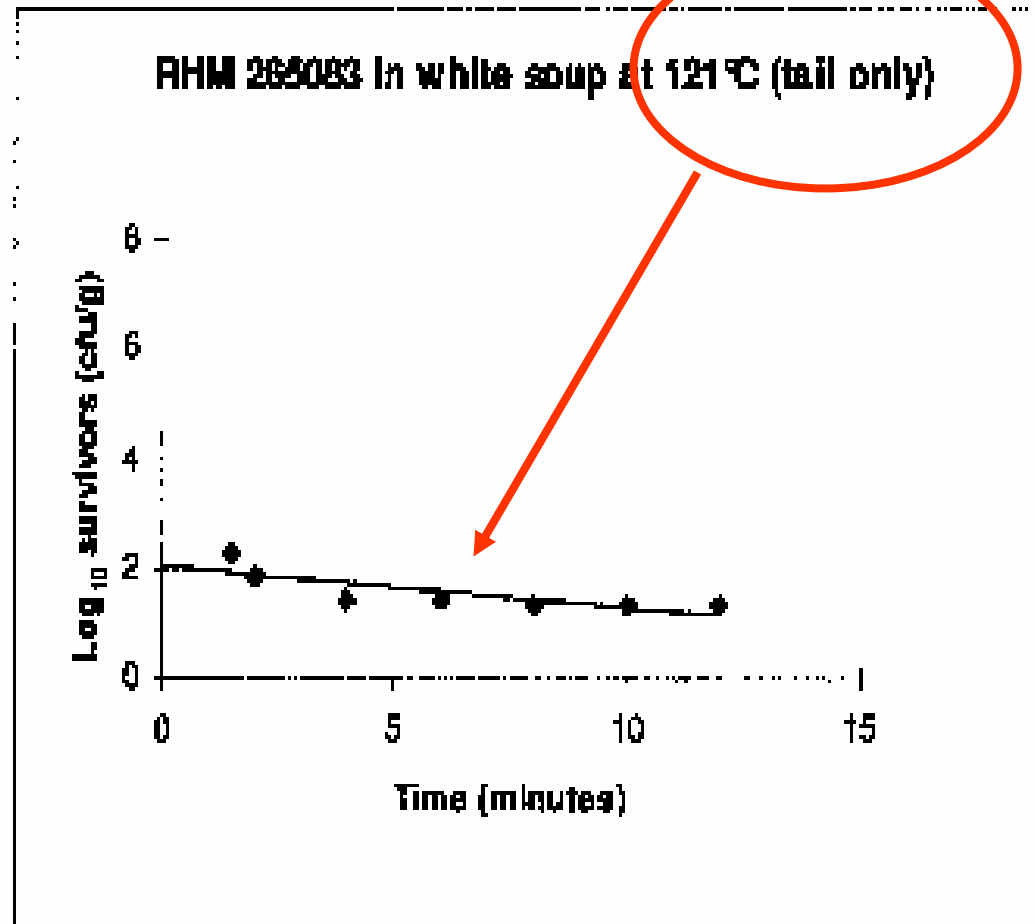


Figure 12. Graph to illustrate the D value of isolate 265083 in white soup at 121°C.
D value determined as 12.76 minutes.



Conclusions / Theories

- **Was rheology implicated in irregular heat transfer (Reel & Spiral Cookers)**
 - **The “fish eye” theory**

- **Was over-use of polyphosphate stabiliser causing the “fish-eye” effect – it seemed that the higher the level the higher the propensity to thin**

- **51717 Survival at F0 10+ (validated through spore challenge testing & further process validation)**

Areas of Concern

- **Microbiology in factory**
- **Product Rheology – consistency**
- **Product behaviour in rotary retort process**
- **Process evaluation – recheck & recheck**
- **Is it a quality or safety issue?**
- **Toxicology – Bacillus subtilis 51717**
 - Found to be negative for toxin production
- **Where did 51717 come from?**
 - Raw material?

Problem Solved?

- **Soups reformulated to remove excess polyphosphate stabiliser – smoother consistency**
- **Affected products moved from rotary cooker/cooler to hydrostatic process**
- **Process increased to min F0 10**
- **Factory line hygiene significantly improved**

Is 51717 Unique?

- **National Collection of Industrial Marine and Food Bacteria data base searched by ribo typing match**
- **B.subtilis 10106 identified as match for our 51717.**
- **No thermal work had been conducted on 10106 – it was being used as an ingredient in specialist paints**
- **D Value of 10106 was assessed alongside 51717**

Is 51717 Unique?

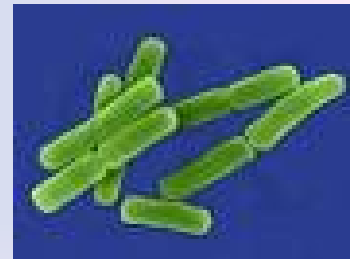
- **Organisms assessed in Dist water, nutrient broth, soup & pH 7 buffer.**

- **B. subtilis 10106**
 - **D Value at 121°C 4.6 mins (9.8 tail)**
 - **Lowest in any media 3.2 mins @ 121°C**

- **B.subtilis 51717**
 - **D Value at 121°C 5.4 mins (10.4 tail)**
 - **Lowest in any media 2.5 mins @ 121°C**

FURTHER IDENTIFICATION July 2007

- **Samples of 51717 tested**
Found to be atypical for B.subtilis – a rogue subtilis or possibly not strictly subtilis at all.
- **Have we a new species that can be distanced from B.subtilis? Important for safety v. quality**
- **Vitek testing by Glasgow Caledonian University**



We will continue to progress identification !

Thanks to IFTPS, Campden &
Chorleywood Food Research
Association, RHM Technology &
Caledonian University, Glasgow.

And Thank You for your attention.