QSense

The New Way to Test Detergent Performance

Biolin Scientific

[Progress Together]

What are your main challenges when evaluating cleaning performance?
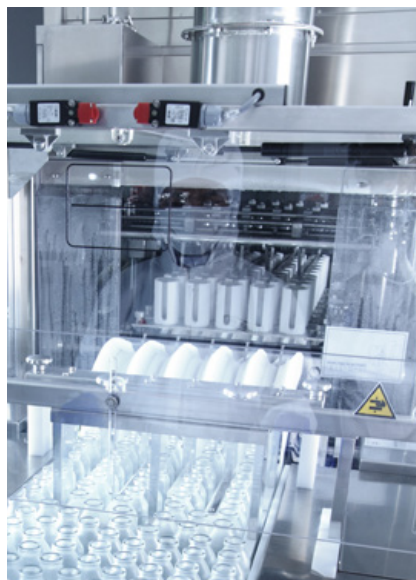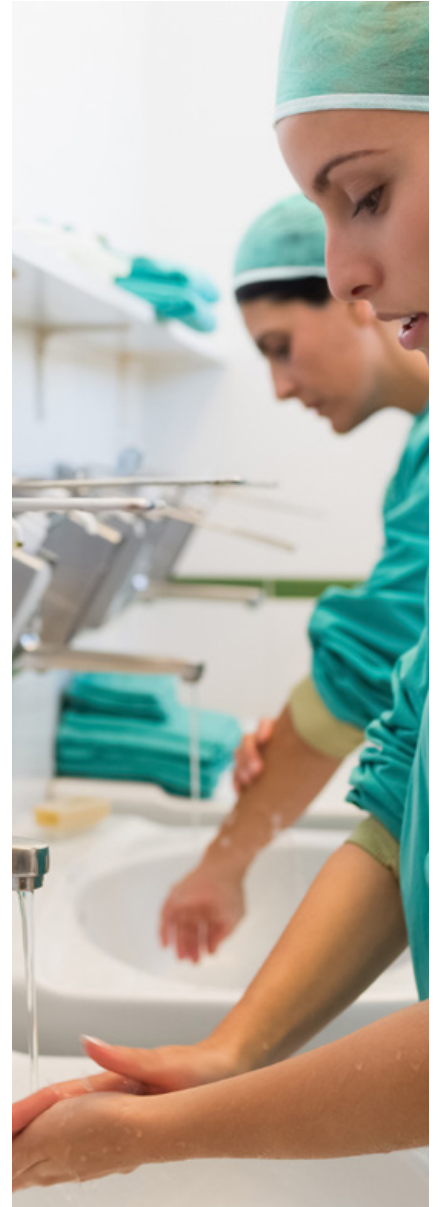
The New Way to Test Detergent Performance

With increasing competition and demand for environmentally-friendly detergents, manufacturers need to monitor performance closely in order to make informed decisions - during product development as well as throughout continued product maintenance.

Balancing performance and cost is challenging. Especially as most cleaning evaluation methods are manual and time consuming, have a low sensitivity and leave room for subjective interpretation.

Challenges with current methods

Current methods to determine detergent efficiency are basic, slow, and mainly "before and after" methods. We repeatedly hear the following areas mentioned by customers as key challenges to improving cleaning efficiency:

- Basic, analogue techniques, e.g. visual inspection, foam height (Ross Miles foaming test), wettability (Draves wetting test).
- One point measures – before and after
- Low sensitivity
- Long test cycles and needing to use several analysis methods
- Non-automated, manual methods

Not only do these methods slow you down, they give you limited insight into the actual cleaning efficiency.

Move forward with QSense

QSense is a well-established method for measuring surface interaction processes with high precision and sensitivity. In the context of cleaning products, several performance aspects can be measured:

- Cleaning efficiency and mechanisms
- Enzymatic activity
- Material deposition
- Etching properties

Test in real-life conditions

With QSense you can test under your specific real-life conditions including the specific target surface, soil, temperature, water hardness and pH level.

Get high quality results fast

With automated measurements and results within less than an hour you can get high quality data that reveals the cleaning, etching or deposition process with nanogram sensitivity.
So that you can be Faster, Cleaner and Greener.

QSense Cleaning Profile

The QSense® Cleaning Profile has been developed for cleaning efficiency evaluation. It provides you with a unique fingerprint of how well your surfactant or formulation interacts with a specific soil, revealing the full cleaning process.

Reveal the chemical cleaning process

QSense doesn't just tell you how clean your detergent or formulation cleans – objectively and with far higher precision than current methods. Through three key parameters; Swelling time, Mass removal rate and Total mass removal, the QSense cleaning profile also helps you know how efficiently it gets you there.

How fast does your detergent or formulation clean?
If the target object is completely clean at the end of the wash cycle, did it take the full cycle to get there, or was the object clean long before?

Could you have reached your result in much shorter time and in a more resource efficient and environmentally friendly manner? Or with lower concentration and a cheaper yet sufficiently efficient final product?

Or, if the target object is not clean enough at the end of the cleaning process, does this mean that your detergent or formulation is bad altogether – or just slow?

Compare candidates and varying conditions

With QSense you can easily and quickly screen and rank different candidates, comparing endless variations in:

- Composition
- Concentration
- Temperature
- Water quality
- Wash cycle time

You can pre-program your test to run up to 8 samples in one go, providing you with high precision, real-time, reproducible data that reveals how your different options perform under varying cleaning conditions.

QSense Cleaning Profile Guide

Procedure for evaluation of cleaning efficiency

1. Sample preparation

Collect the detergent samples for evaluation, the rinse water and QSense sensors coated with a specific soil.

2. Start-up

Place samples and sensors in the QSense instrument. Setup the automatic washing program and start the measurement.

3. Measurement

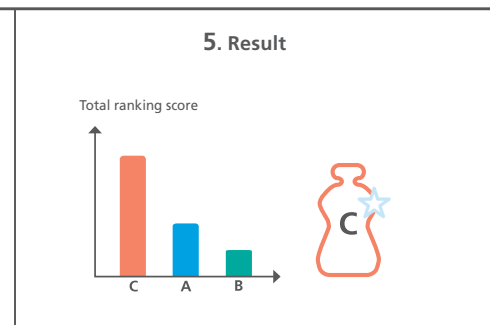Water and detergent samples are flown over the soiled sensors according to the set washing program.
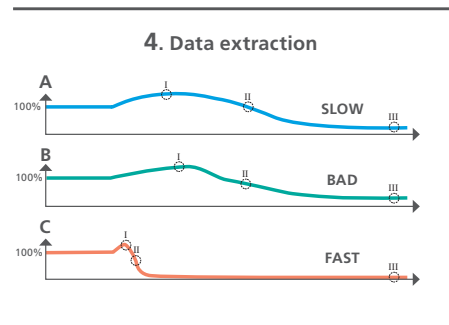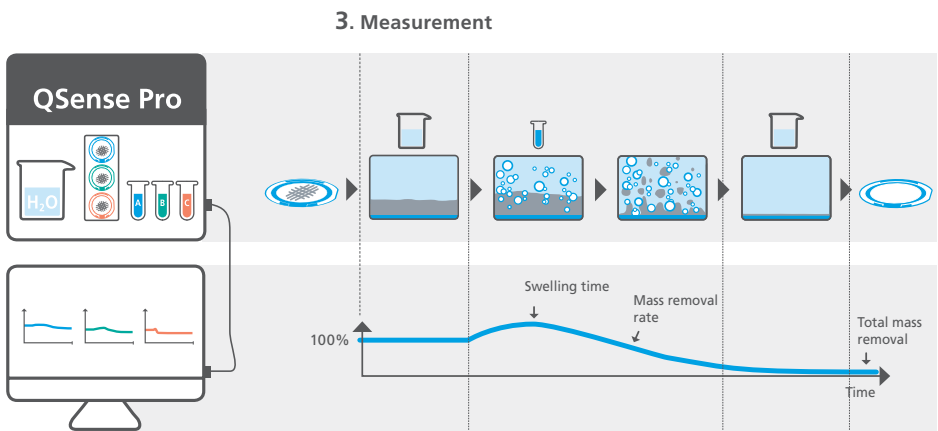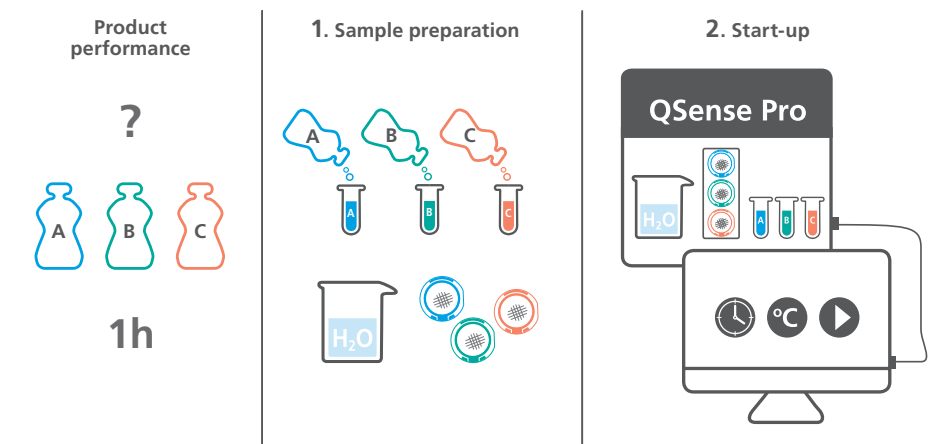
You can follow the soil swelling, degradation and removal in real-time on the screen.

4. Data extraction

The values of the cleaning profile parameters; Swelling time (I), Mass removal rate (II) and Total mass removal (III), are extracted in the analysis software.

5. Result

The cleaning profile values are weighed into a total ranking score which reveals the formulation with best performance.

Product performance

?

1h

1. Sample preparation

2. Start-up

QSense Pro

3. Measurement

QSense Pro

Swelling time

Mass removal rate

Total mass removal

100%

Time

4. Data extraction

A — SLOW
100%

B — BAD
100%

C — FAST
100%

5. Result

Total ranking score

C   A   B

C

Revealing Cleaning Efficiency

Simultaneous and fast screening of 9 different formulations.

In a recent study[1] performed by Biolin Scientific in collaboration with the Center for Testmaterials BV in the Netherlands, nine commercially available dishwashing formulations were screened and ranked based on their ability to swell and remove standardized cooking grease[2] soiled onto a silica surface.

By combining the three cleaning parameters in the QSense Cleaning Profile, rapid and simultaneous screening of the detergents was easily achieved. To be able to rank the performance of the tested detergents, all three extracted parameters were analyzed together. Each detergent was ranked in order of performance for each parameter and was given a value between 1 and 10 (10 is best performing detergent, 1 is the worst). The maximum score was set to 30, indicating that the detergent scoring max value had the best result in all three measured parameters.

Commercial detergents used in study

A B F G **EXPENSIVE**

D E **MID-PRICE**

C H I **CHEAP**

Wash cycle

Fixed concentration of detergents at 4 g/L and measured at 21°C. The cleaning cycle as outlined below was programmed into the QSoft Pro software.

10 min | **40 min** | **20 min**

1. Baseline tap water | **2**. Injection of detergent | **3**. Wash with tap water
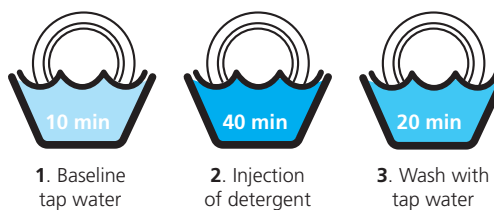
Sample data was collected

Data was collected as triplicates and run in a fully automated mode to maximize efficiency and reproducibility and analyze:

1. Swelling time

2. Mass removal rate

3. Total mass removal

Ranking result

Figure (A): Total ranking score vs Detergents (X, I, D, E, H, G, C, F, B, A)
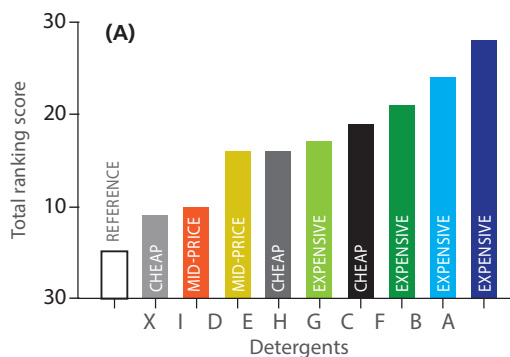
1. Olesen et al. Revealing Detergent Efficiency and Mechanism by Real-Time Measurement Using a Novel and Tailored QCM-D methodology. Tenside Surfactants Detergents 2016 Vol. 53, No. 5, pp. 488-494.
2. Center For Testmaterials (CFT), BV, The Netherlands

An Evidence Based Method

Powerful and proven technology

QSense is based on the QCM-D technology, which is a reliable and well-proven method. It monitors changes in mass and viscoelastic properties of films on a nano-scale by measuring changes in frequency and dissipation of a quartz crystal. Instead of exposing a mimic tile to the cleaning process, the QSense method flows the cleaning formulation over a quartz crystal sensor representing the soil and surface material studied to reveal the chemical cleaning process.

Your world on a sensor

To mimic your soil, QSense sensors are available with four different pre-coated standardized soils:

- Used cooking oil
- Egg yolk
- Mixed starch
- Coffee with milk

In addition, QSense offers sensors with various surface materials representing materials such as glass, cutlery, plastics and stainless steel – and we also have the unique capability to customize sensor surfaces and coatings based on your specific needs.

Multiple analysis methods for cleaning efficiency

Biolin Scientific offers multiple methods and tools for analysing cleaning processes and efficiency:

QSense®
Cleaning Profile

Attension®
Critical Micelle Concentration

Attension®
Contact Angle and Interfacial Rheology

About Us

Biolin Scientific is a leading Nordic instrumentation company with roots in Sweden and Finland. Our customers include companies working with life science, energy, chemicals, and advanced materials development, as well as academic and governmental research institutes. Our precision instruments help develop better solutions for energy and materials, and perform research at the frontiers of science and technology.

Biolin Scientific

[Progress Together]