The Secret Life of Soap

Kevin M. Dunn

Spring 2011

$Revision: 1.2 $

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Soap Research

- Soda Ash and Other White Blemishes
- Background Chemistry
- Sulfated Castor Oil
- Jojoba Oil and its Substitutes
- The Secret Life of Soap

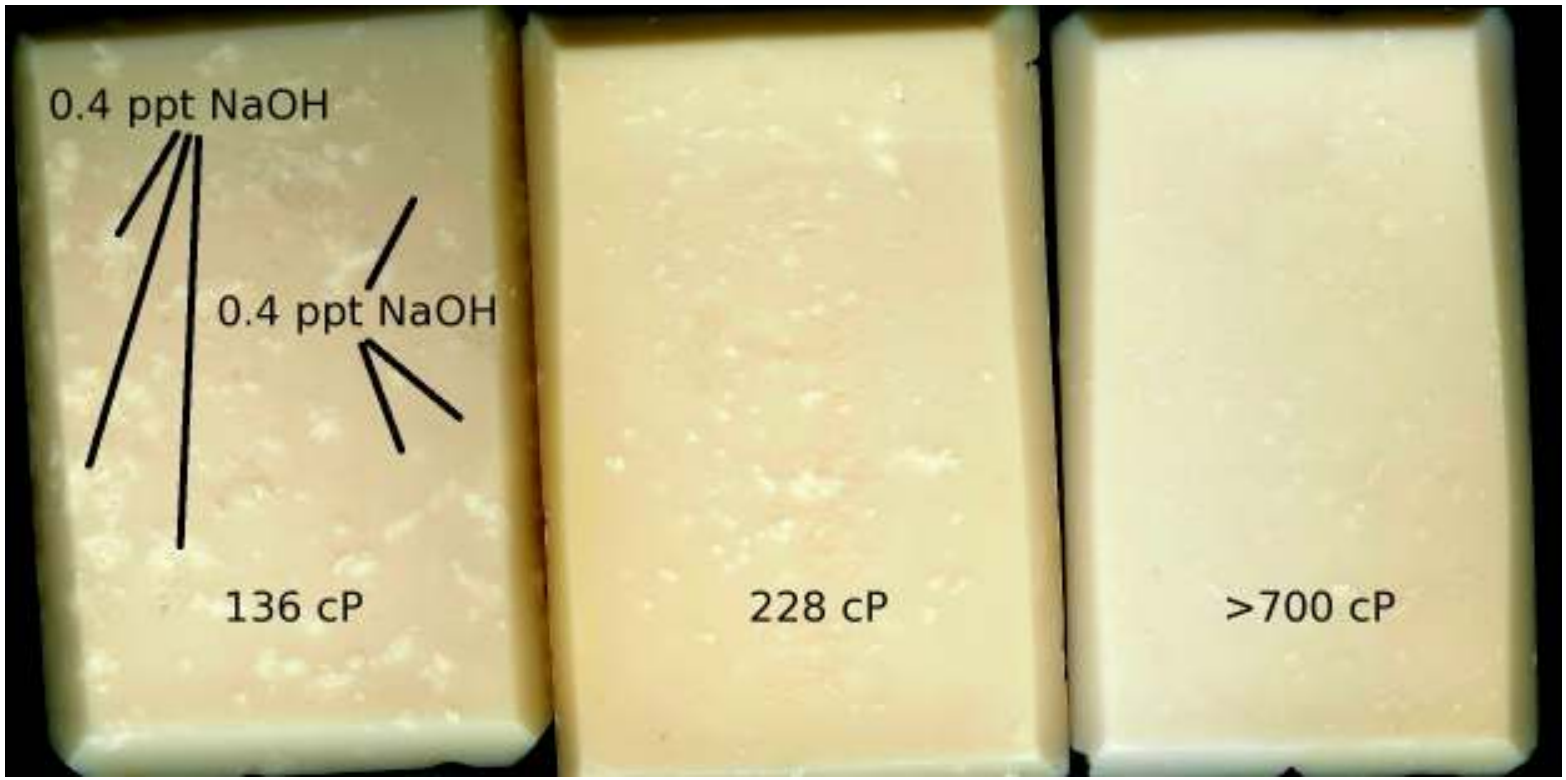
Acknowledgements

- Mike Lawson/Columbus Foods
- Hampden-Sydney College
  - Cole Hawthorne (soda ash/partial gel)
  - Arne Ulbrich (sulfated castor oil)
  - Avery Moncure (microscopy)

All Things White

Not every white blemish is soda ash.

Not Soda Ash

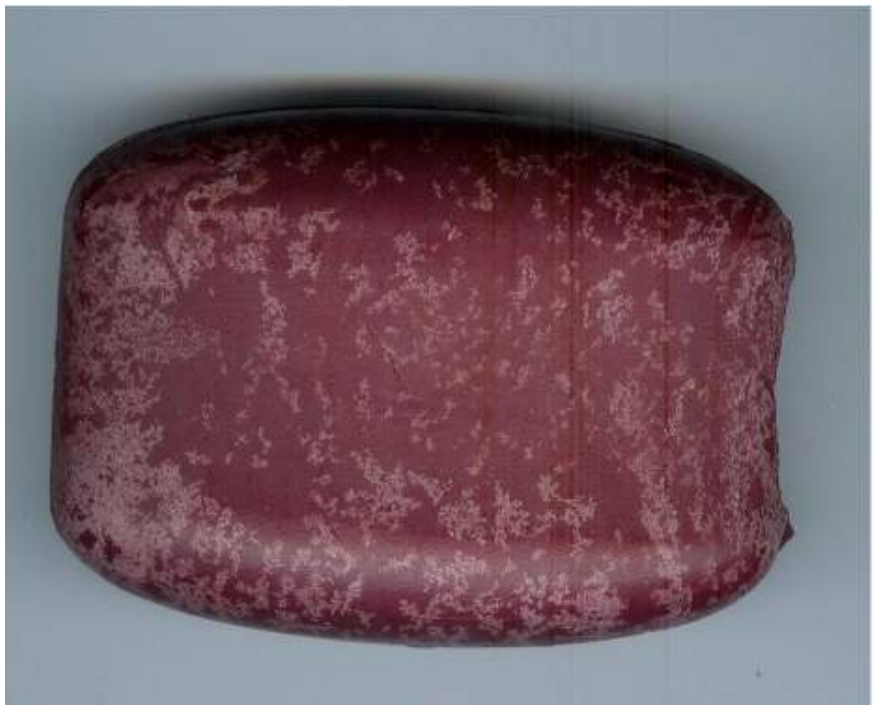


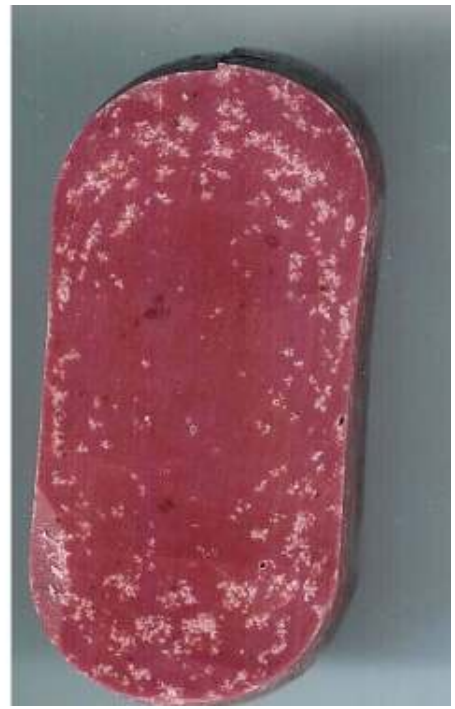
High-Water Olive Oil Soap

Not Soda Ash

Partial Gel Olive Oil Soap

Not Soda Ash





Medium-Water Palm Oil Soap Soap

Soda Ash

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Soda Ash

Medium-Water Duckbar's Delight

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- Soda Ash is not very soluble in alcohol

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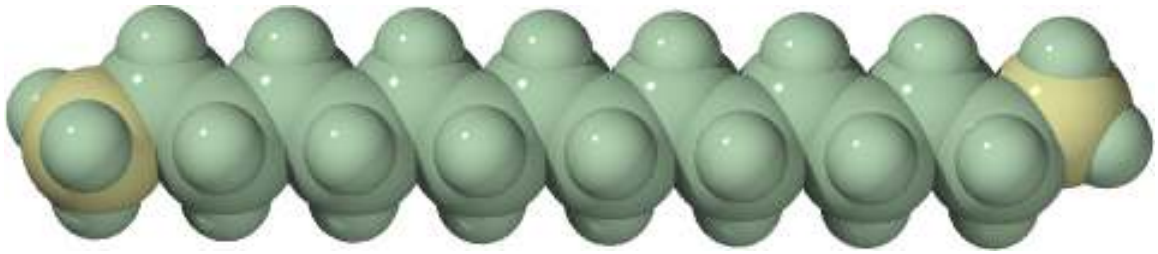
- Soda Ash is easily removed with water

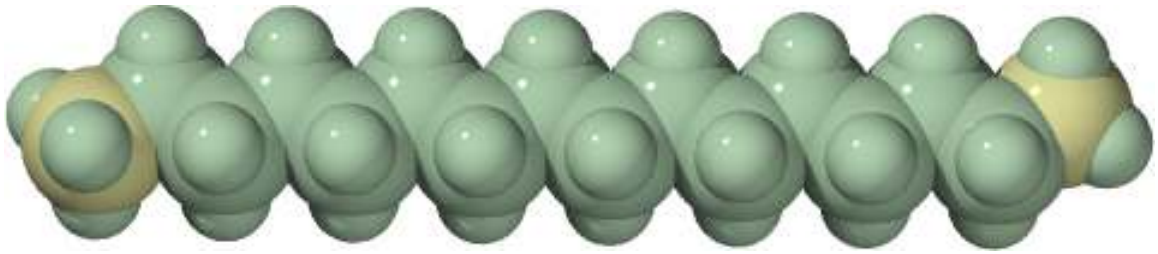
Background Chemistry

Oil and water don’t mix.

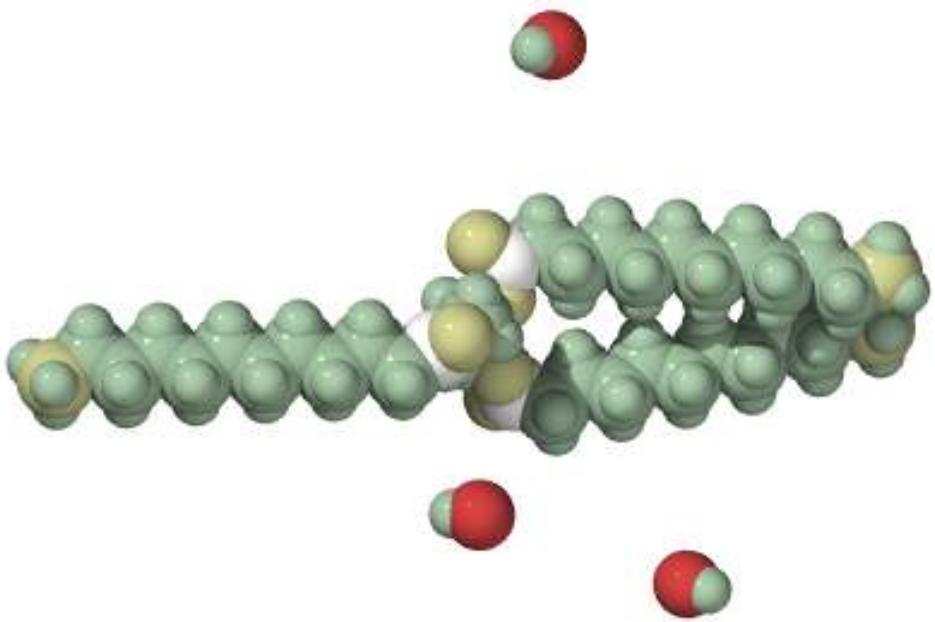
Oil and Water



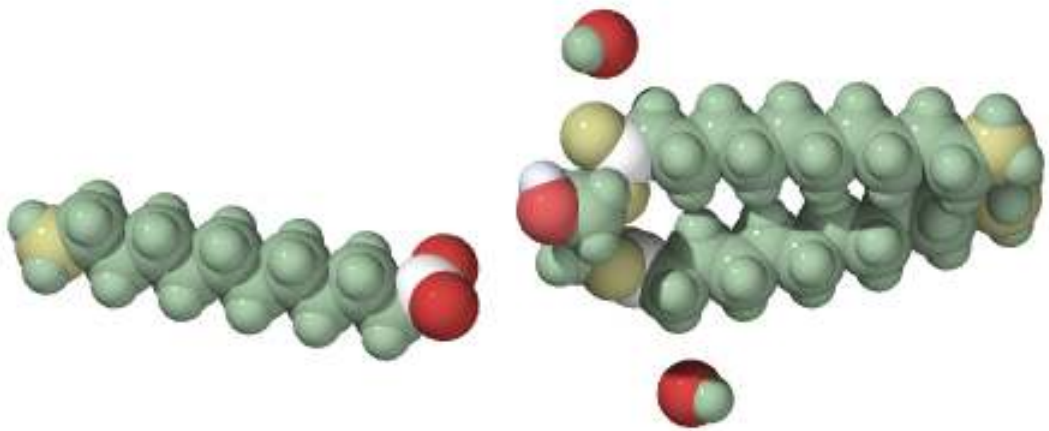
Nerds and Cheerleaders



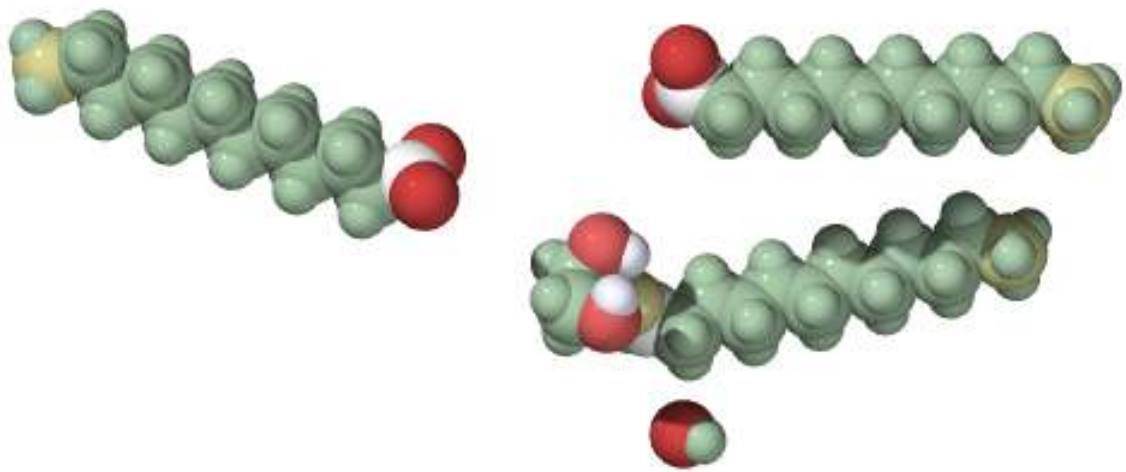
Oil and Lye



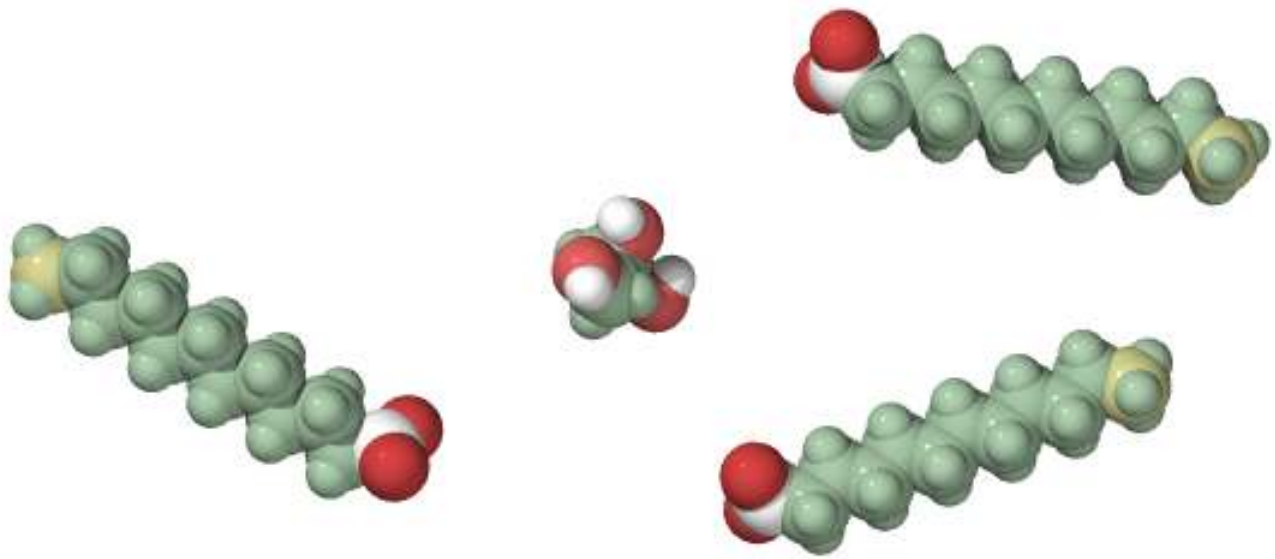
One Soap



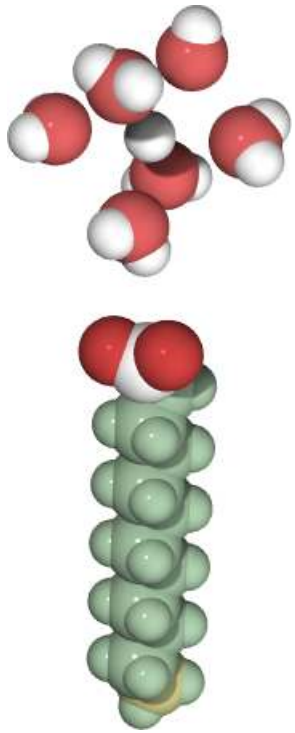
Two Soaps



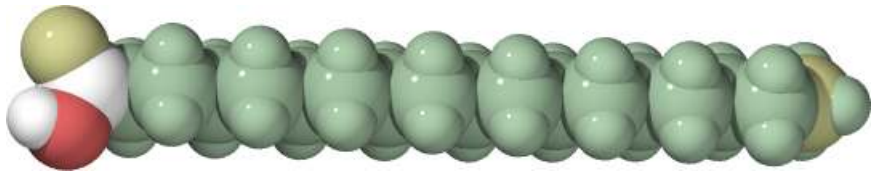
Three Soaps and a Glycerin

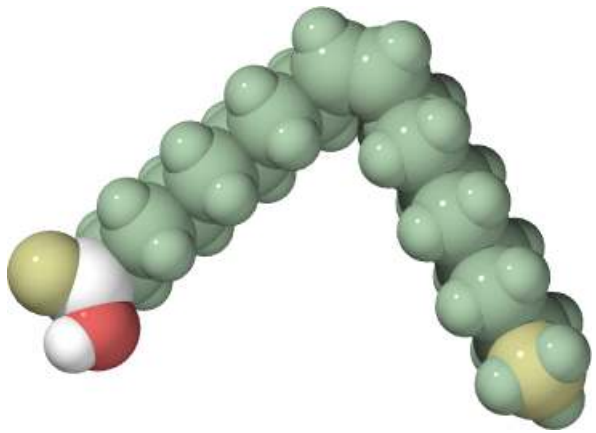


Soap: A Nerdy Cheerleader



Stearic Acid, Oleic Acid





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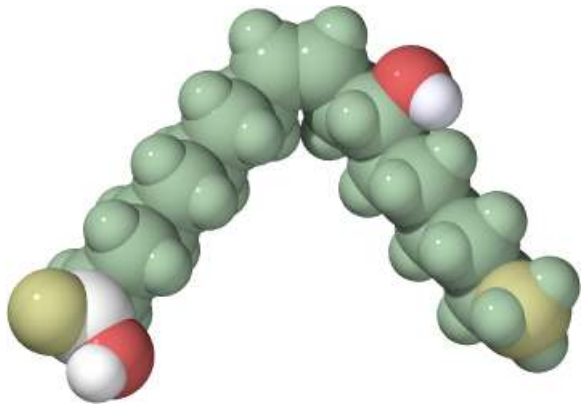
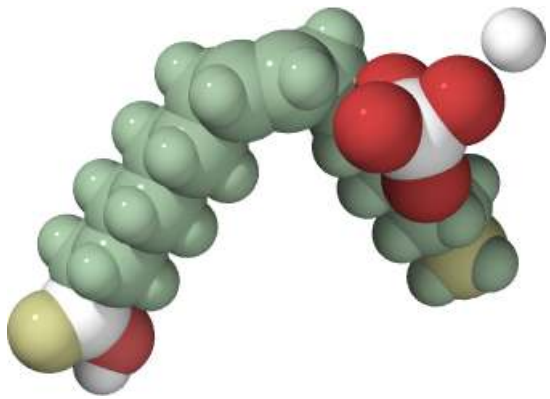
- Made by reacting castor oil with sulfuric acid

Ricinoleic Acid, Sulforicinoleic Acid





Castor vs Sulfated Castor Oil

Castor	SV (ppt KOH)	AV (ppt KOH)	Water Content
Soaper's Choice	184	0	0%

Sulfated Castor	SV (ppt KOH)	AV (ppt KOH)	Water Content
Soaper's Choice	97	40	30%
Southern Soapers	95	23	29%
Organic Creations	82	58	20%

Castor vs Sulfated Castor Oil

Castor oil is widely used for making soap; sulfated castor oil is not. You may experiment with sulfated castor oil in soap, but you must use the appropriate saponification value.

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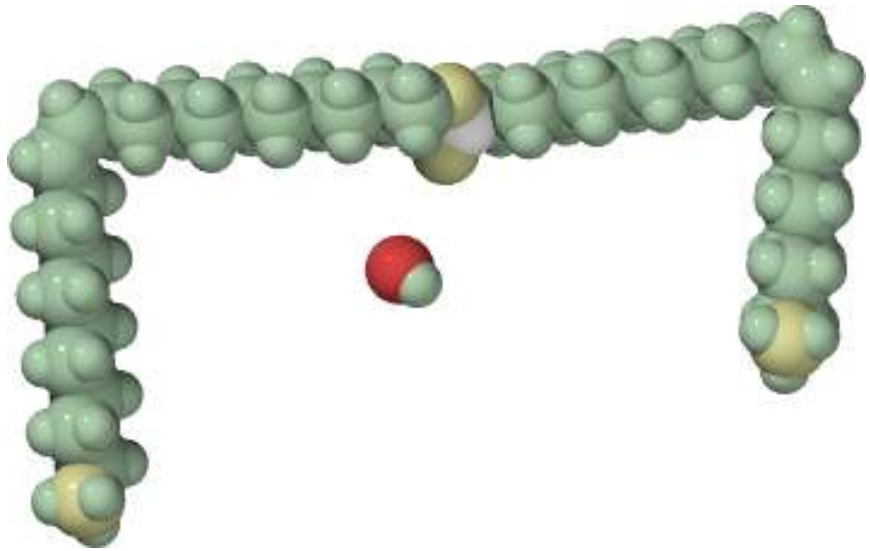
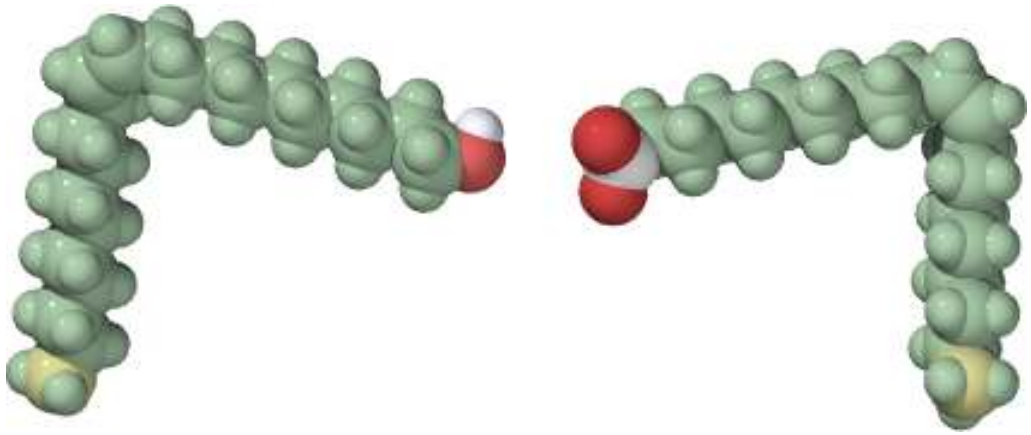
- How does jojoba differ from soapmaking oils?

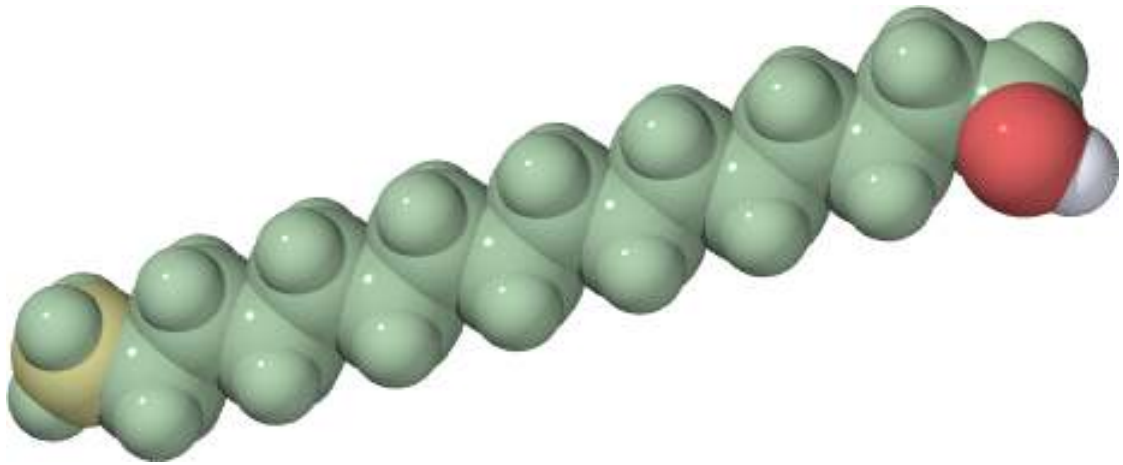
Jojoba and Lye



Fatty Alcohol and Soap



Cetyl Alcohol



Jojoba Substitutes for *Soap*

- Cetyl Alcohol, $4.88/lb (LotionCrafters.com)
- Cetearyl Alcohol, $4.99/lb (LotionCrafters.com)
- Behenyl Alcohol, $8.00/lb (TheHerbarie.com)
- Oleyl Alcohol, $106/lb (ScienceLab.com)

- Beeswax, $3.98/lb (SoapersChoice.com)
- Candelilla Wax, $6.30/lb (CamdenGrey.com)
- Cetyl Esters, $6.38/lb (LotionCrafters.com)
- Carnauba wax, $6.77/lb (CamdenGrey.com)

Delight

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- 144/150.8 = 0.955, 4.5% lye discount

More Lyes

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- $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{0}$ (50.00% NaOH Lye)

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{72}$ (41.67% NaOH Lye)

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{144}$ (33.33% NaOH Lye)

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{216}$ (29.16% NaOH Lye)

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{288}$ (25.00% NaOH Lye)

More Lyes

- Lye = 50.00% NaOH, 50.00% distilled water
- $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{0}$ (11.18% Water)

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{72}$ (15.88% Water)

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{144}$ (20.11% Water)

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{216}$ (23.93% Water)

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{288}$ (27.41% Water)

More Lyes

- Lye = 50.00% NaOH, 50.00% distilled water
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  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{72}$

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{144}$ (Medium-Water)

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{216}$

  $\text{Delight}_{1000}\text{Lye}_{288}\text{Aq}_{288}$ (High-Water)

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  33-38%, 34% average
- Anne Watson, *Smart Soapmaking* (2007)

  30-37%, 33% average

Temperature

- 40°C
- 60°C
- 80°C

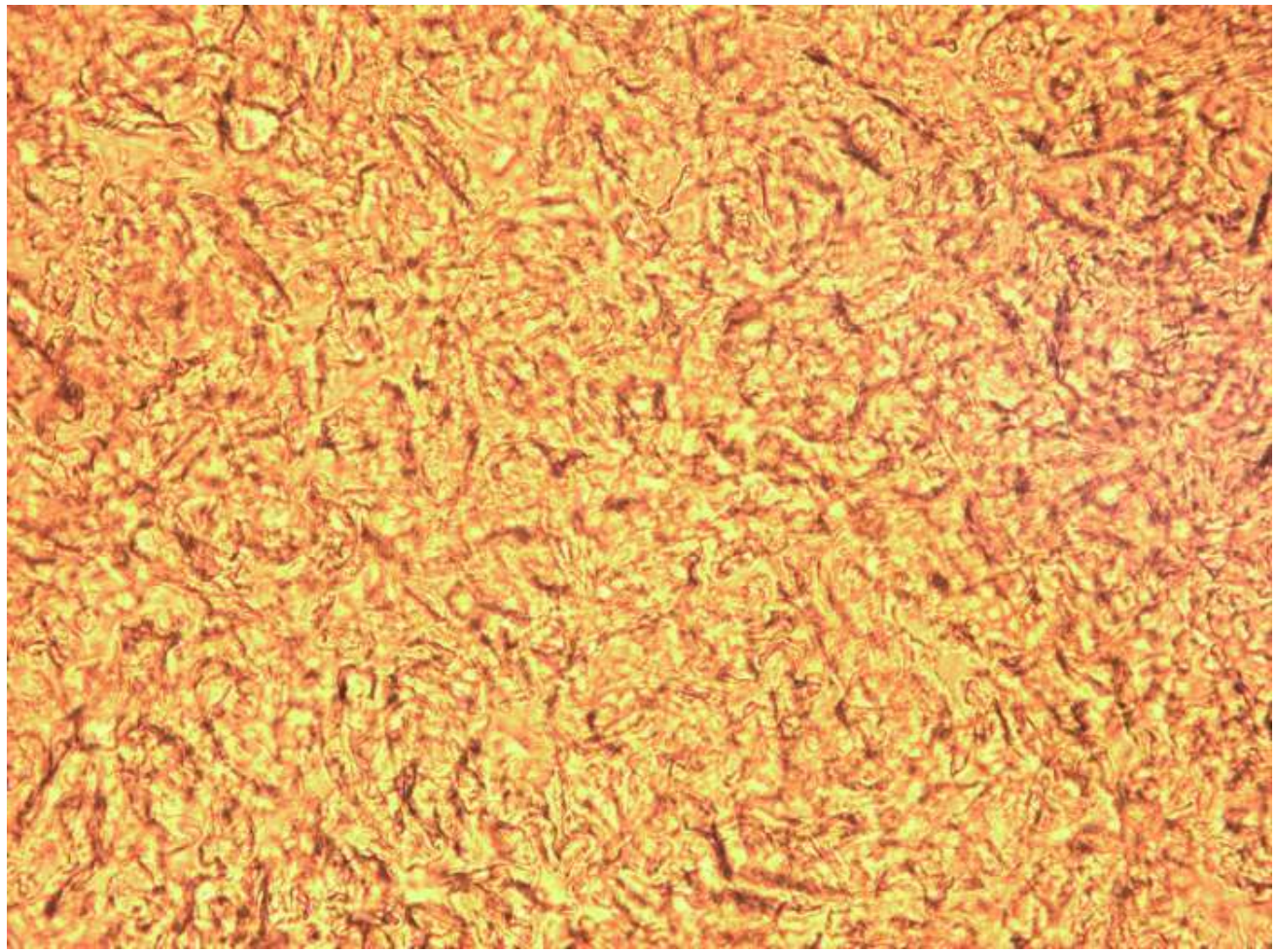
Temperature

- 40°C = 104°F
- 60°C = 140°F
- 80°C = 176°F

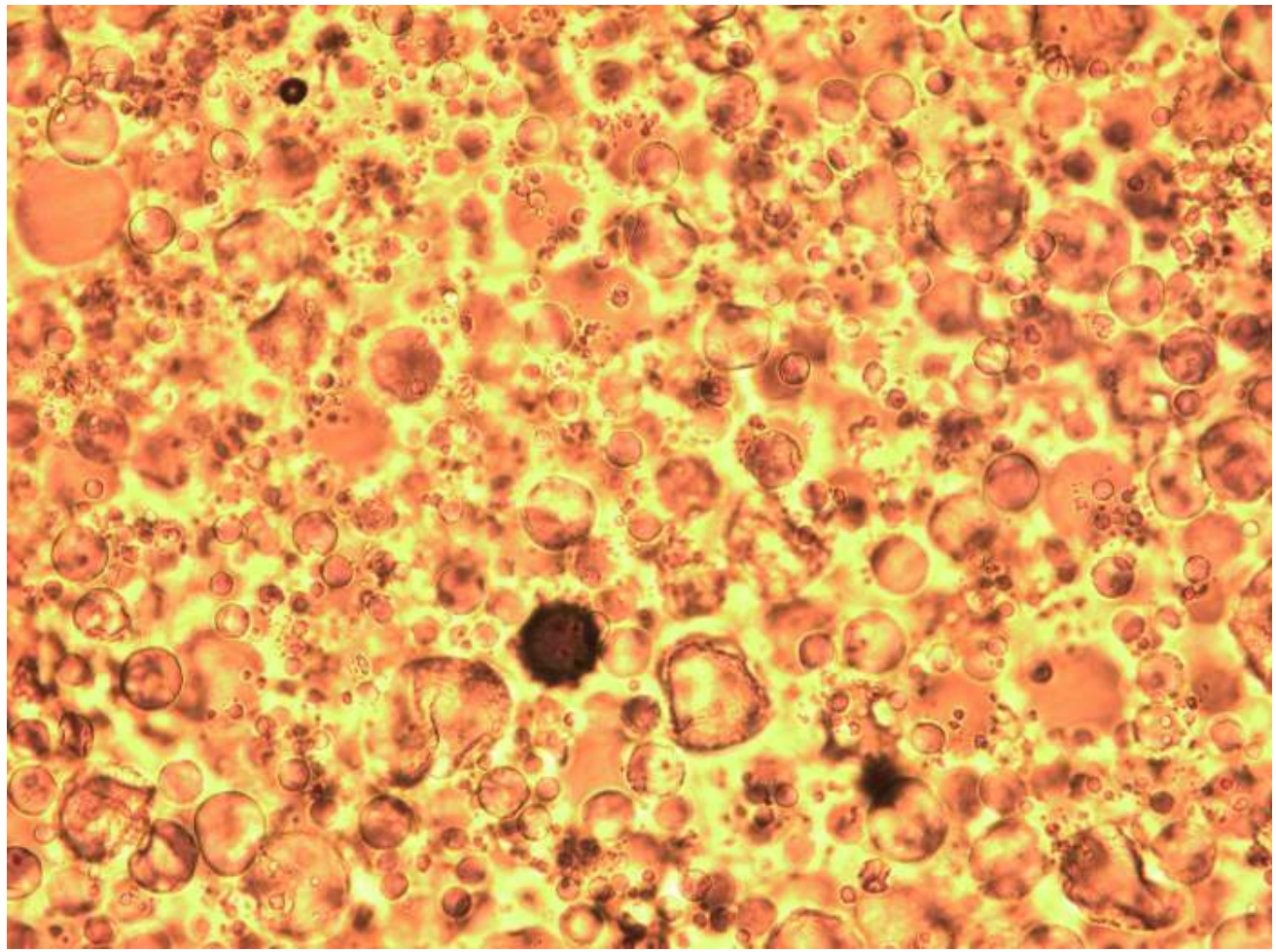
Temperature

- 40°C = 104°F (Cold)
- 60°C = 140°F (Warm)
- 80°C = 176°F (Hot)

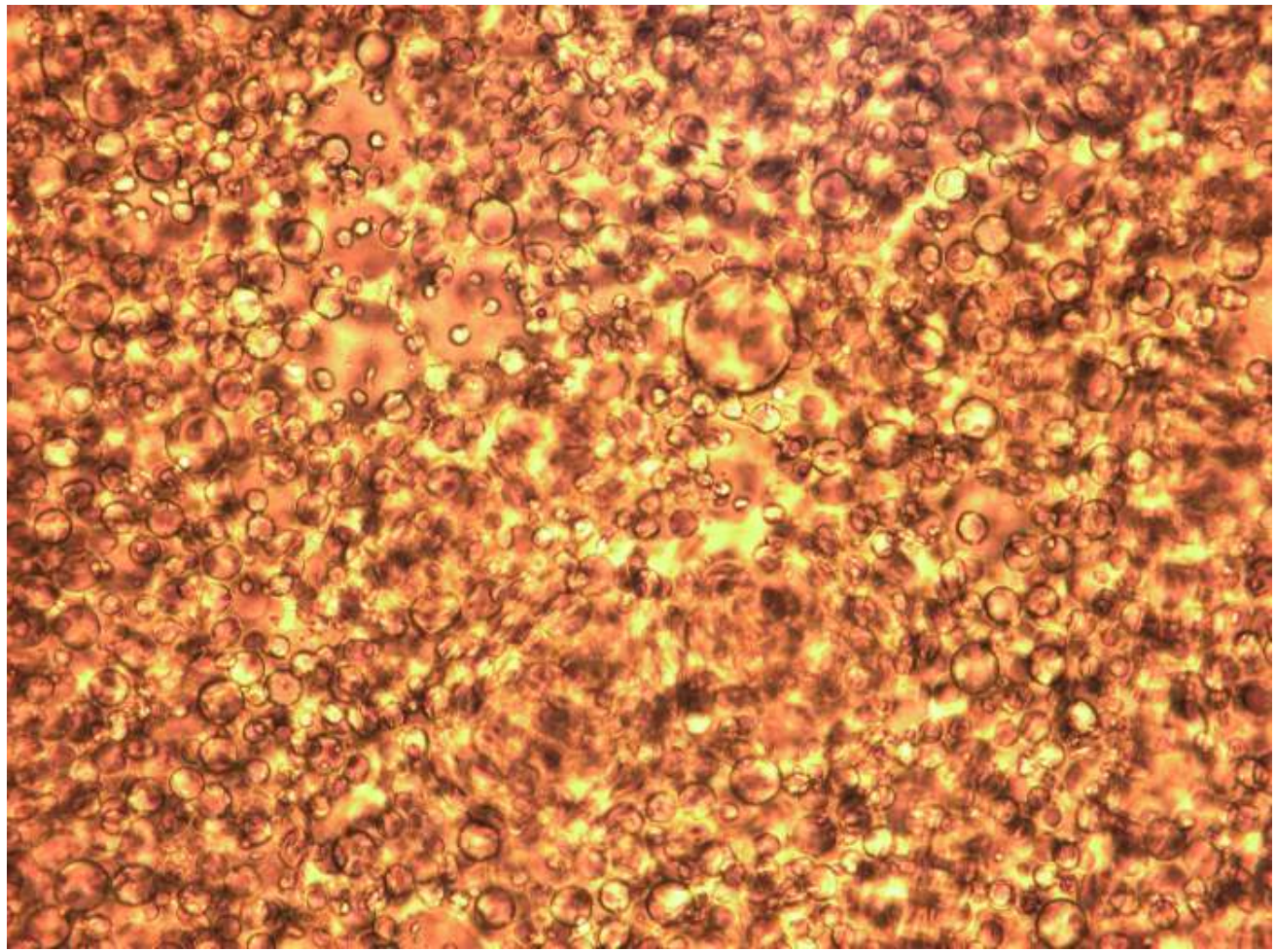
Low-Water Soap, 200X



Medium-Water Soap, 200X



High-Water Soap, 200X



Light Microscopy Lessons

- High-water raw soap contains lye droplets
- Low-water raw soap contains lye channels

The Secret Life of Soap

- Do you peek at soap in the mold?

The Secret Life of Soap

- Do you peek at soap in the mold?
- What is “gel” phase?

Neat Soap?

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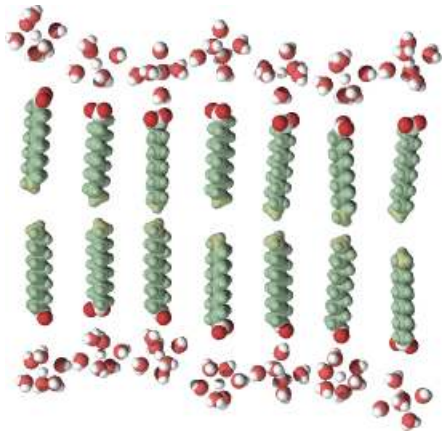
- Neat soap is what handcrafted soapmakers know as “gel” phase

Neat Soap



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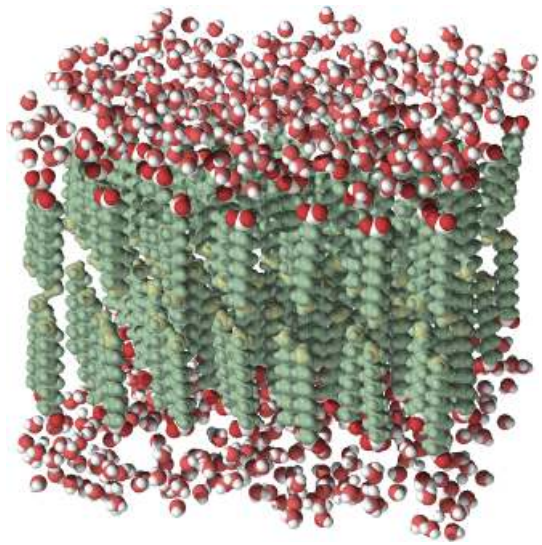

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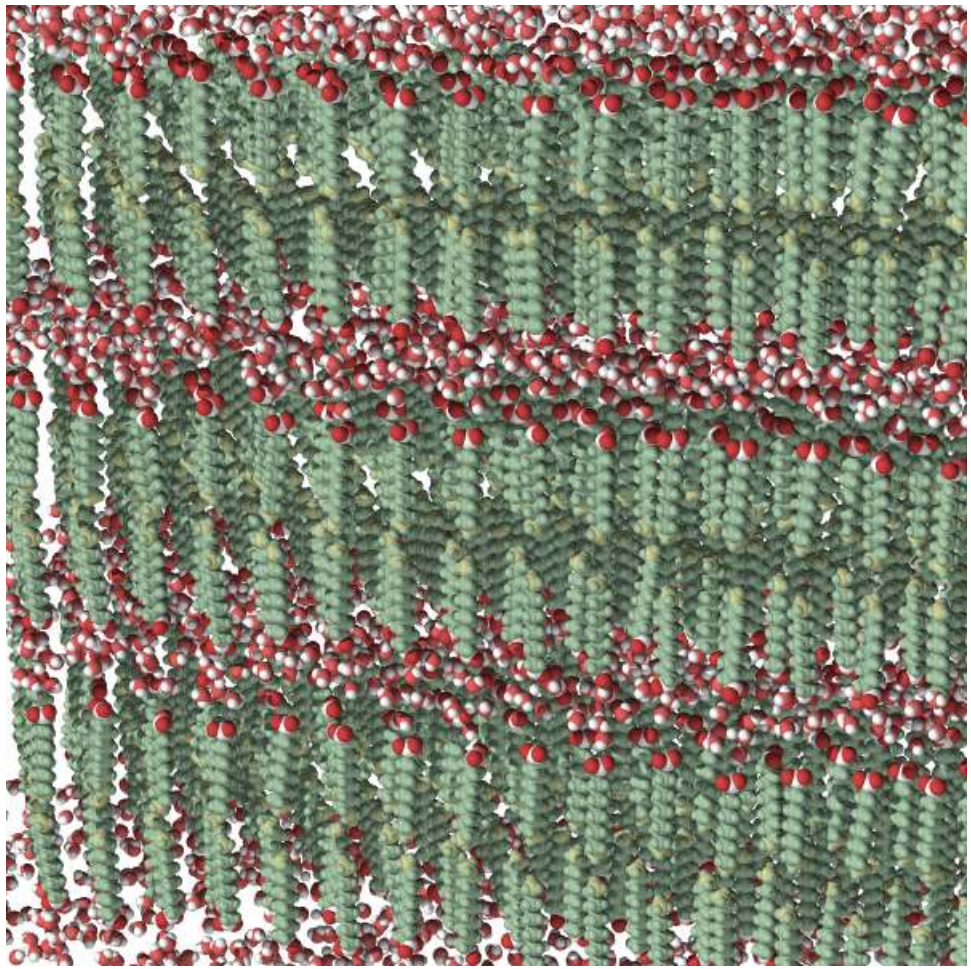
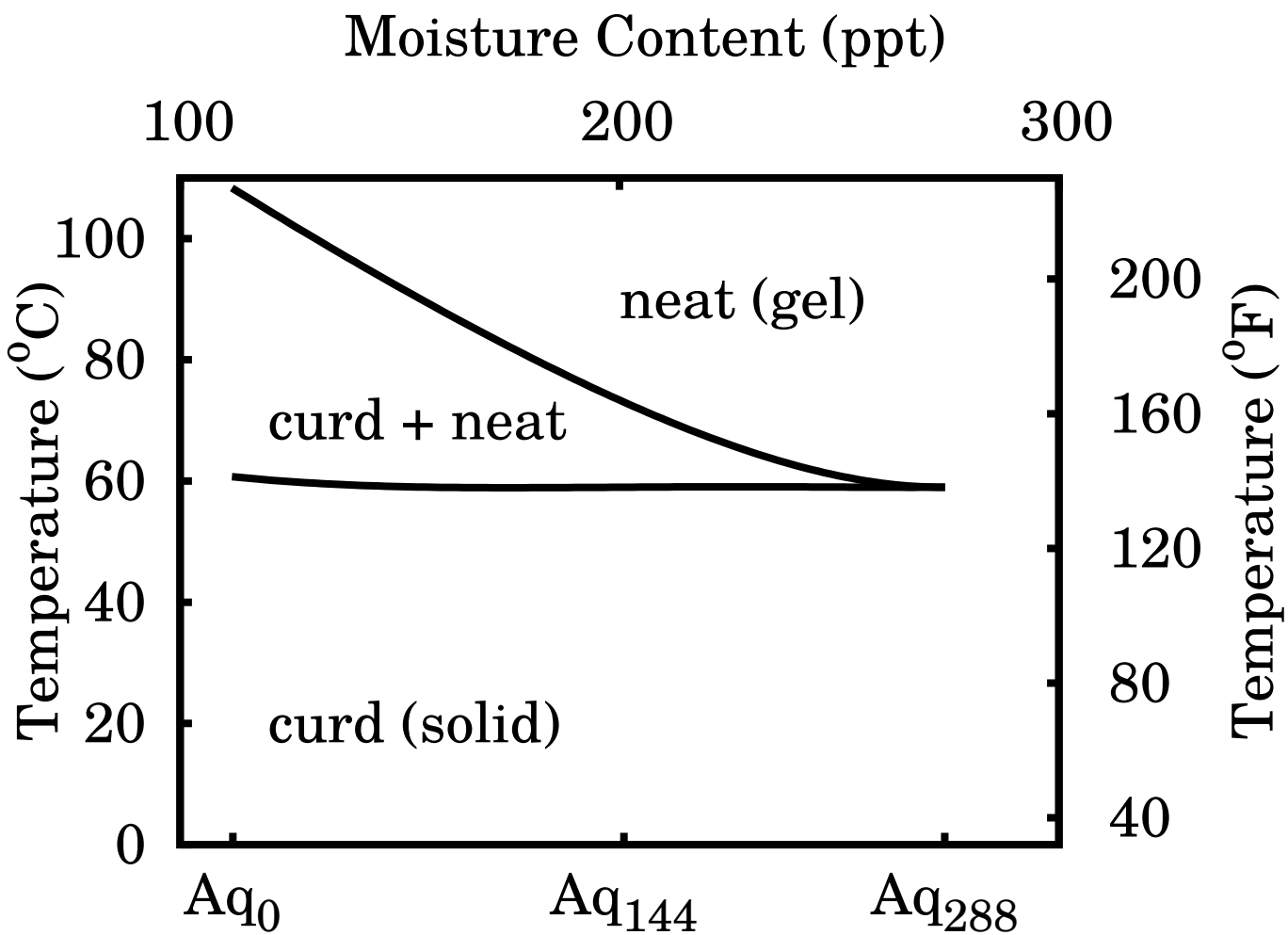


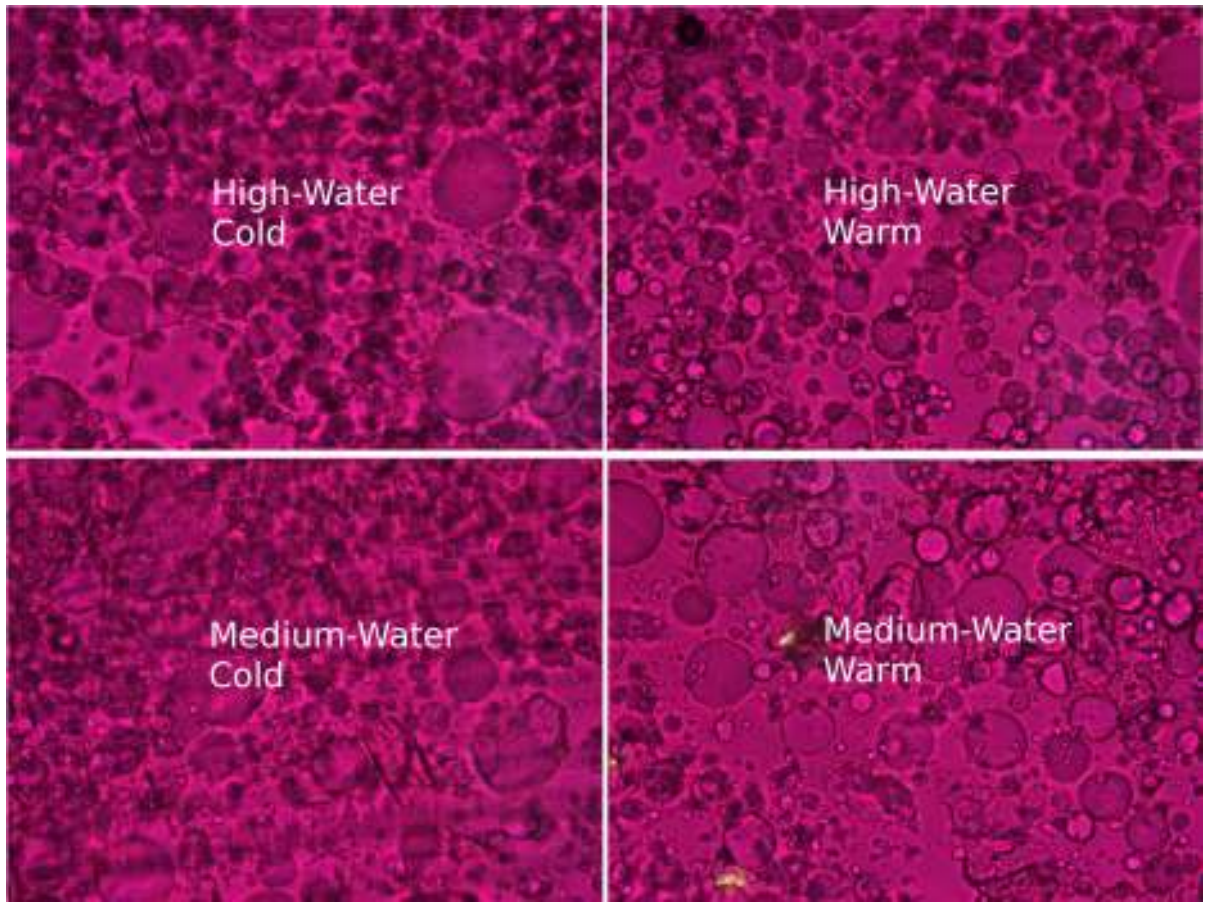
Delight Phases



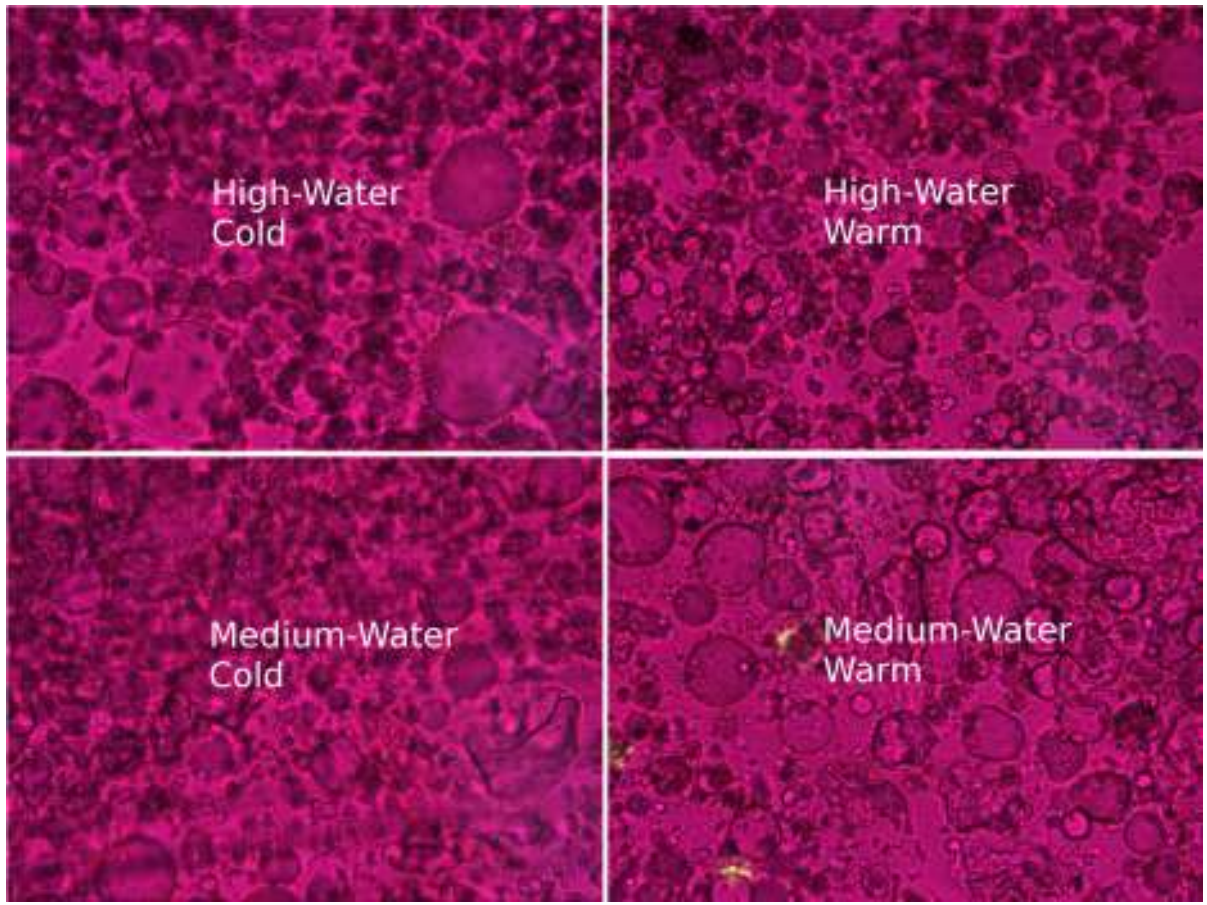
Polarized Light Microscopy

- Lye and oil will appear purple
- Small, solid soap crystals will appear black
- Neat soap will appear red/blue/yellow

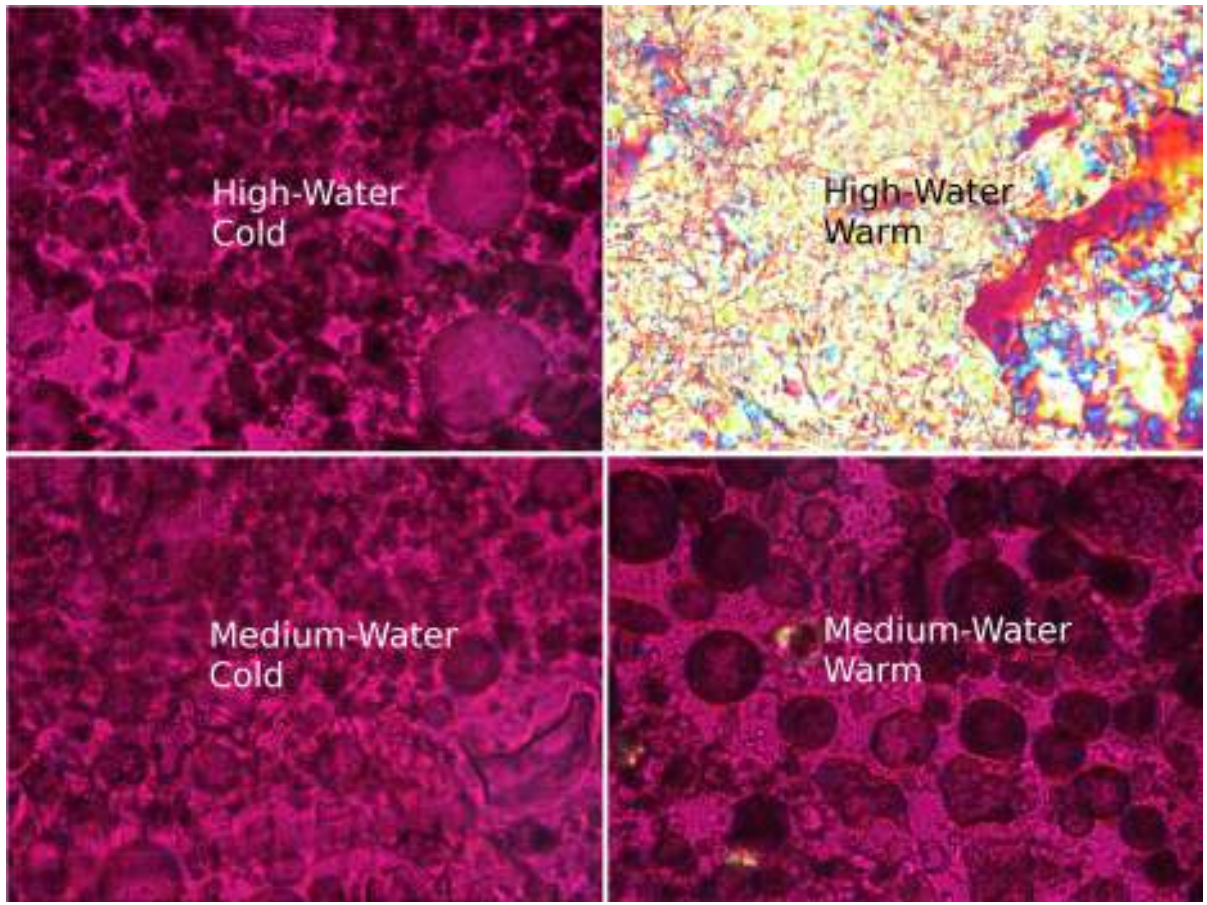
Raw Soap Texture at 0 Minutes



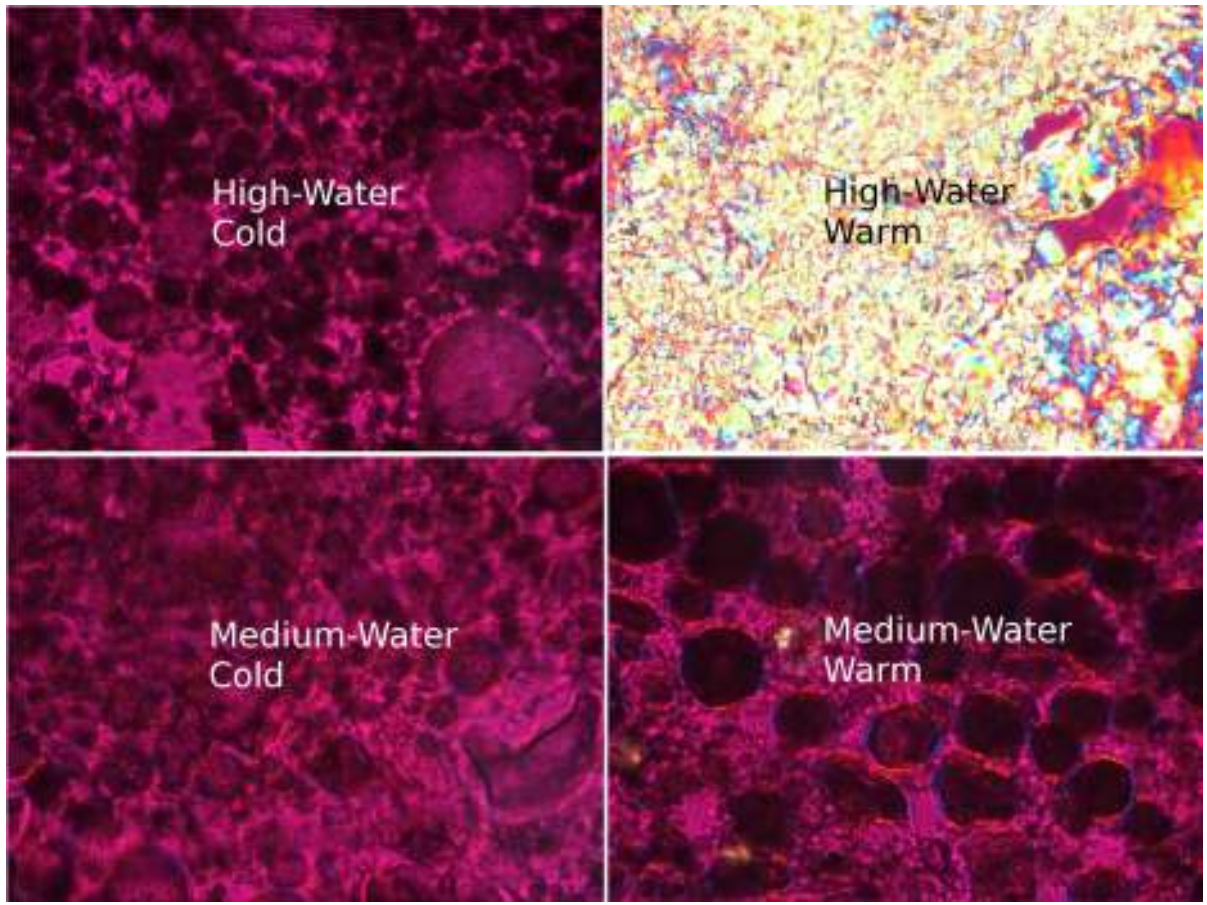
Raw Soap Texture at 10 Minutes



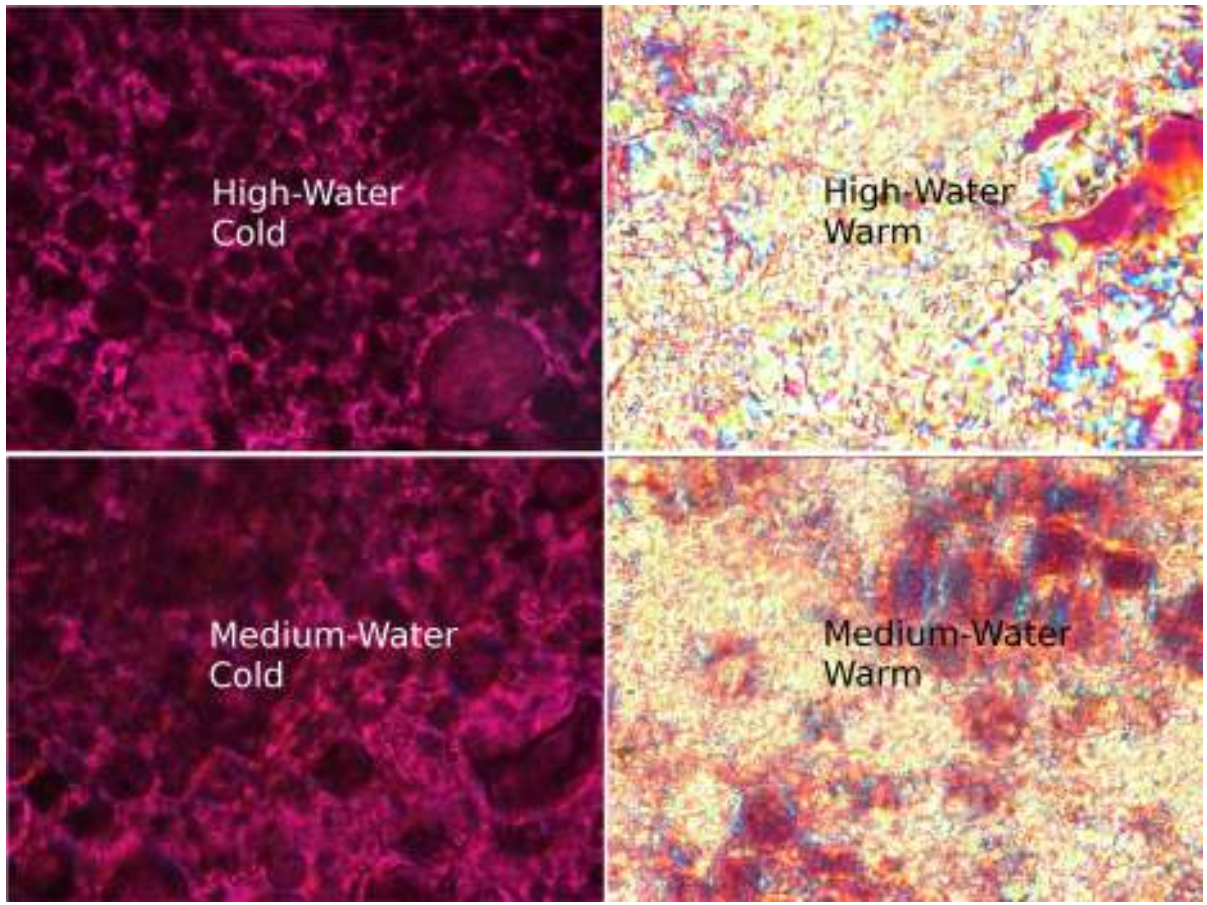
Raw Soap Texture at 60 Minutes



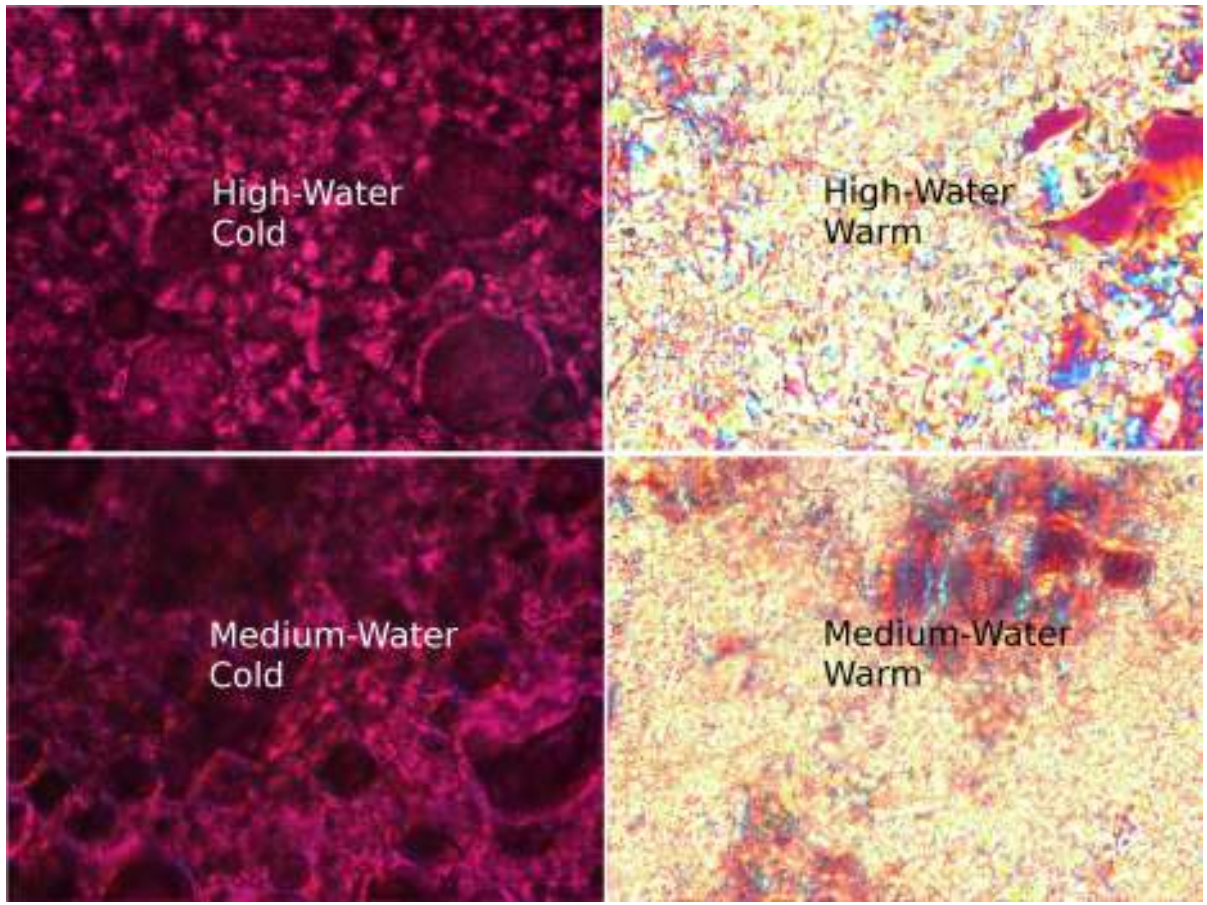
Raw Soap Texture at 120 Minutes



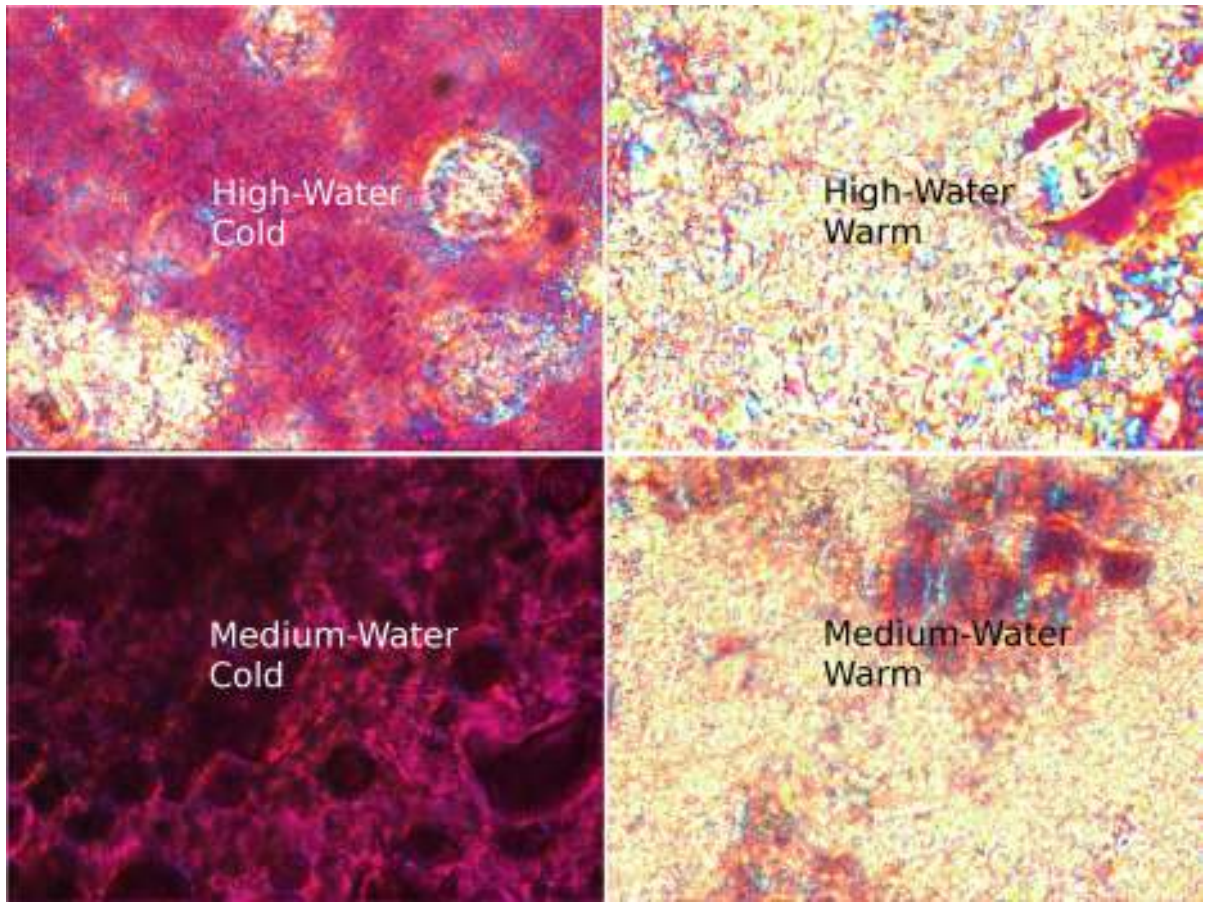
Raw Soap Texture at 180 Minutes



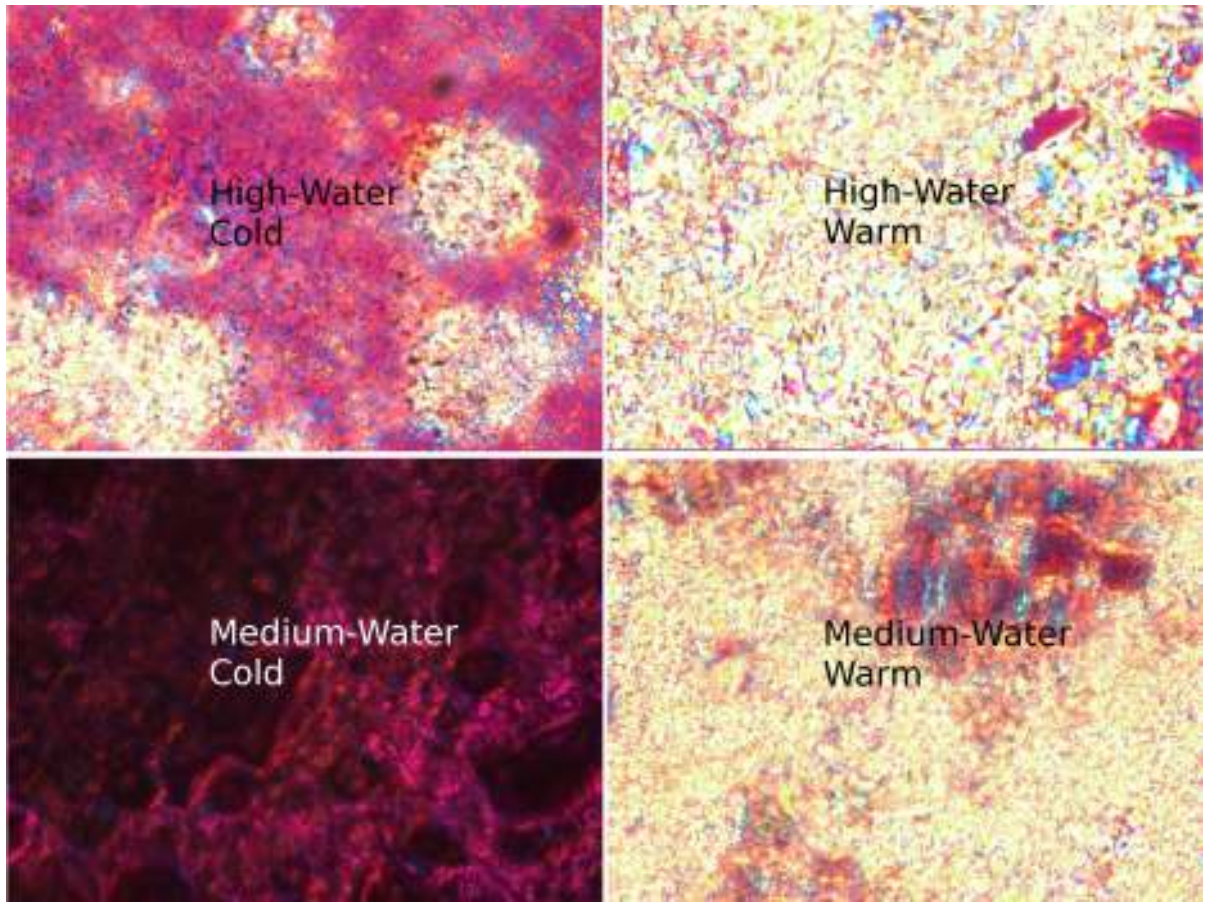
Raw Soap Texture at 240 Minutes



Raw Soap Texture at 300 Minutes



Raw Soap Texture at 8 Hours



Gelling

Soap can be made with lye between 25% and 50% NaOH

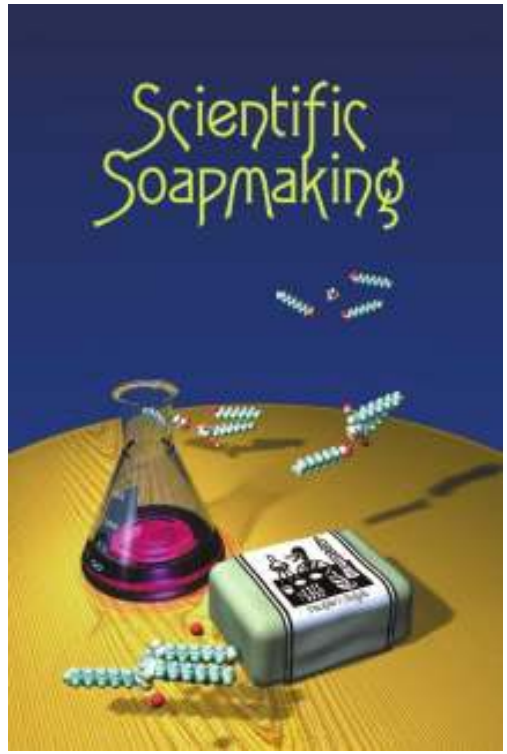
- High-water soaps “gel” at lower temperatures
- Mid-water soaps “gel” at higher temperatures
- Low-water soaps do not “gel”

Appearance

Soap can be made with lye between 25% and 50% NaOH

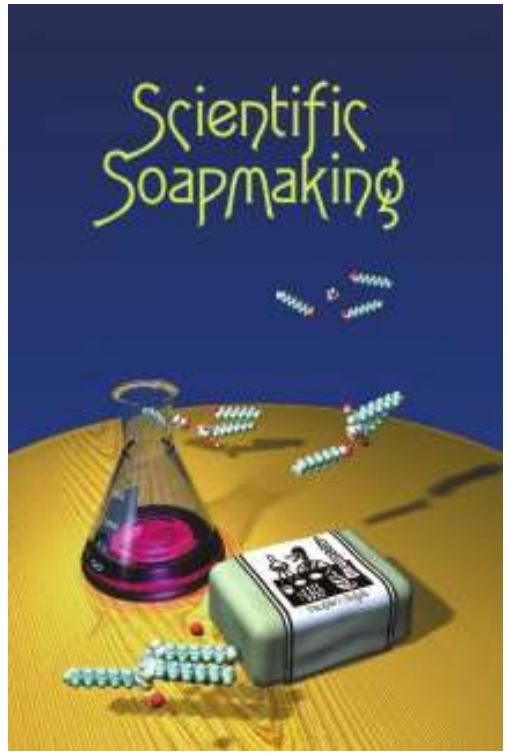
- Soap that “gelled” is translucent
- Soap that did not “gel” is white and opaque

Scientific Soapmaking



Thanks to the HSMG for all the questions I could not have answered 5 years ago.

Scientific Soapmaking



Thanks to the HSMG for all the questions I may be able to answer 5 years from now.