

# ASSAYS FOR BEER FOAM

## Qualitative

"Foam is considered a non-equilibrium dispersion of gas bubbles in a relatively smaller volume of liquid." Okay.....

Hough reports are over 80 methods to measure foam!!

Foam decays at a logarithmic rate.

**Conventional Foam Assays:**  
 a) Rudin  
 b) NIBEM  
 c) **Sigma Head Value (SHV)**  
 d) **Ross & Clark a la ASBC.**

Time-based measurement of foam decay after foam generation with a constant beer volume is the basis of the **NIBEM** method....reports the time taken by foam to collapse 30 mm in height after an initial 10 mm collapse...**measures foam height collapse.**

## De Vries (the other one) Equation for Foam Collapse:

$$r_t^2 = r_0^2 - [4RTDs(\gamma)]t/p(\theta),$$

where:

$r_t^2 = r_0^2$  are the radius of the foam bubbles at time 0 and time t,  
 R=Universal Gas Constant  
 T= Absolute temperature, °K  
 D = diffusion constant for each gas  
 s = gas solubility (thus nitrogen bubbles last longer),  
 gamma = surface tension (higher = less foam stable)  
 (theta) = distance between bubbles.

"**Foam Robustness Test**"....titration with foam inhibiting FFAs....higher the ratio of foam positive:negative compounds, greater the resistance.

## Foam Index Calculations

## Number Scale

Lewis's "**NHL Measurement**": ...pour beer and measure:  
 a) **Head**..foam height after 1 minute; b) **Life**...time required for beer foam to collapse to height of one minute;  
 c) **Normalized Half-Life**...standardizes foam height of all beers to 10 cm at one minute after pouring to permit reasonable comparison of different beers (e.g. adjunct vs. all-malt). No correlation with ASBC Sigma method or hockey players foaming at the mouth while on the bench.

**Foam Cling**...stable foam residues adhering to glass walls

**NIBEM-TP** ...includes an air pressure sensor and standardizes to results for foam results at standard atmospheric pressure  
**NIBEM-Cling**.....measures the amount of foam clinging to the walls after foam collapse - an indication of lacing or cling  
**NIBEM-T**.....uses automated temperature and air flow compensation features.

**Sapporo's "Foam Damaging Effect" (FDE)** value of a free fatty acid...calculated using the surface excess, quantitatively measured by the excess surface concentration of the test compound in a bulk solution. FDE values negatively correlate with NIBEM values.

**Carlsberg's Lg Automatic Foam Tester** ....reports the following parameters after beer 100% converted to foam:

- a) "**First Drain Time**": time for the initial 1/4 of beer beer to reconvert from foam to beer.
- b) "**Half Life**": time for 1/2 of the beer foam to convert back to beer.
- c) "**Total Volume**": total volume of foam created when beer liquid is 100% converted to foam.

"**Machine Vision Technologies**"...measures bubble size and foam homogeneity with a camera...combines with a software program to analyze foam data.

**Bubble size** as measure of stable foam.

**Four Processes of Foam:** bubble formation...then drainage...then coalescence...then disproportionation.

**Newer Foam Assays:**  
 a) **Digital Analysis** (e.g. Sapporo's **FCT** unit to assay **Foam Collapse Time**).  
 b) **Lg Automatic Foam Tester**...measures drain time.

Shaking

## Measuring Beer Foam

Half-life of foam decay.

Foam decay times.

**Robotic Foam Testing**....large source of **reproducibility error** is inherent to variation in **diameter** and **scoring** of bottle openings.

Catalytic release of CO<sub>2</sub>...add glass powder; depressurize.

**IFVA: Integral Foam Volume Assessment.**

"**Importance of the balance between foam +'s and foam -'s should not be overlooked**"...when dilute beer, see great differences in NIBEM values depending on the **ratio** of positives and negatives.

**Lg Automatic Foam Tester from Denmark**...foam is generated by forcing a constant beer volume through a 0.6 mm nozzle....decay of foam in a glass cylinders then measured optically....measures average bubble life time...assesses both collapse rate and specific volume of foam generated.

Free Fall/Pouring.

**Introduction of Gas** e.g. nitrogen...air is 80% nitrogen, therefore less disproportionation relative to CO<sub>2</sub> as is closer to atmospheric equilibrium.

**Sigma, Rudin HRV and NIBEM values do not closely relate to visual foam stability** ....**FCT** values do though (i.e. time for a reduction of the 40% or 3.2 cm foam layer to a single layer in a prescribed glass).

**NIBEM, Lg & ASBC Beer-22A** generate foam by depressurization....**ASBC Method A** by free fall. **NEIBEM** is a conductimetric based method measuring foam collapse.

**CB's "PAMEPS"**...**Path Analysis Method of Eliminating Preferred Stimuli** to assess/judge foam preferences.

## Generating Foam Strategies

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