

Foam-positive compounds in roasted barley and black malt

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Foam

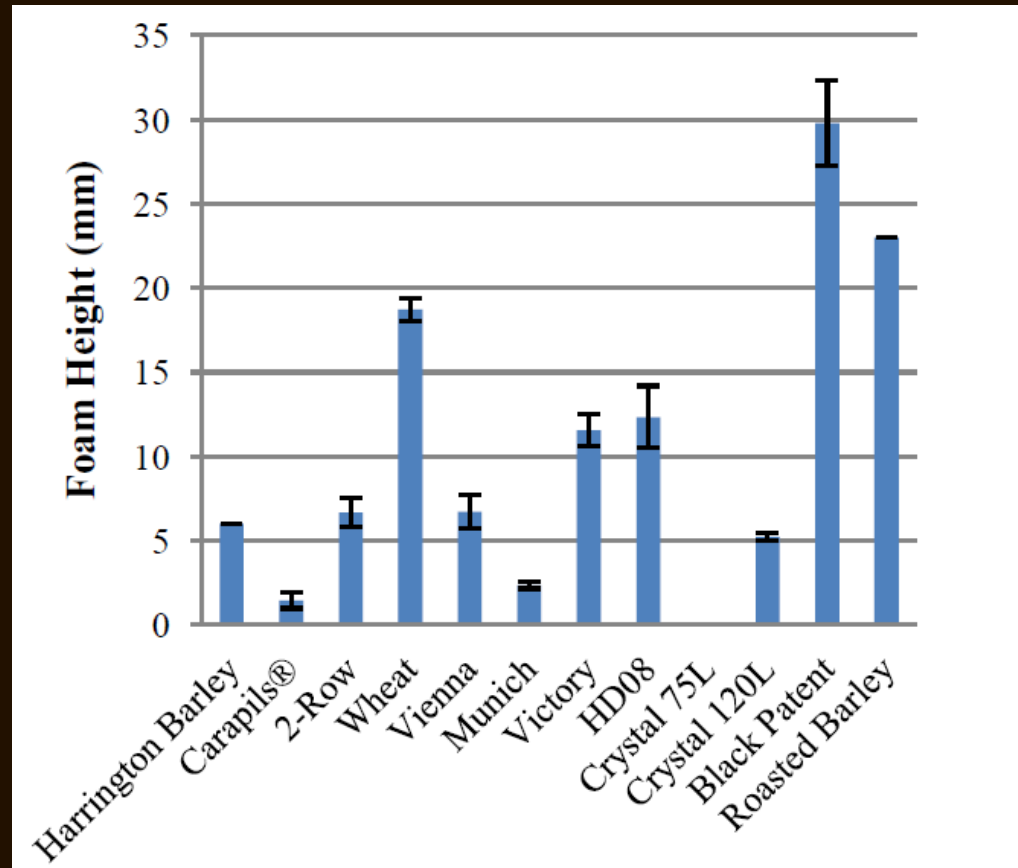
- Quality and consumer perception
- Longstanding area of research in Bamforth Lab
- Approaches for a stable foam
 - Process
 - Dispense/serving
 - Raw materials
 - Hops
 - **Grain**

Foam and grain selection

Combe, *et al* (2013) investigated foam contributions of assorted brewing grains

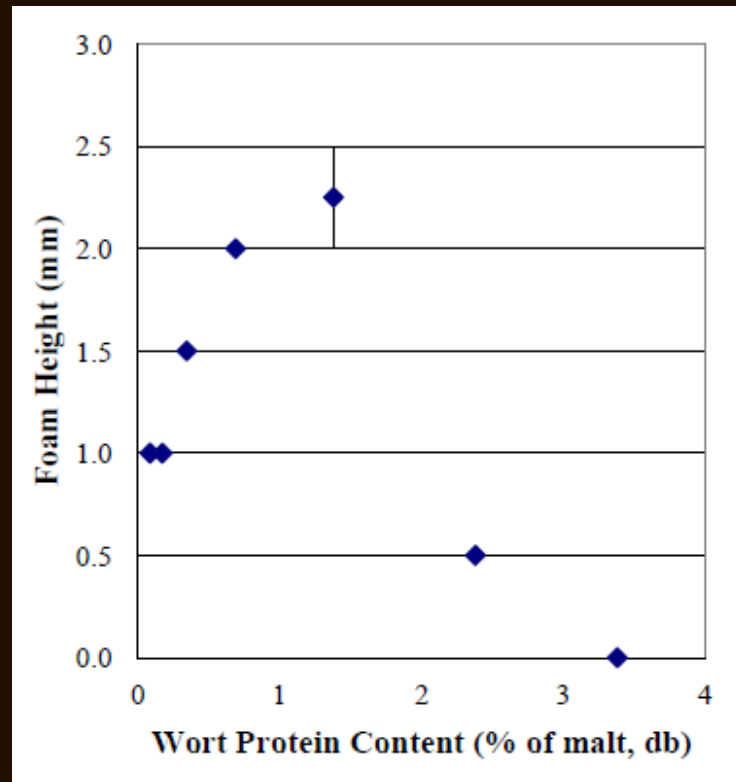
- All grains contain some foam-negative compounds
- Crystal malts: particularly foam-negative!
- Black malt and roasted barley: foam-positives greatly outweighed foam-negatives

Foam and grain selection



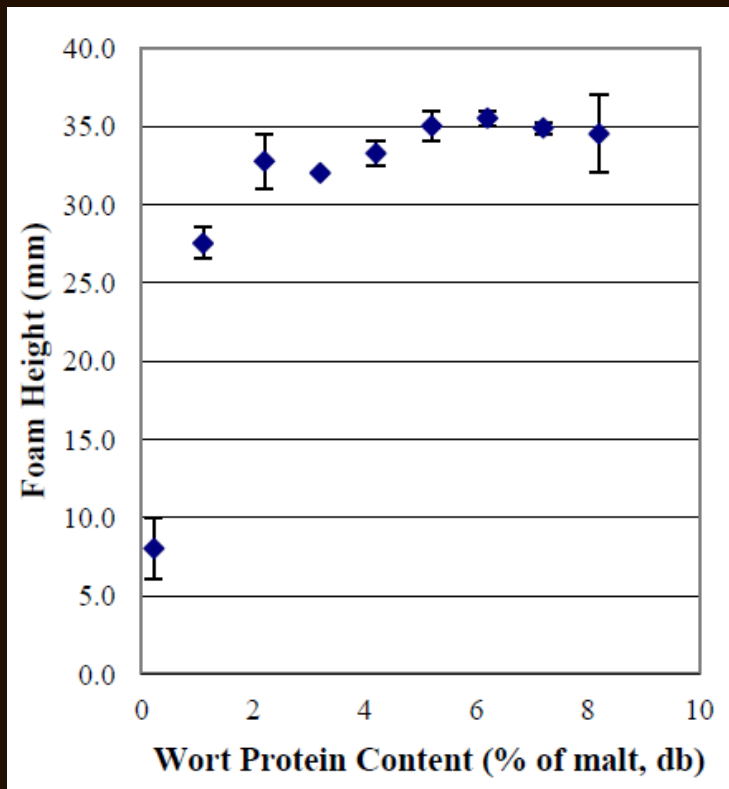
Foam height of wort after 30 minutes
(Combe, 2013)

Crystal malt



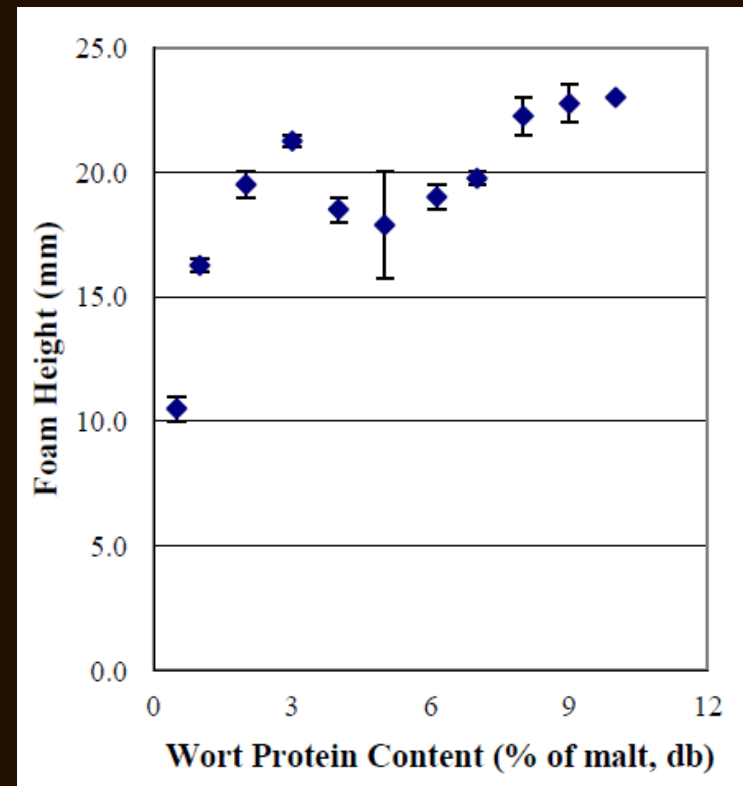
Crystal 75L Foam height after 30 minutes (Combe, 2013)

Black malt, roast barley



Black patent malt

Foam height after 30 minutes
(Combe, 2013)



Roasted barley Foam height
after 30 minutes (Combe, 2013)

Foam and grain

Combe, et al. (2013)

- All grains: contain some degree of foam-negatives
- Crystal malts: particularly foam-negative!
- **Black malt and roasted barley: foam-positives greatly outweighed foam-negatives**

...why?

Black malt, roast barley

- What are these foam-positive compounds?
 - Bishop hypothesis (1975)
 - Melanoidins
- Can they be separated from color and aroma?
- Can they be added back to finished beer as a foam stabilizer?

Approach

- Water extractions of roasted barley and black malt
- Separation
 - Activated charcoal
 - Ammonium sulfate precipitation
 - Foam tower
- Shake tests (Kapp and Bamforth, 2002)



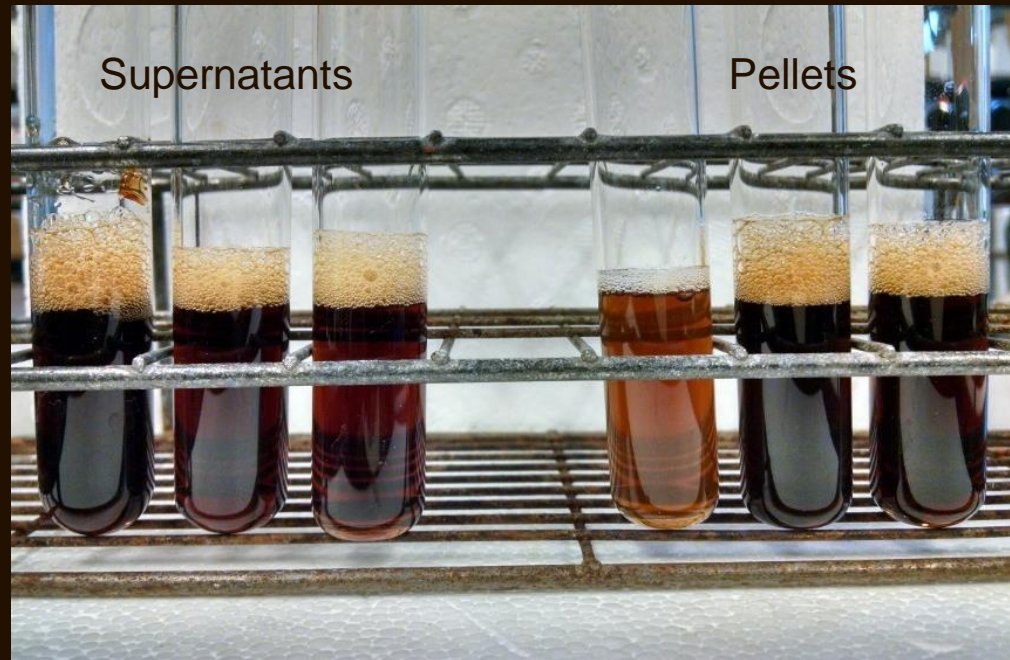
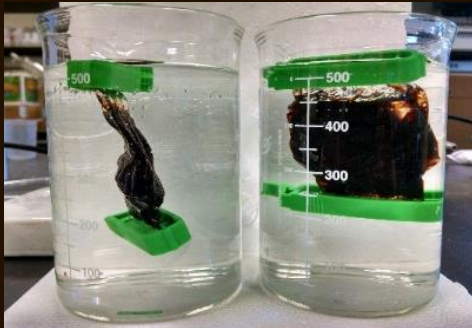
Ammonium sulfate precipitation

Objective: a fraction with low color and high foam stability

Salt addition and centrifugation



Dialysis



Ammonium sulfate precipitation

First precipitate at 70 → 80% saturation

- High water affinity
- Unexpected with respect to Bishop hypothesis

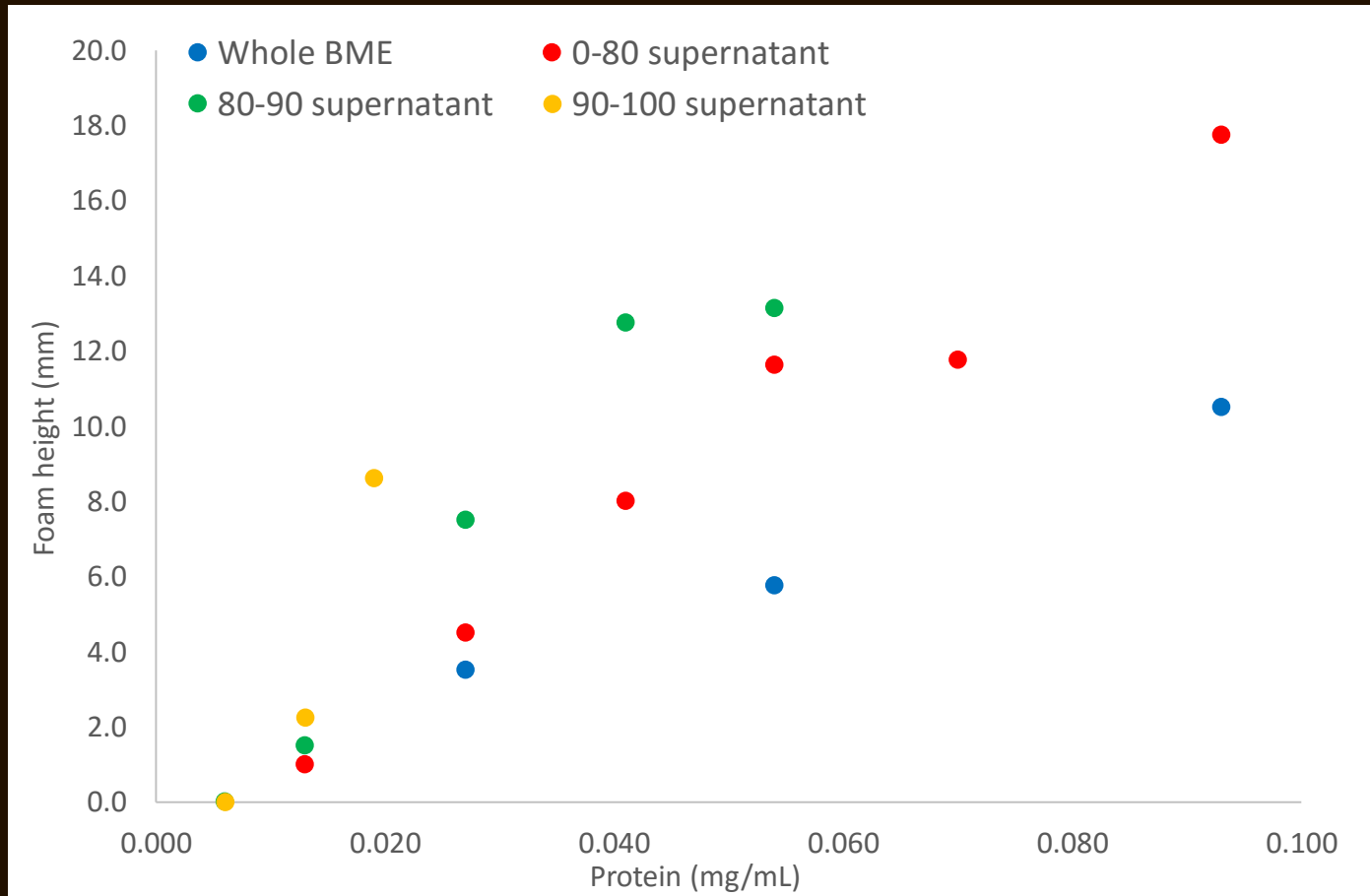


Ammonium sulfate precipitation

Clear differences across fractions' foam stabilities, even when protein content is standardized

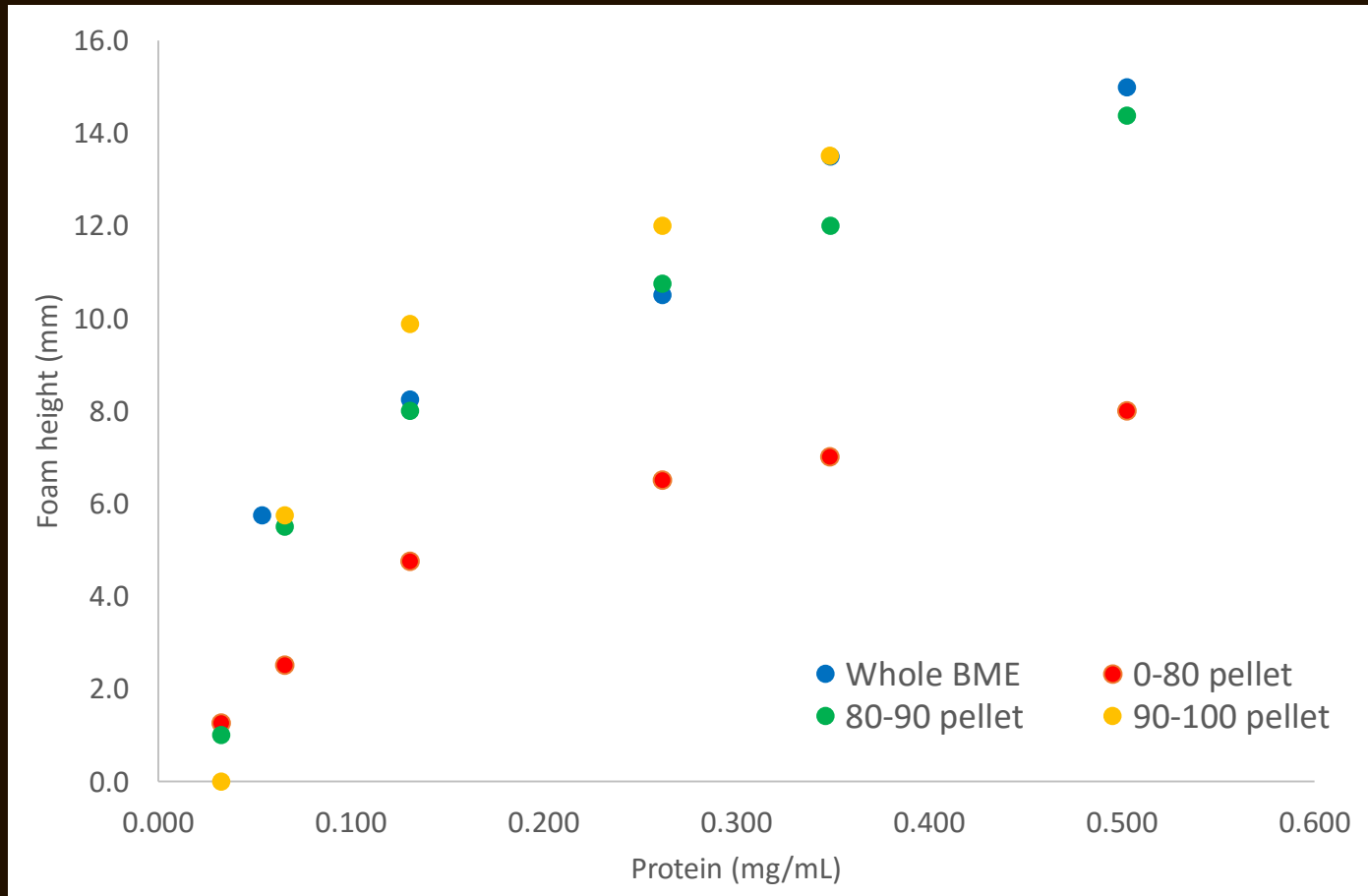


Ammonium sulfate precipitation



Supernatants Protein concentration vs. foam stability

Ammonium sulfate precipitation



Pellets Protein concentration vs. foam stability

Ammonium sulfate precipitation

Color not uniformly related to foam stability
...but still too dark to supplement light beers



0→80% Supernatant descending protein content (0.1 to 0.01 mg/mL)



American light lager
Color target (2.8 SRM)

Foam tower

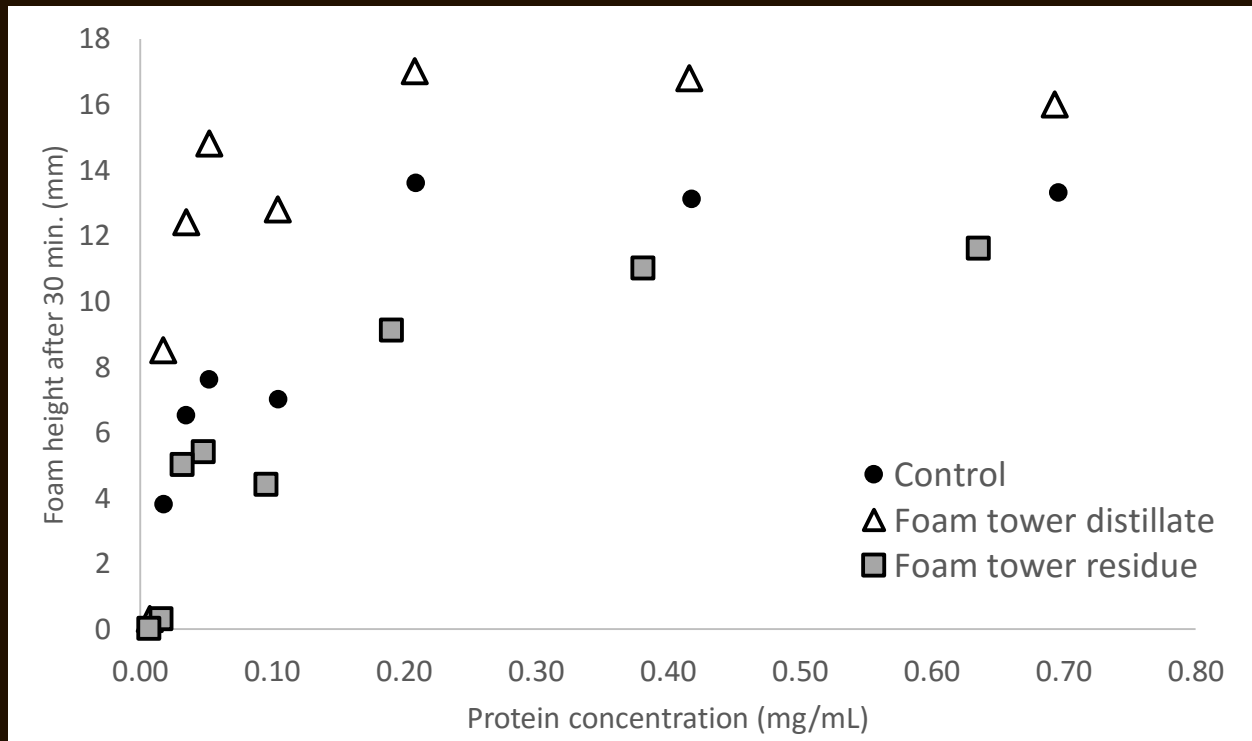
Objective:
separation by degree
of surface activity

*Adapted from Leiper, et al.,
2003*



Foam tower

Effective to yield a more foam-stable portion



...but again the color comes along with the foam.

Conclusions

- Black malt and roasted barley are exceptionally foam-positive, whereas crystal malts tend to be fairly foam-negative.
- “Salting out” and the foam tower are effective means to separate malt extracts into fractions of distinct foam behavior even at identical protein concentrations.
- Color can be removed, but it does not yet appear that it can be removed independently of foam-positive compounds.

Acknowledgments

- Joe Williams
- Charlie Bamforth
- Alex Combe

Questions

