

22nd VH Yeast Conference

Berlin, April 27 – 28, 2009

New Raising Power Measurement Devices for Advanced Tasks

Helmut Trautmann

abiotec AG

advanced bioprocess technologies

CH-5445 Eggenwil

How all began . . .

**Customer-Driven Development for
*Centre de Recherche Nestlé (CRN) in Lausanne:***

Low Temperature Inactive (LTI) Yeast Project
asks for a sensitive measuring device to detect
gassing activities of 100- to 1000-fold below
standard yeast dough conditions



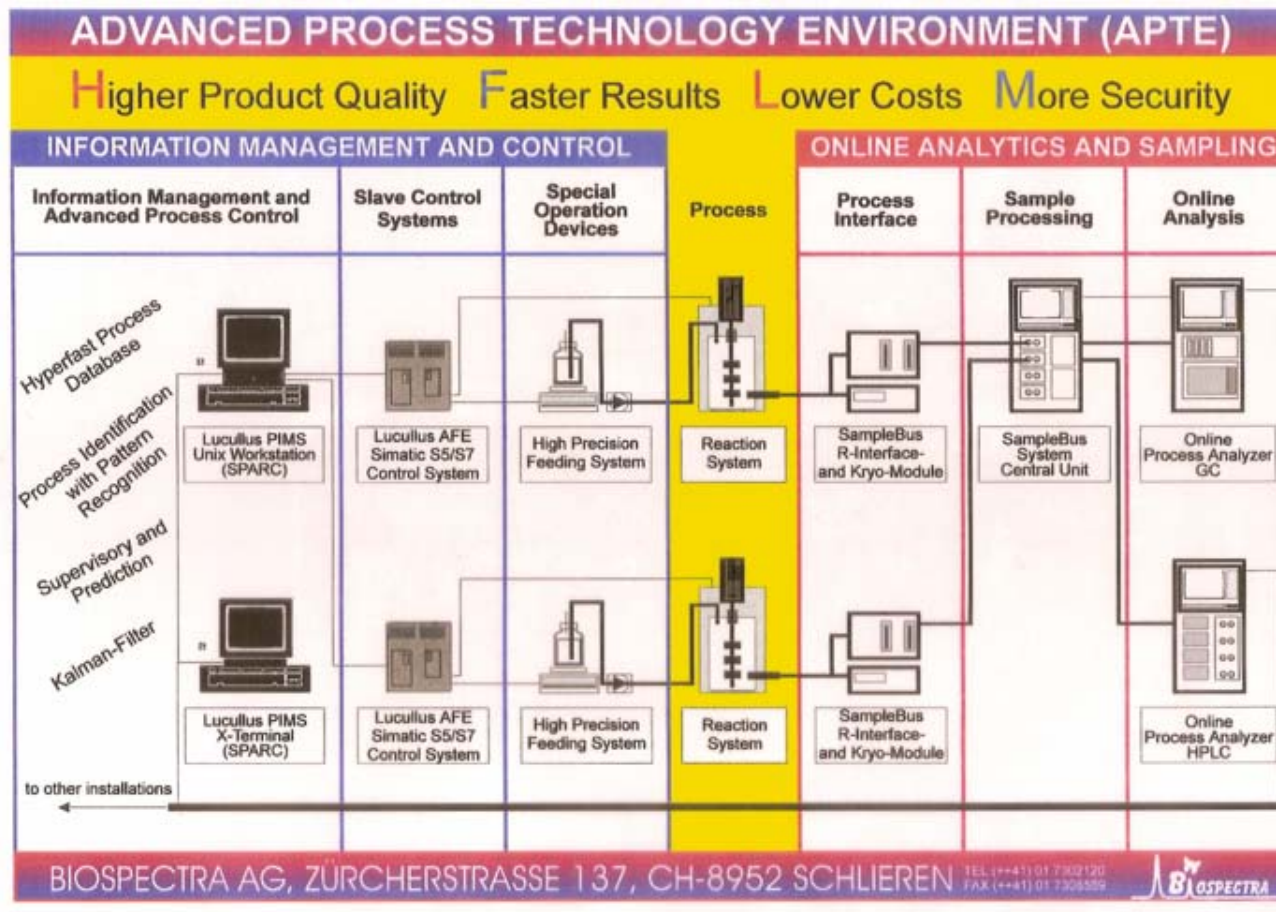
Systems on the market did not fulfill these criteria!

**We: A Spin-off Company from ETH-Zürich were already in collaboration
with Nestlé in the topic of**

Advanced Bioprocess Technology

„Quality Control by Process Control“

Our concept from 1994 . . .

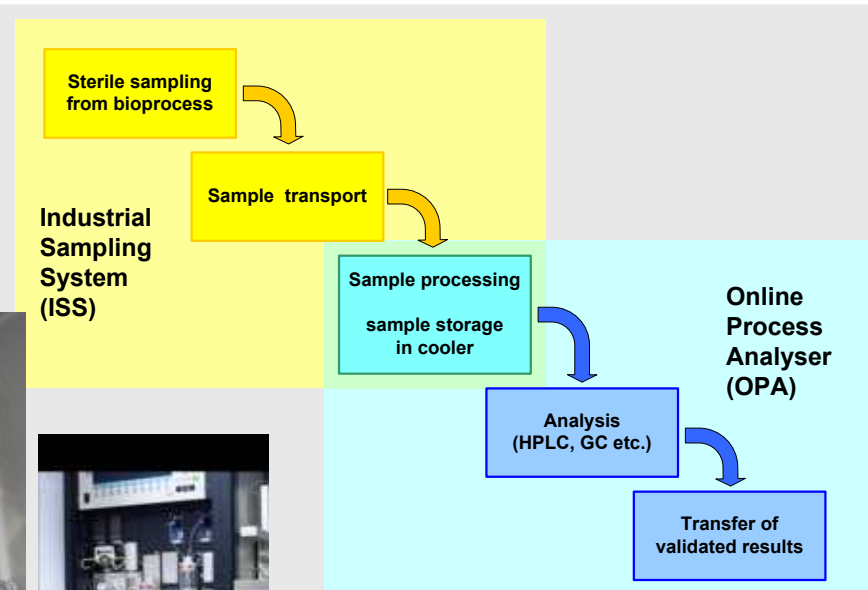


Presented at Hannover Trade Fair
and at Biotechnica

. . . becomes 10 years later a major demand of US-FDA's PAT-Initiative !

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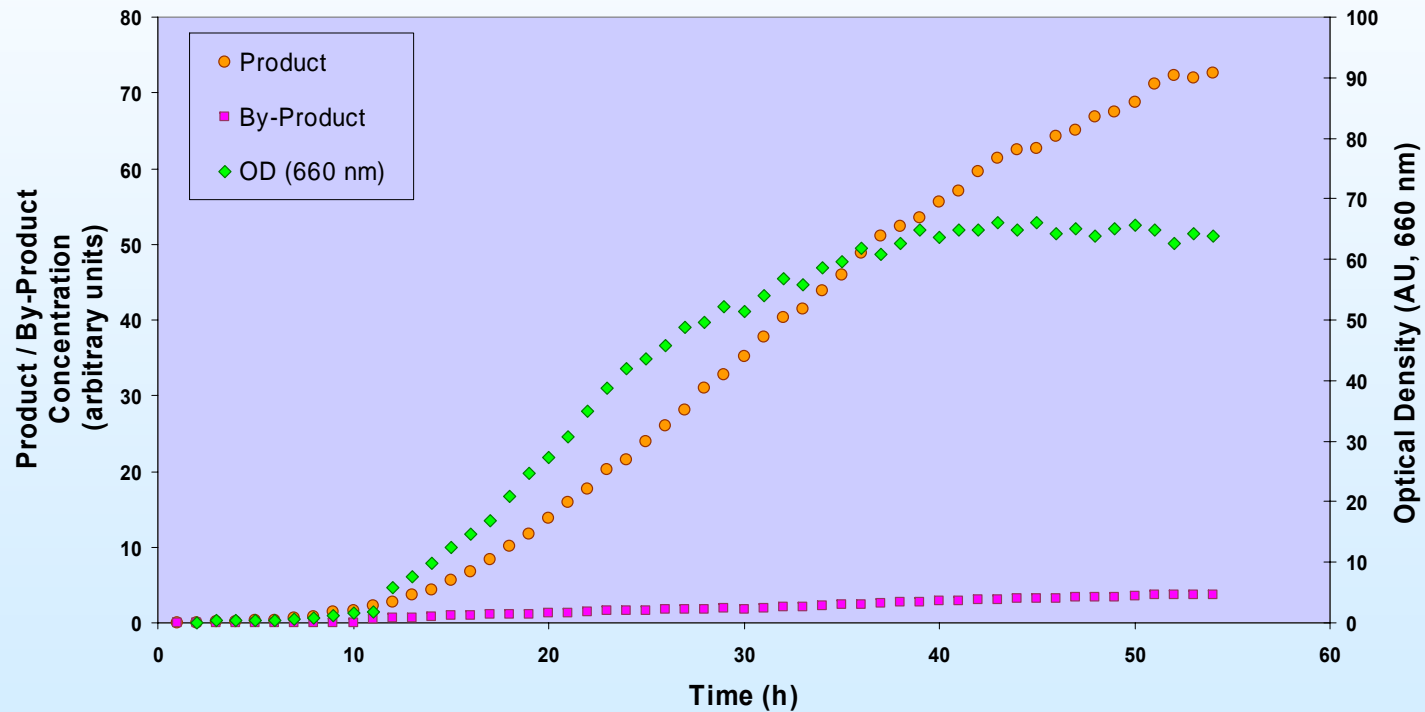
Process Analytical Technology in „State of Routine“



**Roche Vitamins / DSM:
Production Plant with
6 Bioreactors, each 140 m³**

Monitoring of Product, Byproduct and Cell Density

On-line Monitoring of Industrial Fedbatch Process



User Requirements (selection)

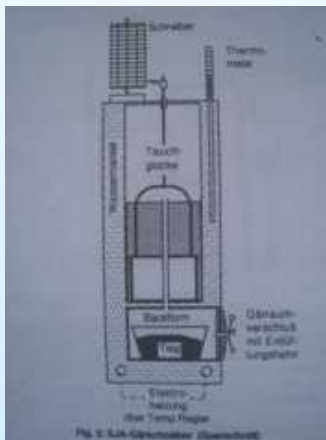
- Lower detection limit at about 1 ml gas per day
- Suitable system-volume for samples of about 30g dough
- Duration of experiments up to 3 weeks
- Ambient temperature range from 0°C to 40°C
- User-friendly concept
- Modular extendable system

Selection of Measuring Principle

1. Open Systems

1.1 Massflow Sensors not sensitive enough

1.2 „Classical“ Displacement principles



Automated evaluation of measuring requires additional sensors,
complex handling

Selection of Measuring Principle

2. Closed Systems

Measurement of Pressure-Differences by

2.1 Absolute Pressure Sensors

2.2 Relative Pressure Sensors

reference measurement required

Disadvantage: Management of overpressure and security aspects

Realised System

Gasvolume-Monitor „Niesler“

(Name according to the Initiators Dr. Peter Niederberger and Dr. Christof Gysler from CRN)



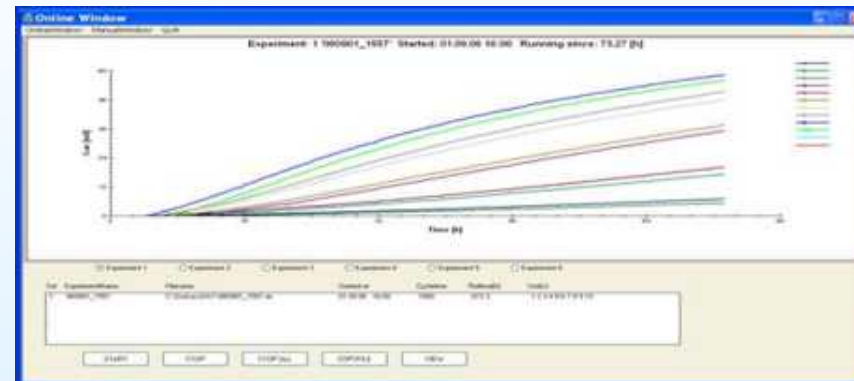
Recording of absolute pressure over time,
calculation of generated gas volumes according to

Ideal Gas Law

$$p * V = n * R * T$$

Gasvolume-Monitor „Niesler“

System Overview

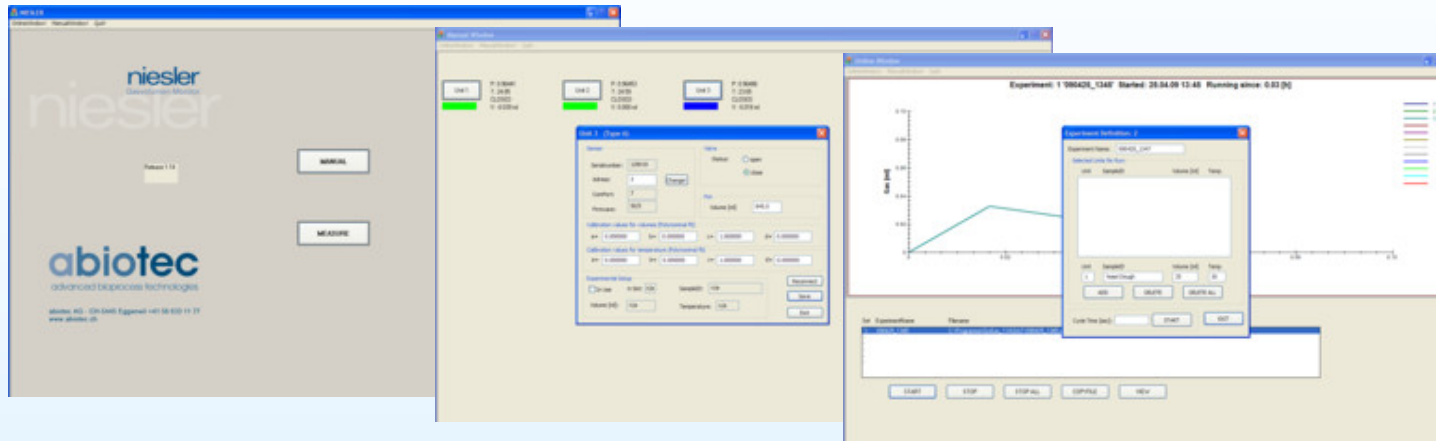


Measuring Range: >4 Magnitudes
Lower Limit: 1 ml per day
Upper Limit: 3 L per hour
Resolution: 0.05 ml



Gasvolume-Monitor *Niesler*

Windows-based Operation-Software



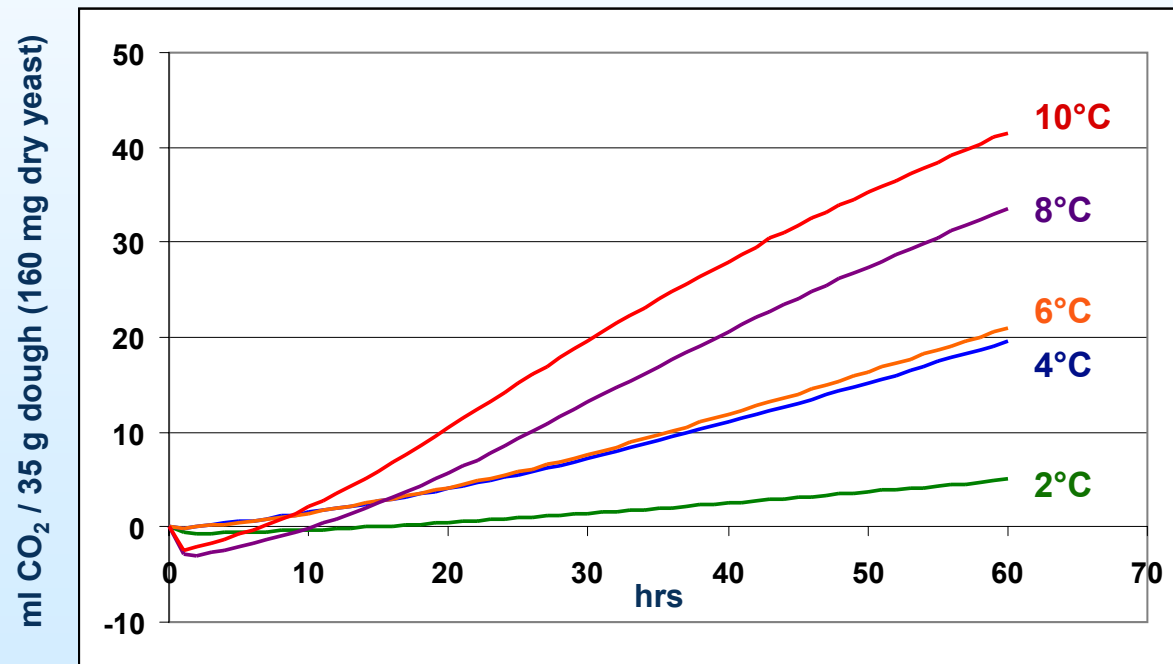
- Automated and manual interactions with measuring units
- Units can be freely combined in experimental sets
- Multiple sets can be registered simultaneously
- Results are presented directly via online view on the screen
- Excel-readable files are generated for subsequent user-specific operations
- Generation of standardised reports in QA routine measurements is possible

Data from Dr. Christof Gysler, Nestec Lausanne:

Activity = f (Temperature)

- gassing activity increases with increasing temperature

Baker's yeast in model dough



Niesler[®] gas-monitor:

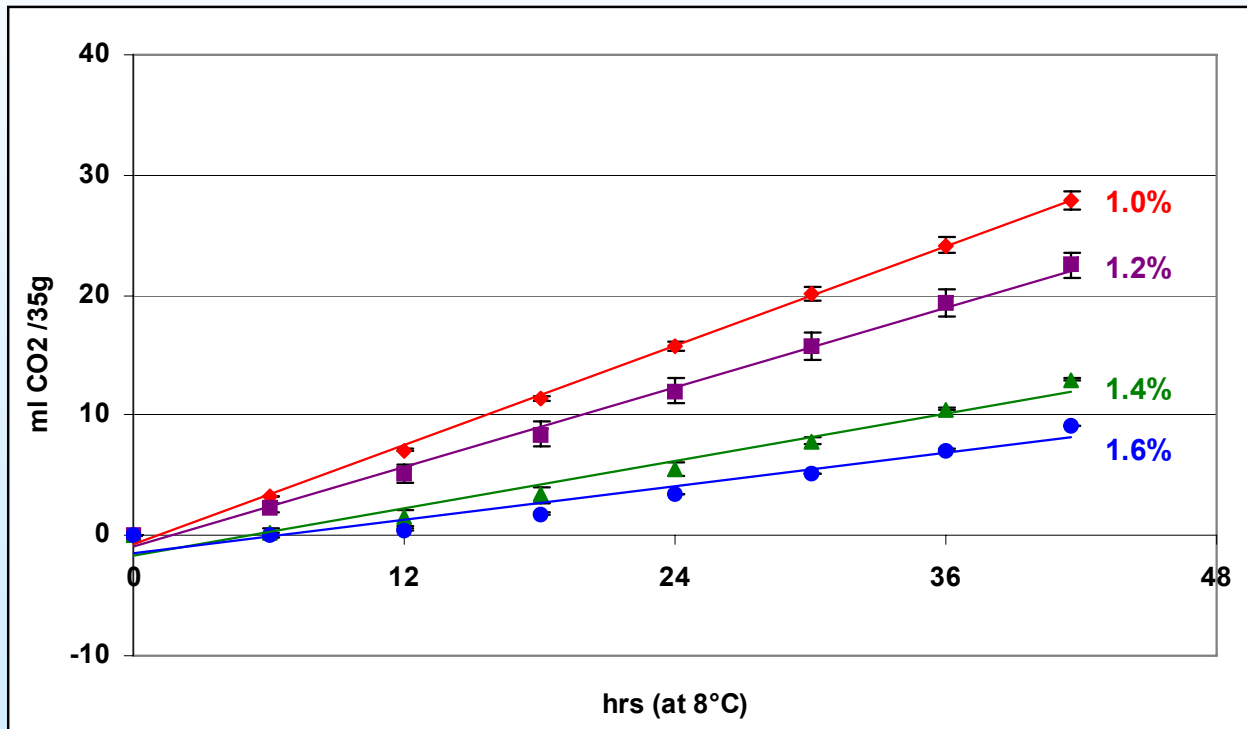


2.4 ul CO₂ / g *h

Data from Dr. Christof Gysler, Nestec Lausanne:

Activity = f (Recipe)

e.g.: NaCl concentration



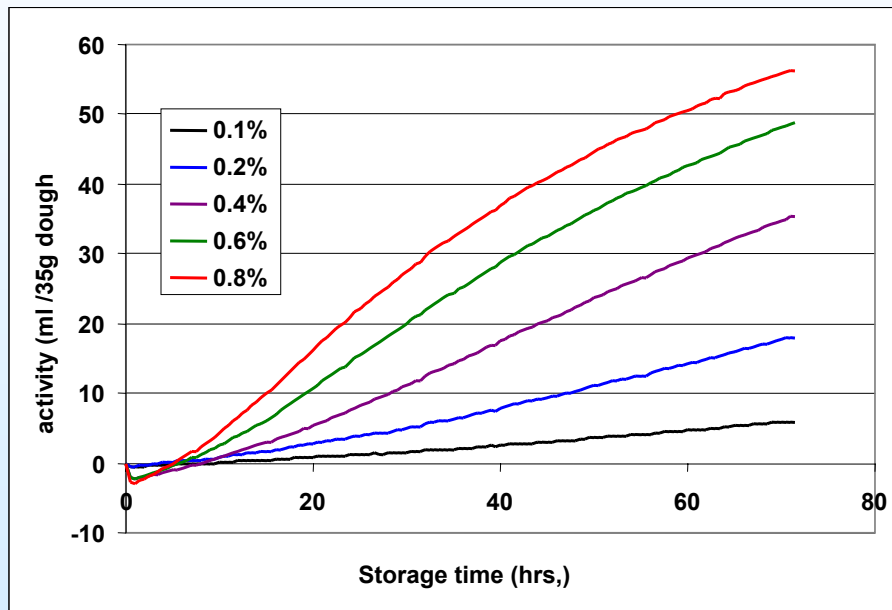
Niesler[®] gas-monitor:



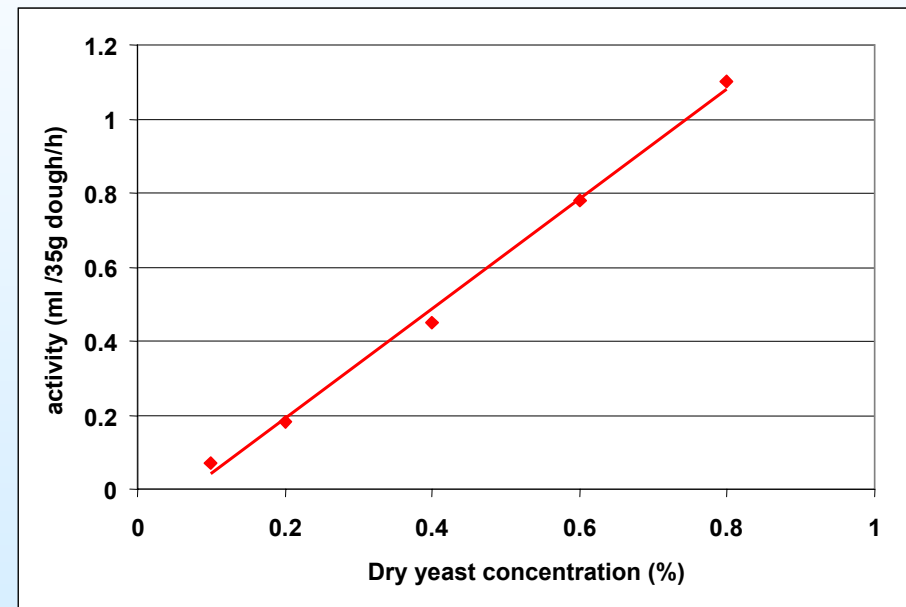
Data from Dr. Christof Gysler, Nestec Lausanne:

Activity = f (Yeast concentration)

Cumulative CO₂ development



Initial activity (5-35 hrs) vs. [conc.]

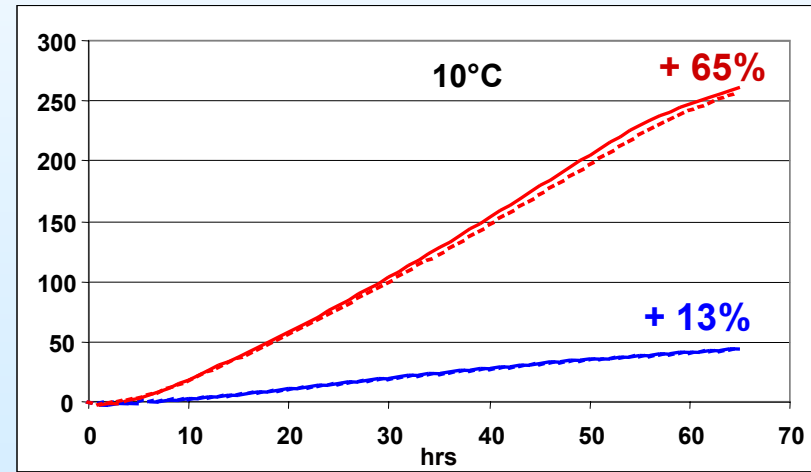
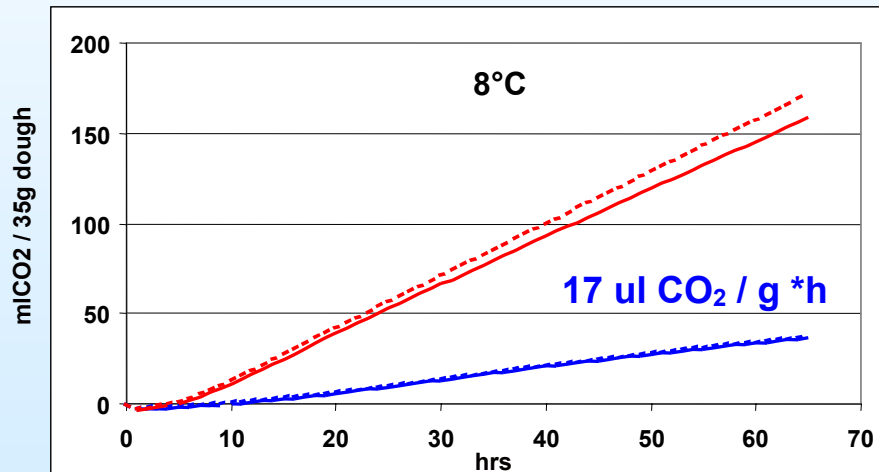


Data from Dr. Christof Gysler, Nestec Lausanne:

Activity = f (Time)

➤ At low temperatures and low yeast conc. the gassing activity is linear

« normal » dry Yeast / *LTI* Yeast



Temperature-Profile of *LTI*-Yeast is not according Arrhenius

Niesler: New Edition 2009



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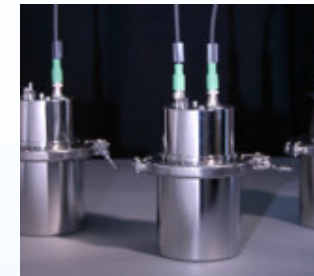


ROBUST AND PRECISE

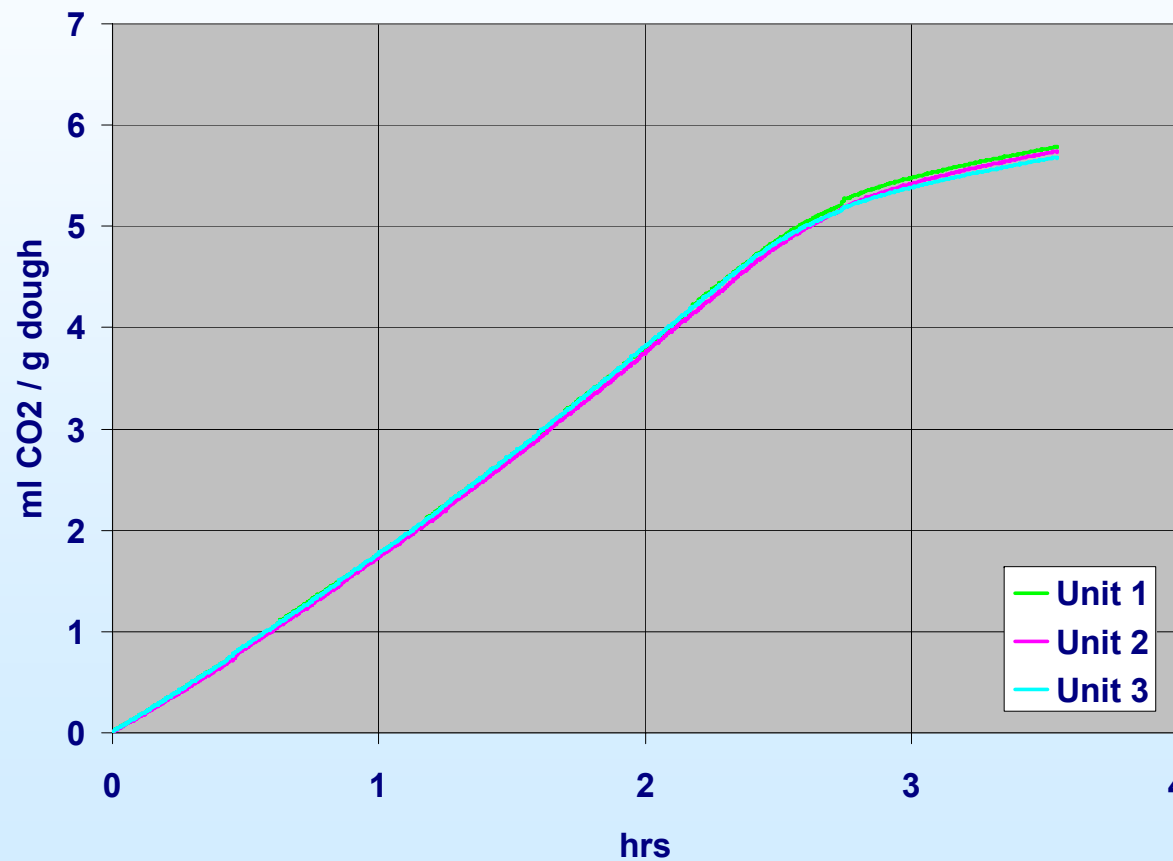
- Fabricated completely in stainless steel
- Water protected measuring head
- User-friendly and efficient Tri-Clamp fastener
- „Plug and Work“-Layout
- Improved concept of components => improved gas-tightness
- Extended Security-Concept for Overpressure (Software, Firmware, Hardware)

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Niesler 2009: Reproducibility



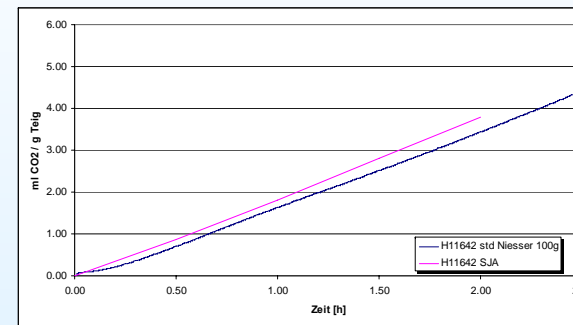
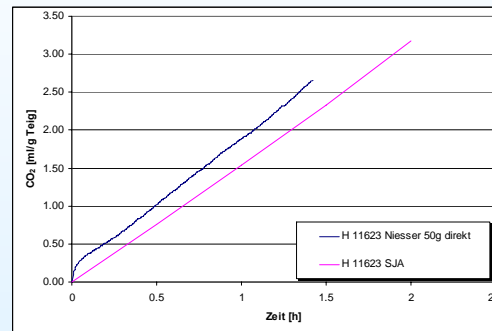
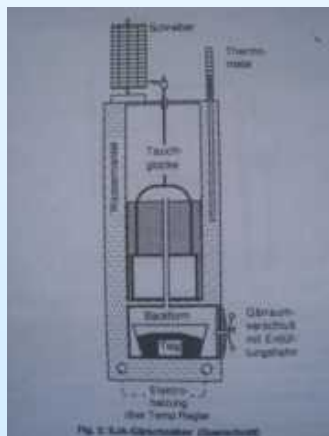
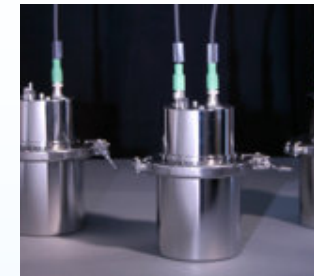
**Gassing activity from 100g model dough at 30°C,
measured in 3 different Units**



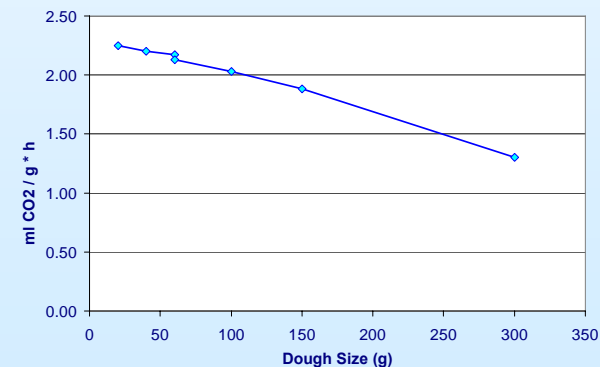
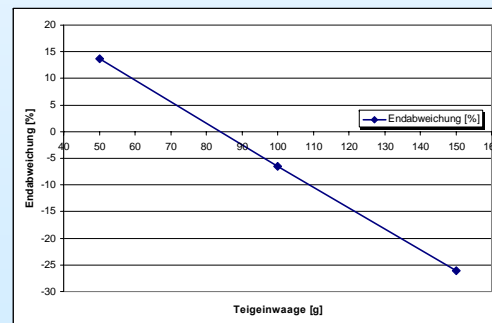
rel. StdDev \leq 1%

Comparison of Niesler with SJA Fermentograph

Experiments at VH-Berlin
by Dipl. Biotechnol. Claus Decker
were just started . . .



Spec. Gassing Activity Rates vs. Dough Size



Exemplary first results: Gassing activity as a function of sample size

Niesler 2009:

Future Perspectives:

**Development of new Evaluation and Reporting Tools
for Industrial Routine Applications**

**Development of other Vessel Formats
adapted to Customer-specific Work-Flows**

. . . to be continued . . .

What are your specific needs ?

