Clémence MILLET

Technology Manager

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Work Experience

Technology Manager, CTCPA **2013 – Current**

+ 50 projects / year dealing with thermal processes (retorts / exchangers) and food innovation
Expert in process qualification for local market and export - including US, Process Authority
Skills in non-thermal decontamination technologies: PEF, HPP, ozone, pulsed light, H_2O_2...
Expert in processing aids
+ 10 training courses / year

Project Manager, CTCPA **2009 –2013**

Education

Engineer in Food Science and Technology – Ecole Supérieure d'Agriculture (Angers, Fr)

Aside from work...

CTCPA

SUPPORTING
TOMORROW'S FOOD MODEL

DO'S AND DON'TS OF HEAT TRANSFER STUDIES WITH STEAM-AIR RETORTS

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IFTPS Annual Meeting 2023

ITAI
INSTITUT TECHNIQUE AGRO-INDUSTRIEL

cti réseau
COMPÉTITIVITÉ TECHNOLOGIE INNOVATION

IFTPS

WHAT IS CTCPA ?

French Technical Center for Food Preservation

Created in 1950, under the supervision of French Ministry of Agriculture

Unique expertise in preservation technologies

Supporting all agri-food companies with our scientific and technical expertise in the development and acceleration of their projects

Cutting-the-edge skills

90 people, 4 technology halls, 3 expert labs (microbiology, packaging, nutrition)

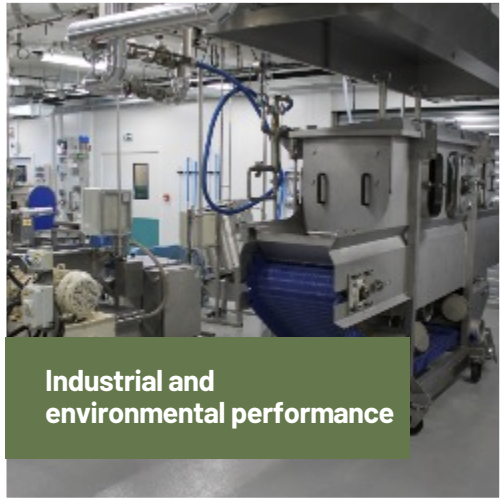
Reliable partner

More than 750 projects / year, involved in several scientific networks and regulatory workgroups

Acknowledge as the reference center for thermal processes

By French government

OUR MISSIONS



OUR APPROACHES

CTCPA IN FIGURES (2021)

10.1 M€
Turnover

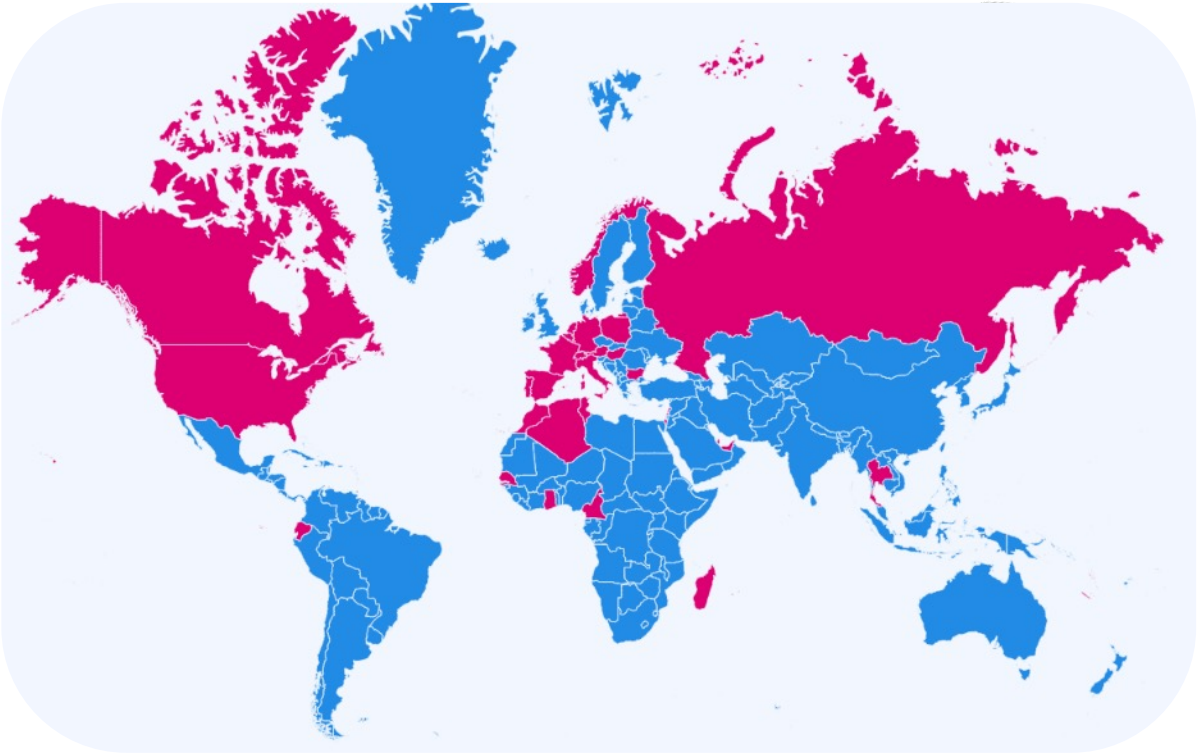
30
Scientific research projects

425
Training courses

39
Webinars

750
Projects for clients

2179
R&D days



63
Scientific and technical articles

2000
Training days

HEAT TRANSFER (=heat distribution) STUDY

For steam-air retorts

Purpose : make sure that the air used for overpressure is efficiently mixed in the steam

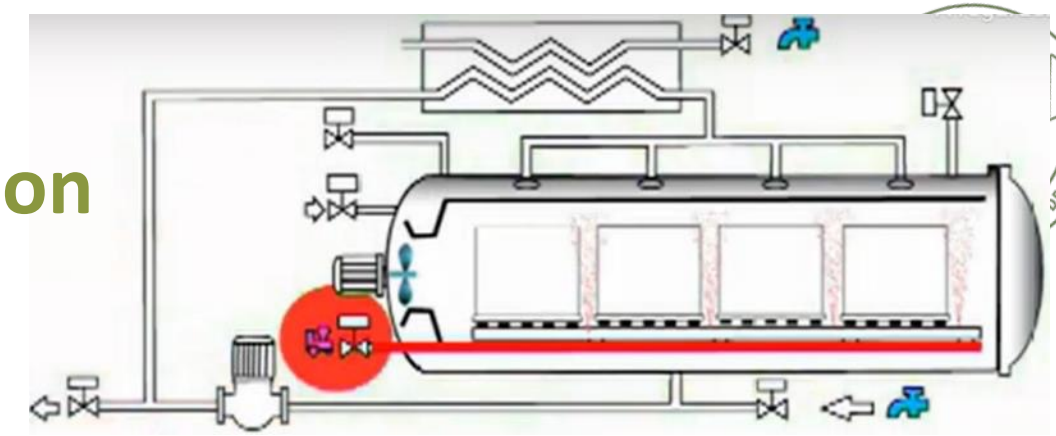
Ambient temperature is not considered as sufficient data

Objectives :

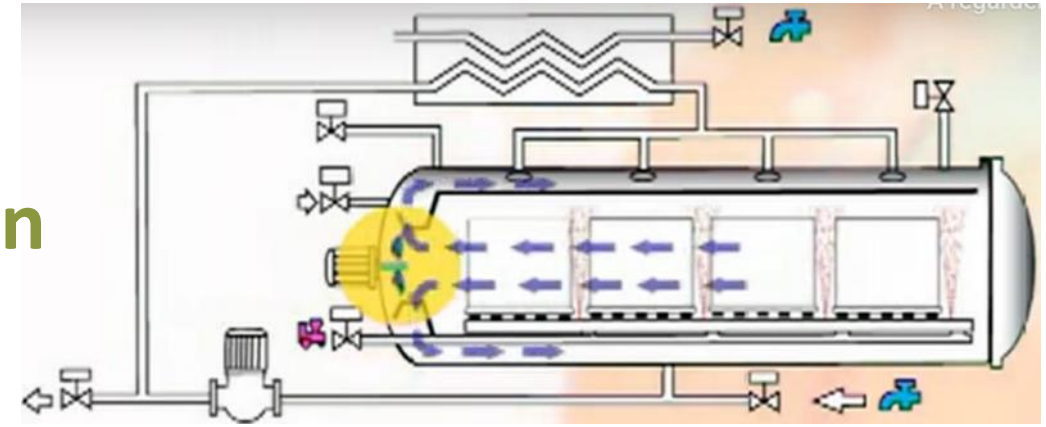
- identification of the slowest heating location (for further HP study)
- check the repeatability (2 runs)

GENERAL VIEW OF STEAM-AIR BATCH RETORT

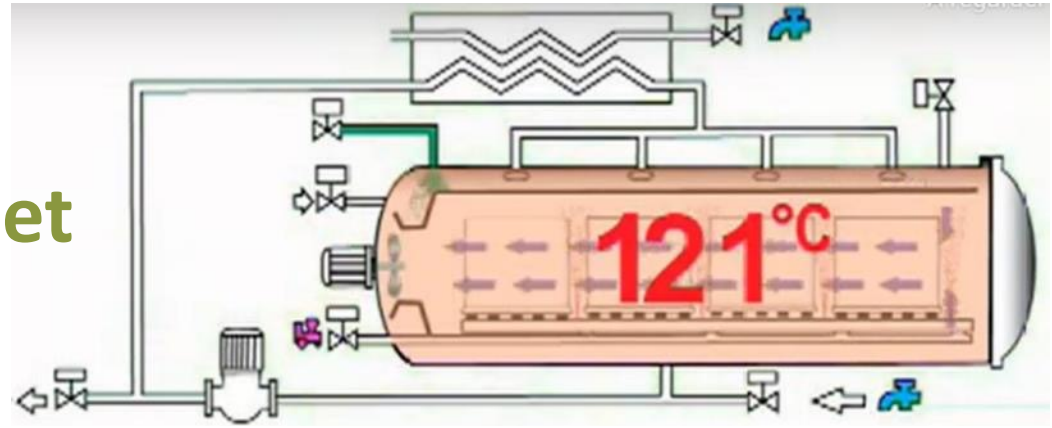
1. Steam injection



2. Fan action



3. Air inlet

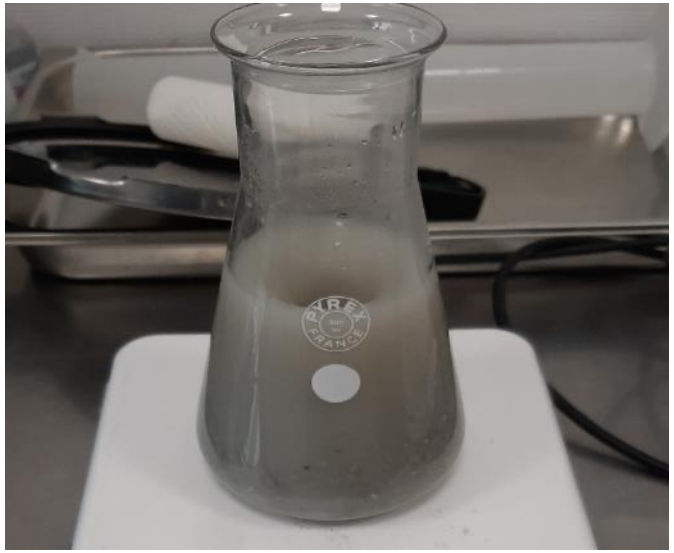


Pictures issues from « Lagarde autoclaves Steam and Air process » video, created by Lagarde Retort company (Fr), available on https://www.youtube.com/watch?v=BcliGCSFV_M&t=207s

How to measure the steam / air mixture behavior ?

1. Choose in inert product, likely to react homogeneously in the load

Bentonite clay



+	-
Cheap Easy to find	Irregular behavior (thickener) Sedimentation Not suitable for flexible packaging

Teflon blocks

+	-
Identical blocks Tight logger => reliable	Tailor-made (packaging + logger) Expansive

How to measure the steam / air mixture behavior ?

2. Perform the cycle (with replication)

CTCPA recommendation: 3 positions / basket or crate

Together with an ambient logger (quite a lot of loggers)
=> after or simultaneously than TD

+ Maximum pressure recommended

How to measure the steam / air mixture behavior ?

3. Extract the Fh values for each logger

For each logger

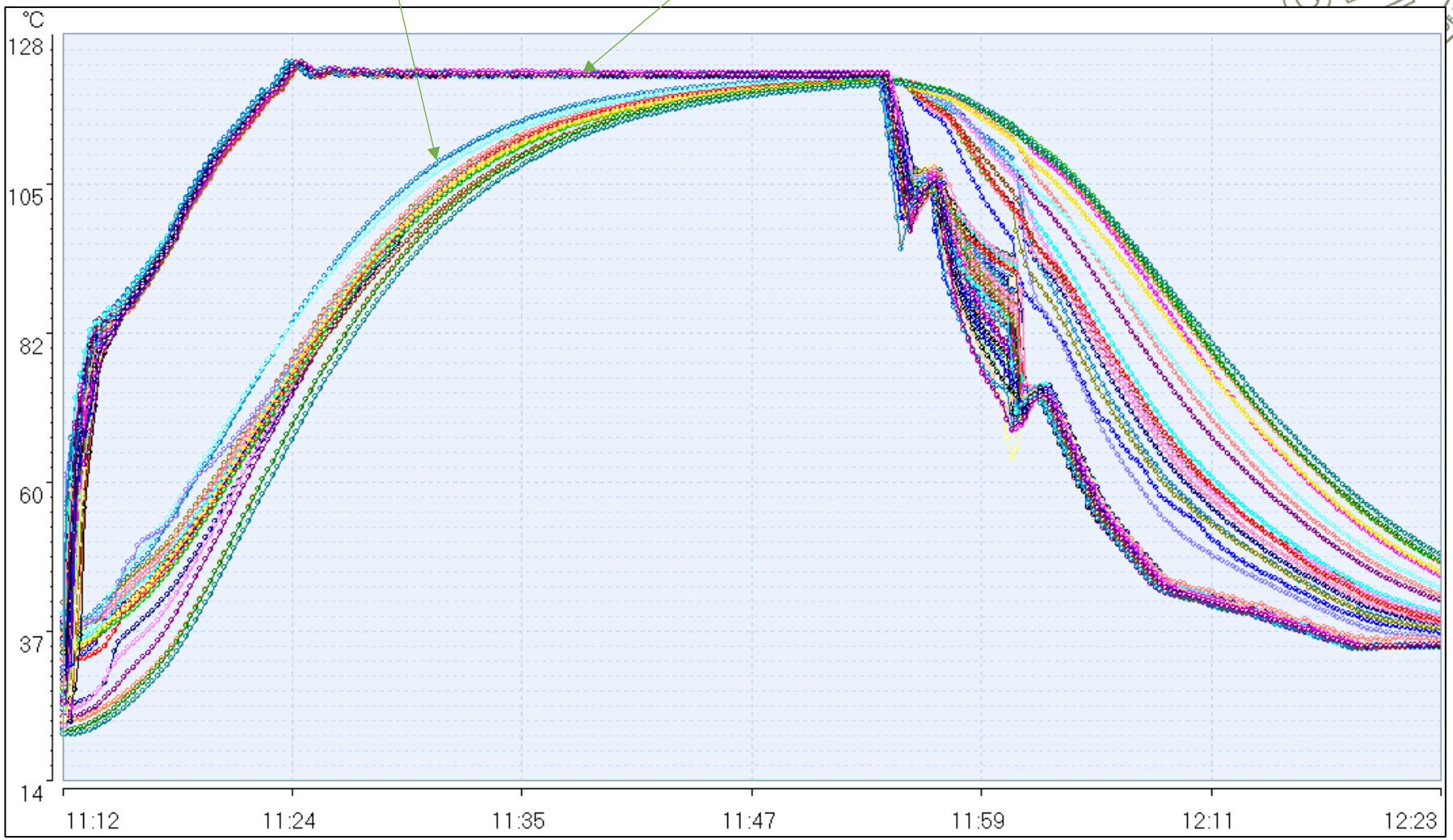
Assess the variation with CV: (Standard deviation / mean x 100) **< 5%**

If > 5%, existence of a cold spot, use this zone for HP study

NB: a CV > 5% does not mean that the retort cannot be used for products sterilization!

Examples of results

Static process
Teflon blocks



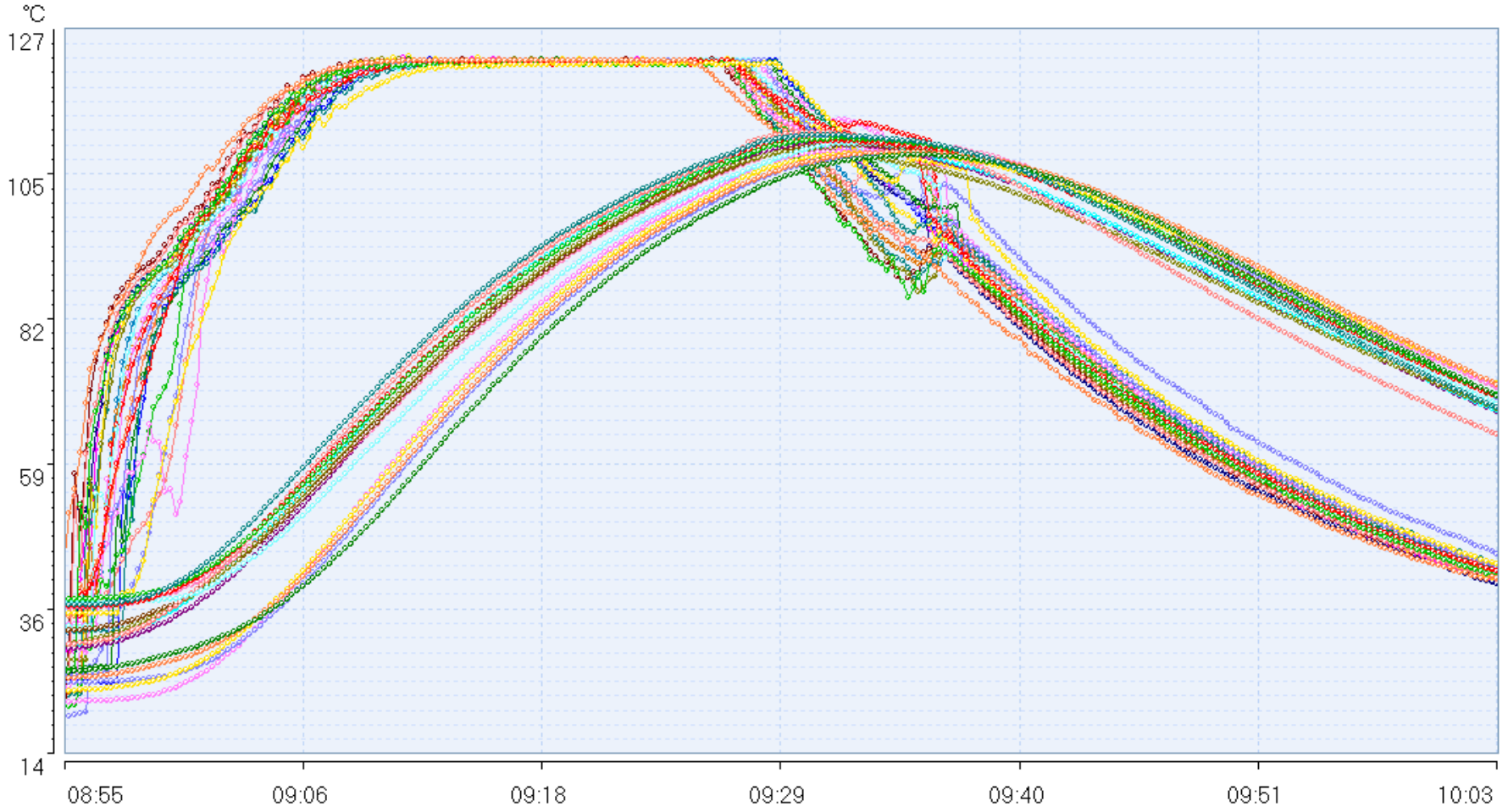
13.44 < Fh < 15.90 Mean = 15.03 Std dev = 0.58 **CV = 3.88 %**

Examples of results

Static process

Cans

Bentonite



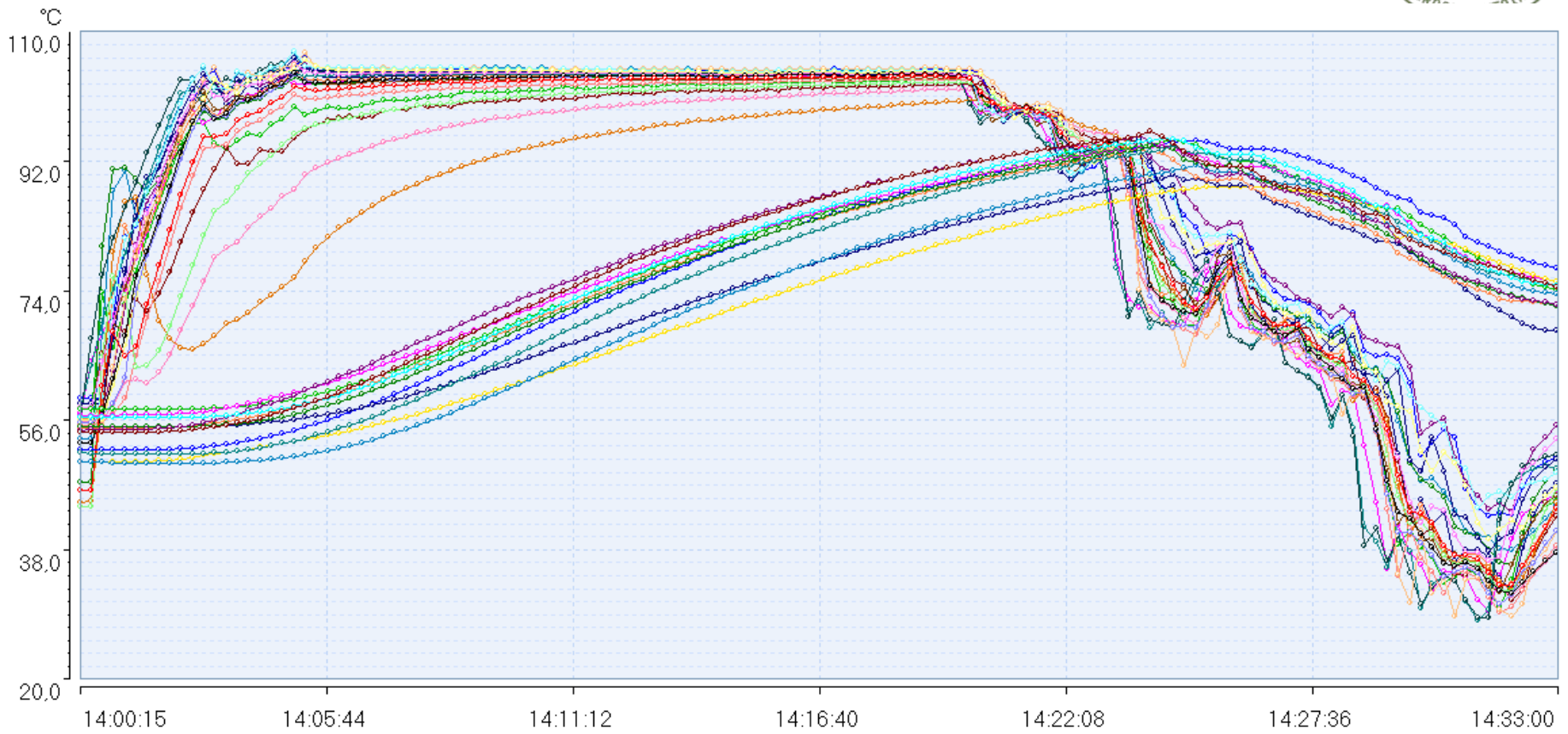
27.68 < Fh < 32.60 Mean = 30.08 Std dev = 1.35 **CV = 4.49 %**

Examples of results

Static process

Small jars

Bentonite



23.02 < Fh < 33.94 Mean = 26.32 Std dev = 3.06 **CV = 11.63 %**

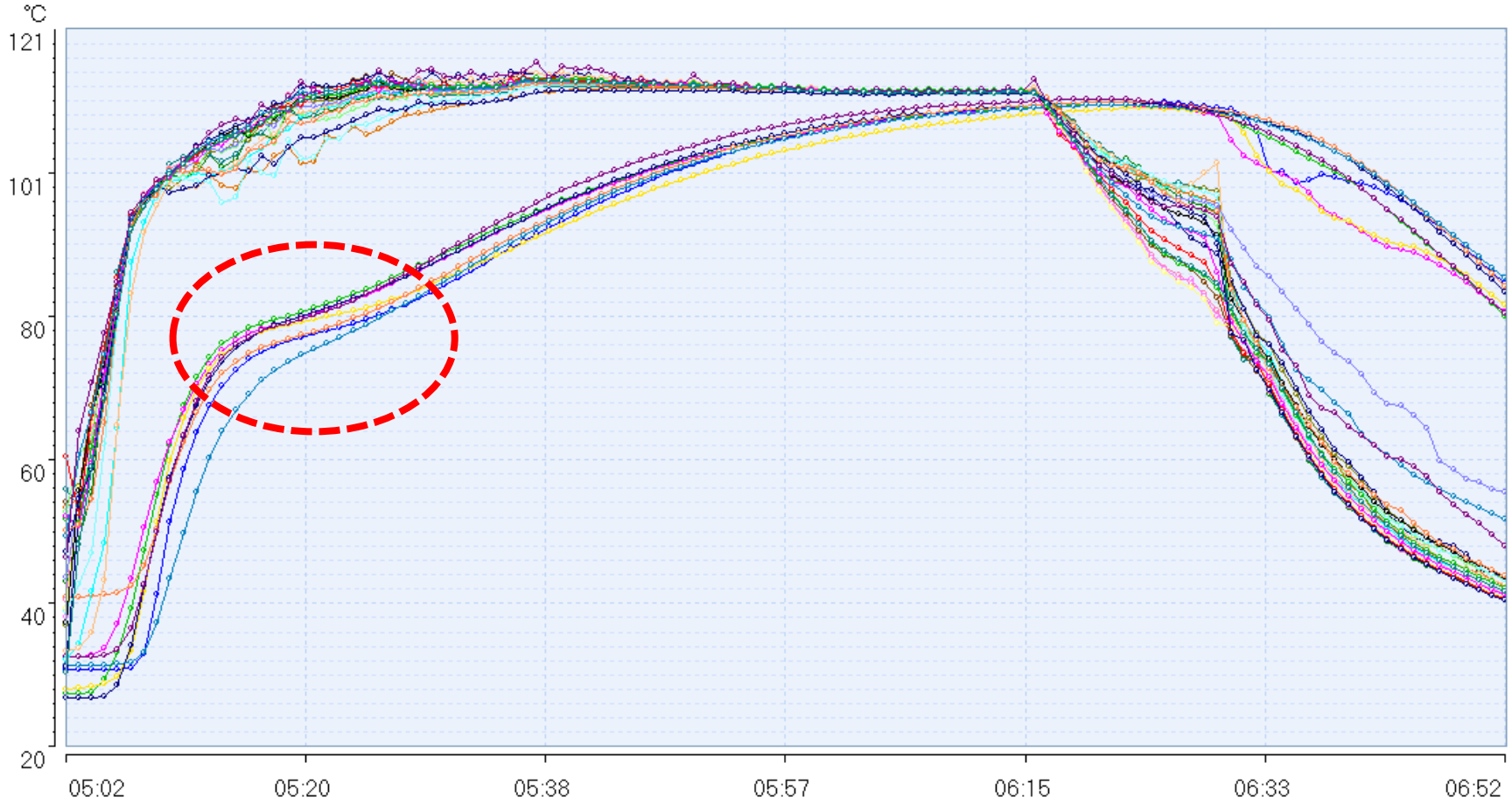
Heterogenous retort => 2 slowest heating profiles in bentonite (dark blue / yellow)

Examples of results

Static process

Glass bottles (1L)

Bentonite



CV = 12.16 %

Thickening of bentonite => broken curve => irrelevant Fh

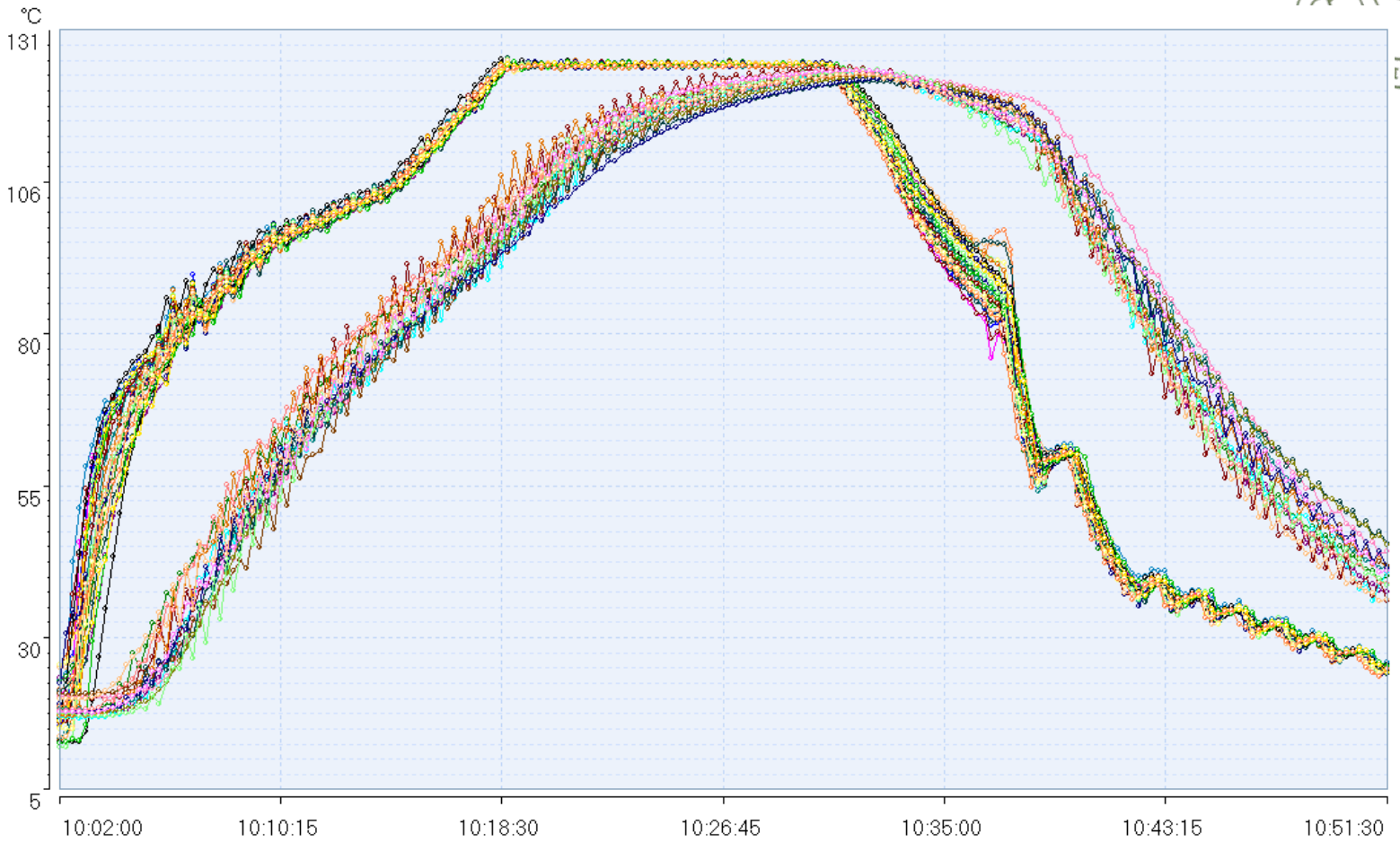
Examples of results

Agitated process

Gusseted pouches

Bentonite

Looks homogenous !



16.80 < Fh < 20.10 Mean = 18.66 Std dev = 1.14 **CV = 6.09 %**

Agitation + flexible pouches with air => flow movements around the loggers

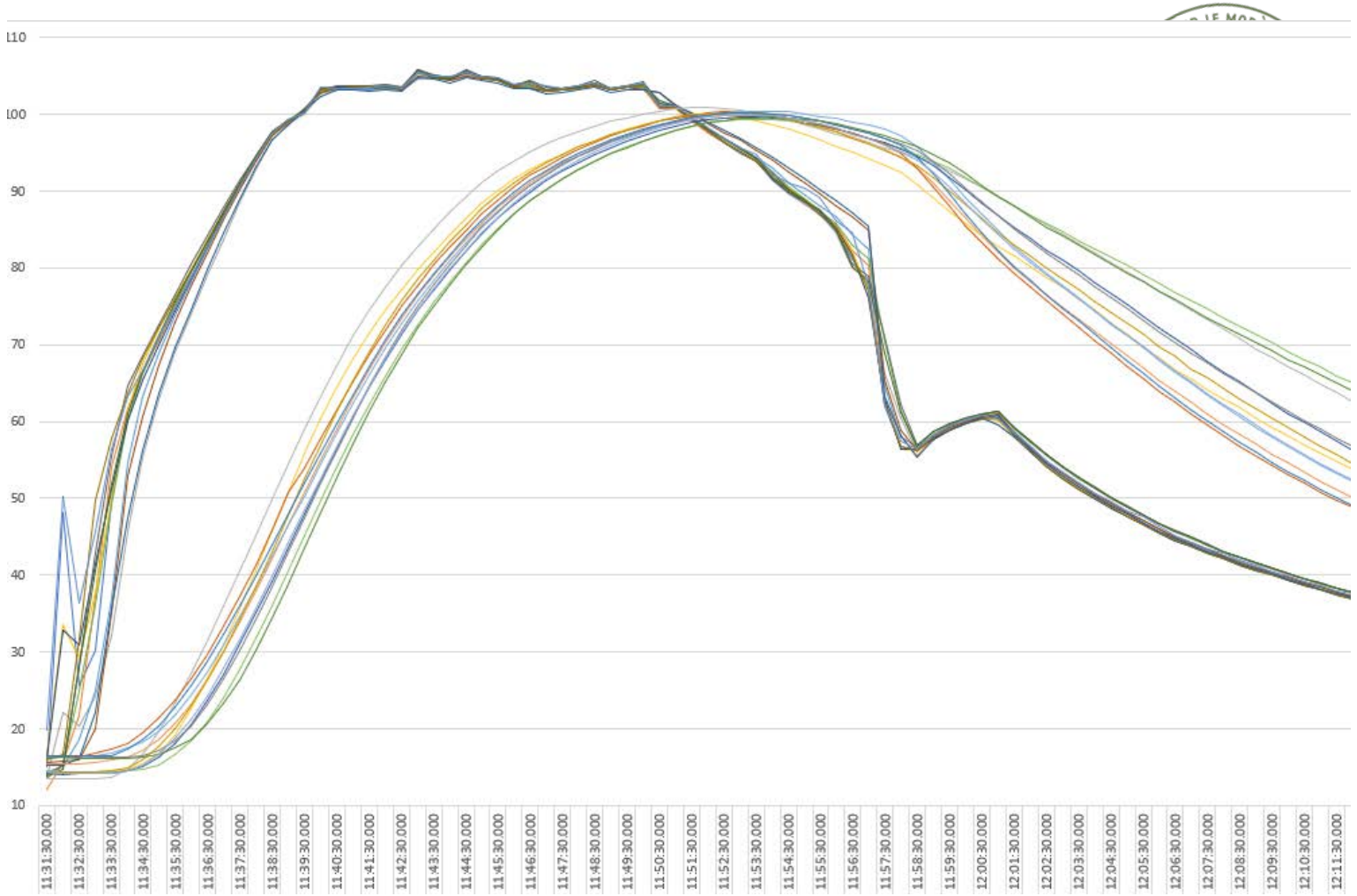
Examples of results

Still process

Small pouches (80 g)

Bentonite

Looks homogenous !



12.01 < Fh < 15.22 Mean = 14.32 Std dev = 1.01 **CV = 7.05 %**

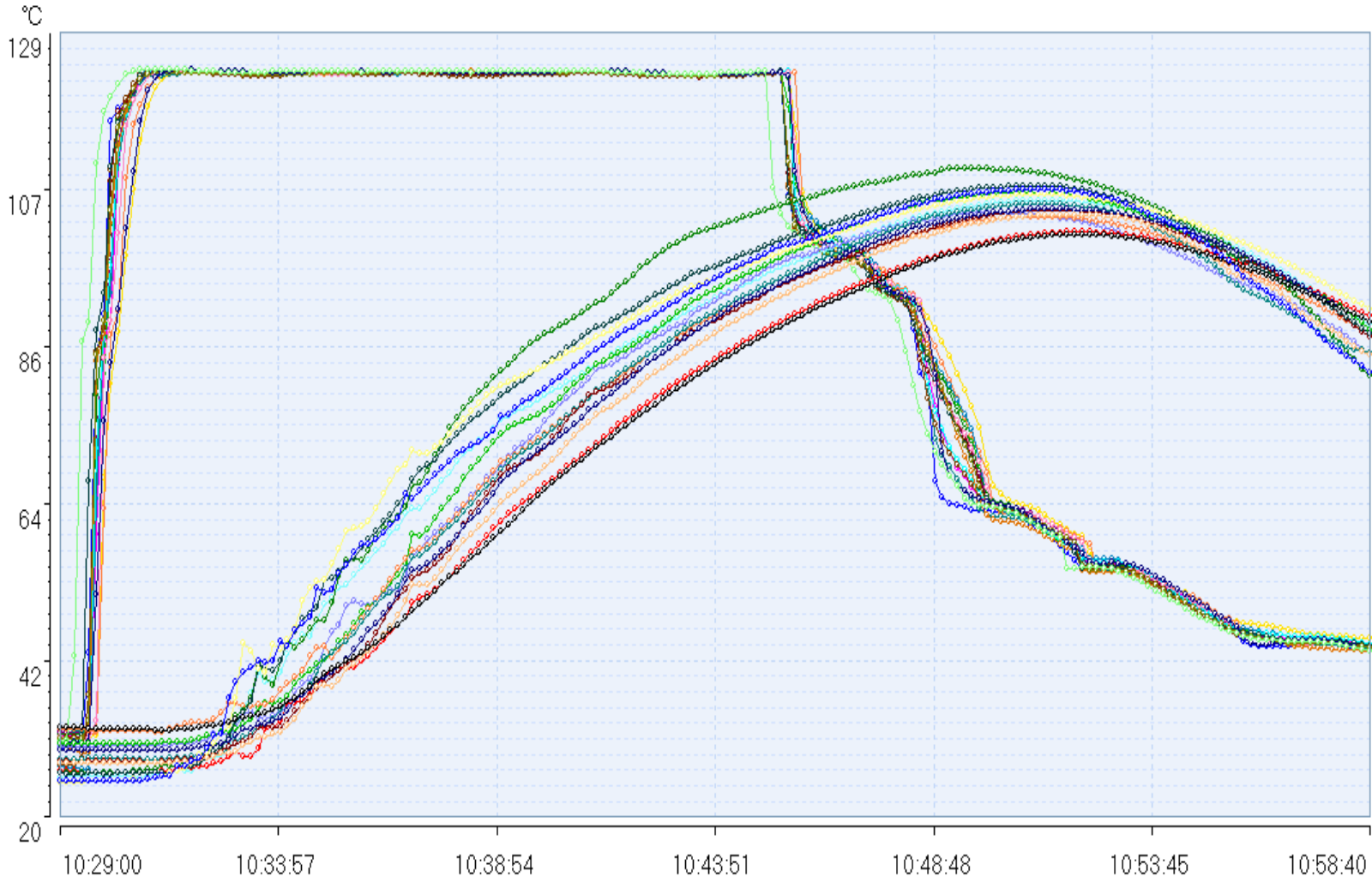
Small pouches = small Fh => slight variations lead to great change in CV

Examples of results

Agitated continuous process

Small cans (120 g / 4.23oz)

Bentonite

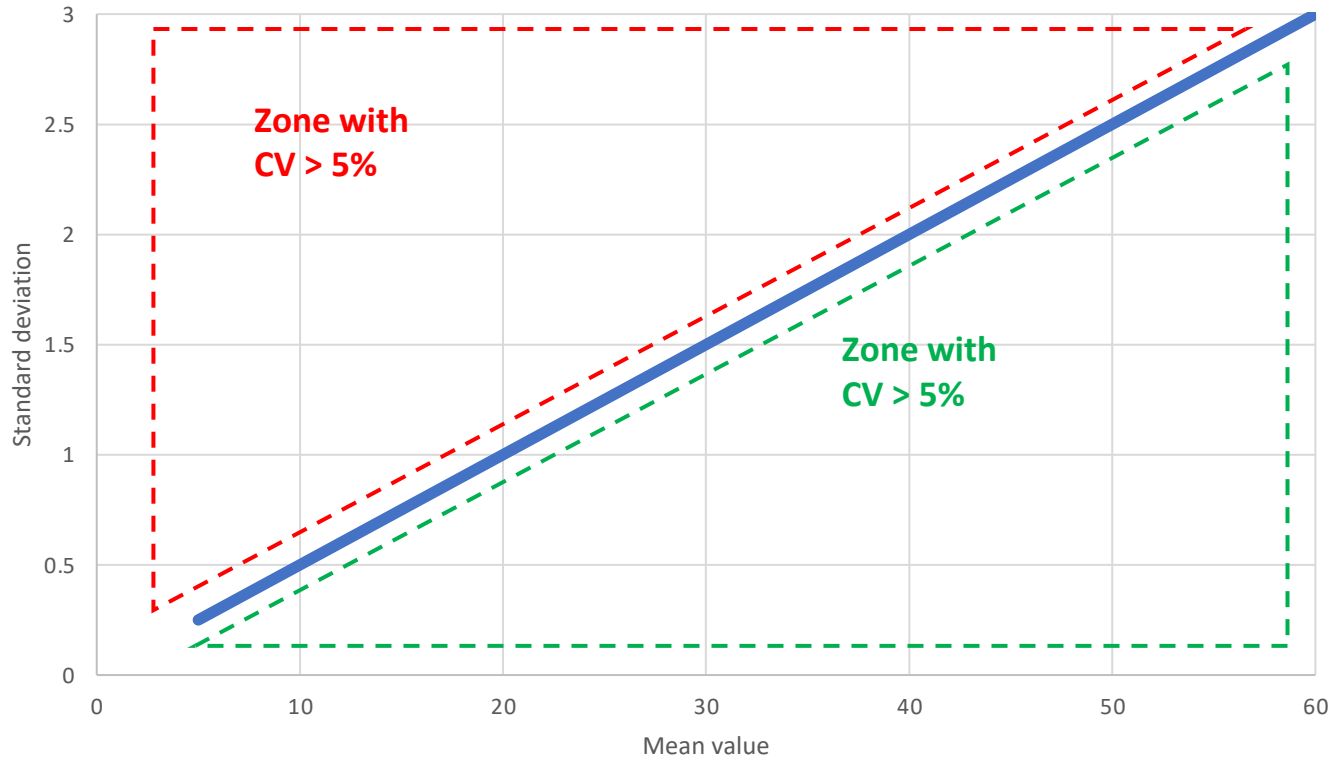


19.15 < Fh < 23.39 Mean = 21.15 Std dev = 1.24

CV = 5.86%

Small cans + agitation = slight variations

Fh / heating profile



Small packaging, quick heating => small Fh

Slight variation: agitation, position of logger, movements during cycle, air bubble, weight of bentonite…

Particular care for these situation, as variations can quickly occur and may lead to CV > 5% because of experimental variations

General recommendations

Type of material

Bentonite clay

Must be pre-cooked for thickening

Suitable for rigid packaging with medium or large volume

Not suitable for agitated processes

Teflon blocks

Easier to handle

Suitable for small-sizes packaging

Adequate for agitated processes

General recommendations

Methodology & Interpretation

3 positions per basket / crate / stack

If CV > 5%, correlate with TD results to locate the cold spot (but the retort can still be used !)

Tolerance for CV greater than 5% in case of agitated process / very small packaging (100 ml): not necessarily a cold spot, could be due to experimental variations

Thank you for your attention

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