

Haze Measurements in Beer

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Haze in beer

- Definitions
- Haze types in beer
- Challenges to harmonised measurements
- Current solutions



Haze in beer

- Key quality parameter
- One of the first things a consumer makes a judgement on
- Can be an indicator of process efficiency
- Measured under a variety of conditions

Haze definitions

- EBC = European Brewery Convention
- ASBC = American Society of Brewing Chemists
- FNU = Formazine Nephelometric Unit



Conversions

1 EBC	1 FNU/NTU	1 ASBC	
1	0.25	0.014	EBC
4	1	0.057	FNU/NTU
70	17.5	1	ASBC

Descriptive scale

Grade	EBC	ASBC
Brilliant	0.0 to 0.5	0.0 to 34.5
Almost brilliant	0.5 to 1.0	34.5 to 69
Very Slightly Hazy / Cast	1.0 to 2.0	69 to 138
Slightly Hazy	2.0 to 4.0	138 to 276
Hazy	4.0 to 8.0	276 to 552
Very hazy	> 8.0	> 552

Challenges to harmonisation

- Different manufacturers
- Angles of measurement
- Wavelength
- Angles of aperture
- Standards for calibration

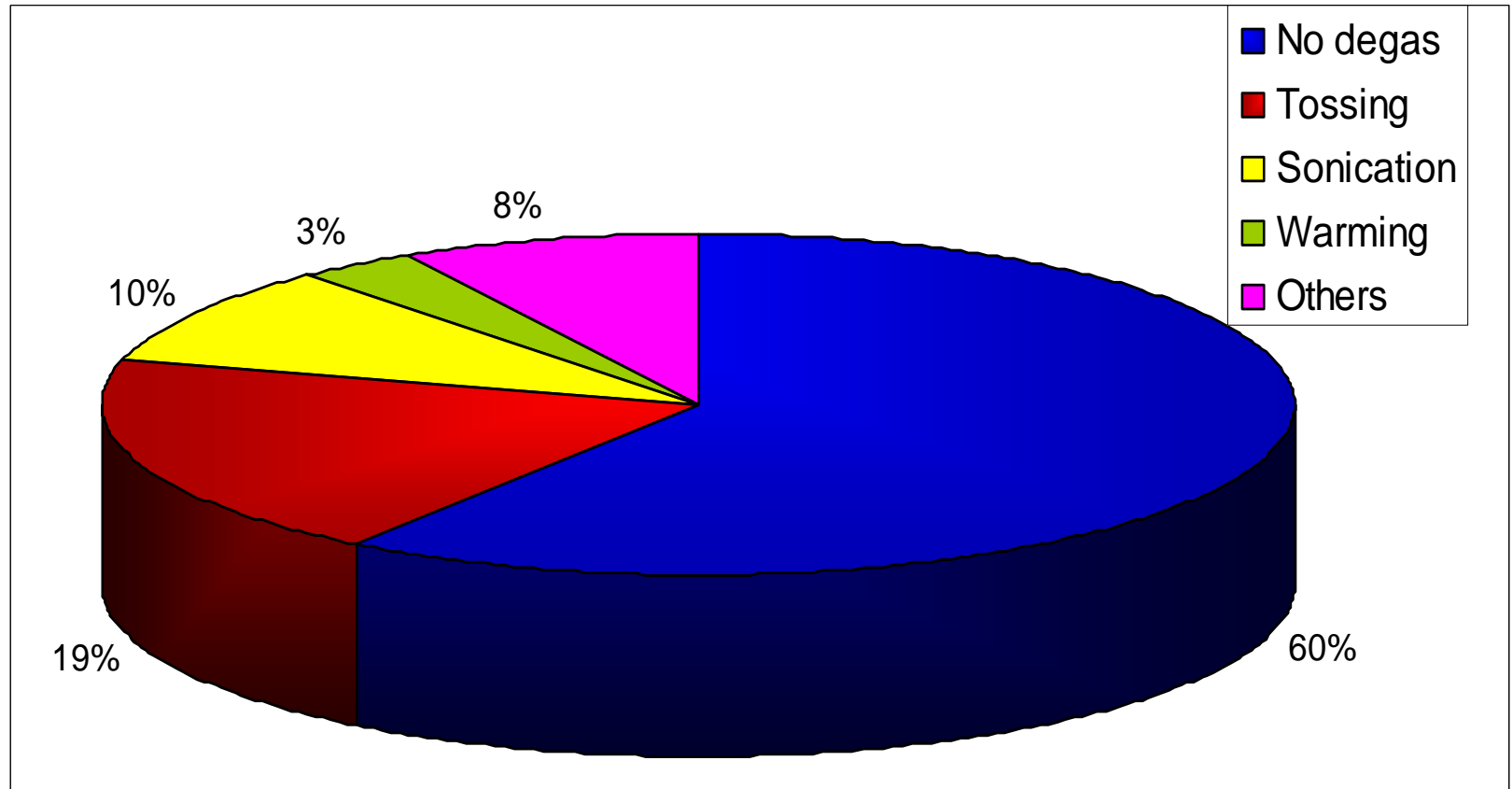
Recommended methods

- EBC
 - Measuring wavelength not specified
- ASBC
 - 580 nm
- MEBAK
 - 650 ± 30 nm

Other method issues

- Degassing
- Temperature
 - Chill haze
- Forced ageing
- Laboratory
- In-line

Sample preparation



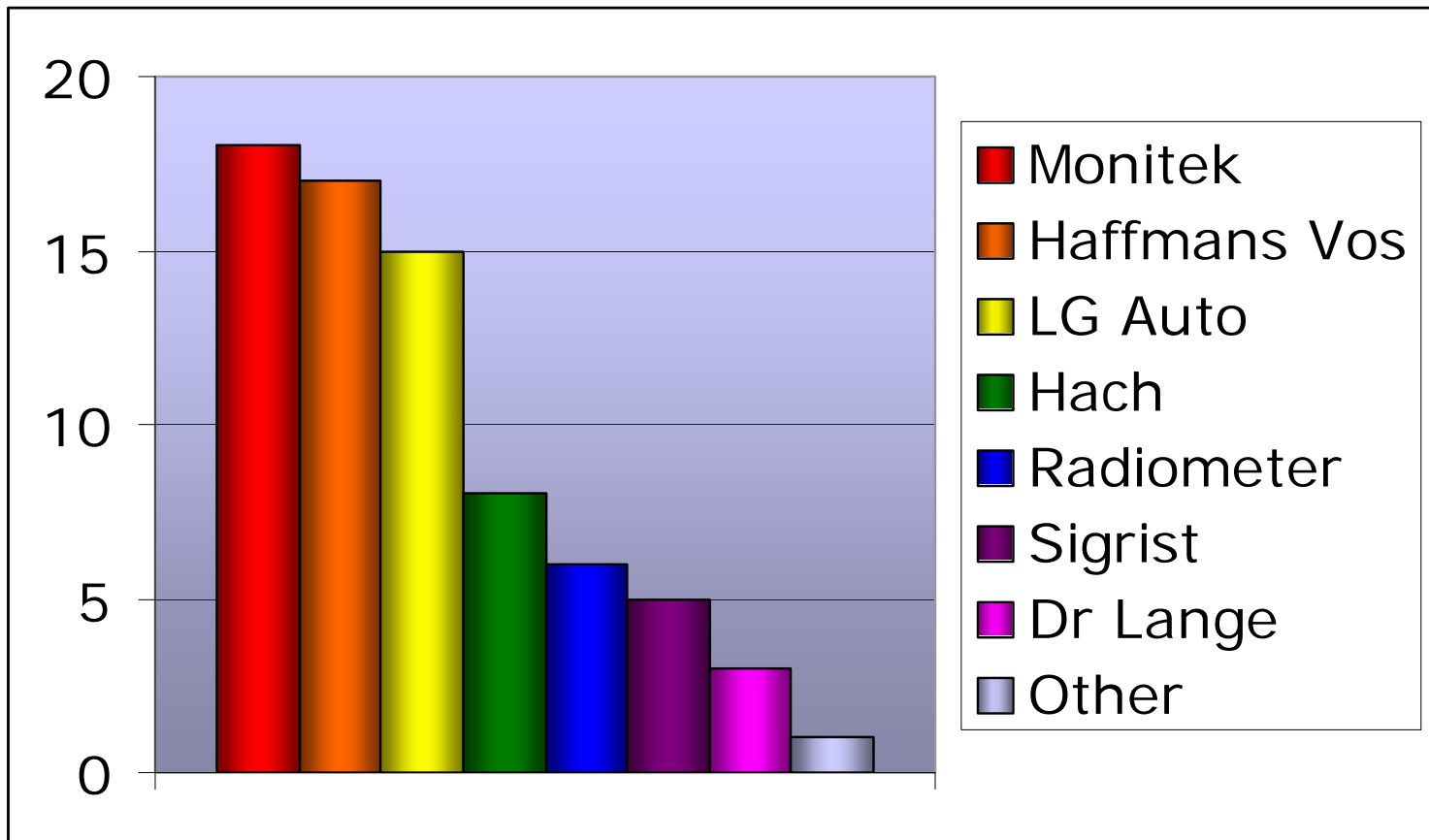
Cuvette vs. bottle

Product	Cuvette Ø 60 mm	Brown bottle Ø 60.5 mm	Green bottle Ø 59.8 mm
Formazin 0.5 EBC	0.51	0.49	0.50
Formazin 1.0 EBC	0.99	0.98	0.98
Formazin 2.5 EBC	2.50	2.48	2.48
Pils (colour 10 EBC)	0.28	0.25	0.33
Dark beer (colour 110 EBC)	2.93	3.13	2.97

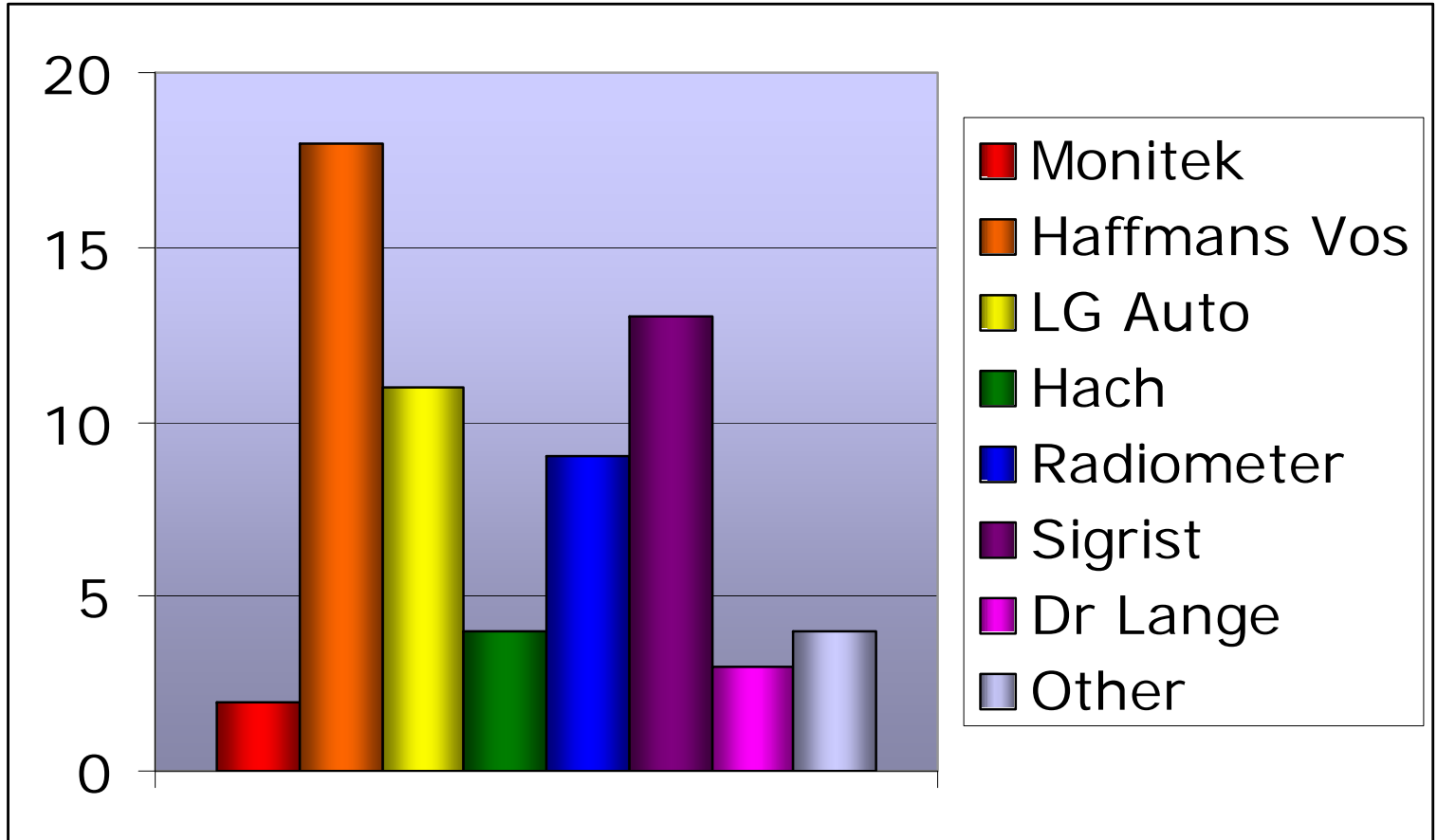
Brau. Ind. 10/2000, 568-571.



Types of haze meter used - 1



Types of haze meter used - 2



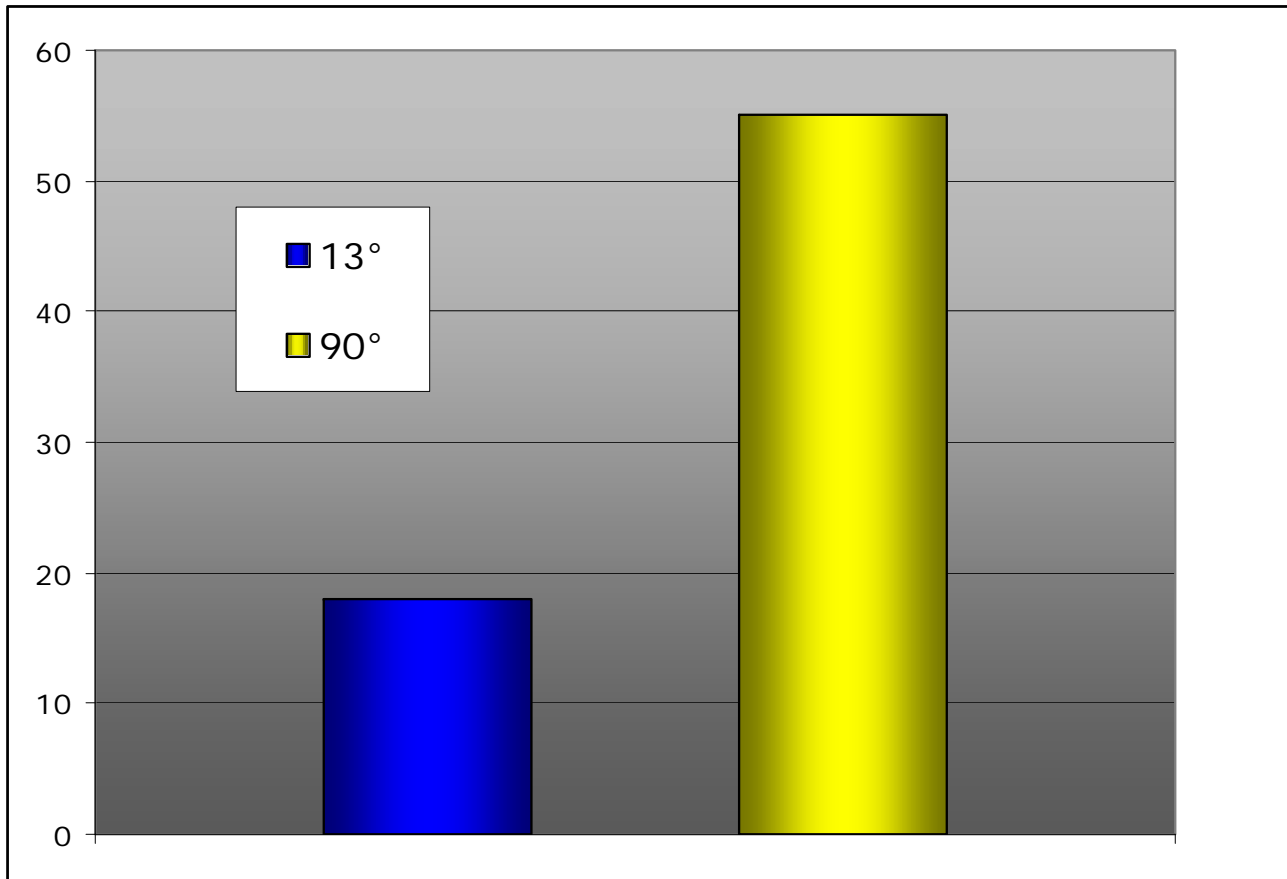
Variation in measurements

Laboratory turbidity equipment	Formazin in cuvette			Beer (Pils) in cuvette		
	0.5 EBC	1.0 EBC	2.5 EBC		+ 1.0 EBC	+ 2.0 EBC
VOS ROTA 90	0.50	1.00	2.50	0.28	1.20	2.02
VOS 4000	0.49	0.98	2.46	0.46	1.22	1.65
Radiometer (green light)	0.48	0.90	2.15	0.35	1.00	1.50
Sigrist (green light)	0.48	0.94	2.45	0.51	1.35	1.93
Dr. Lange	0.62	1.08	2.58	0.26	1.46	2.29

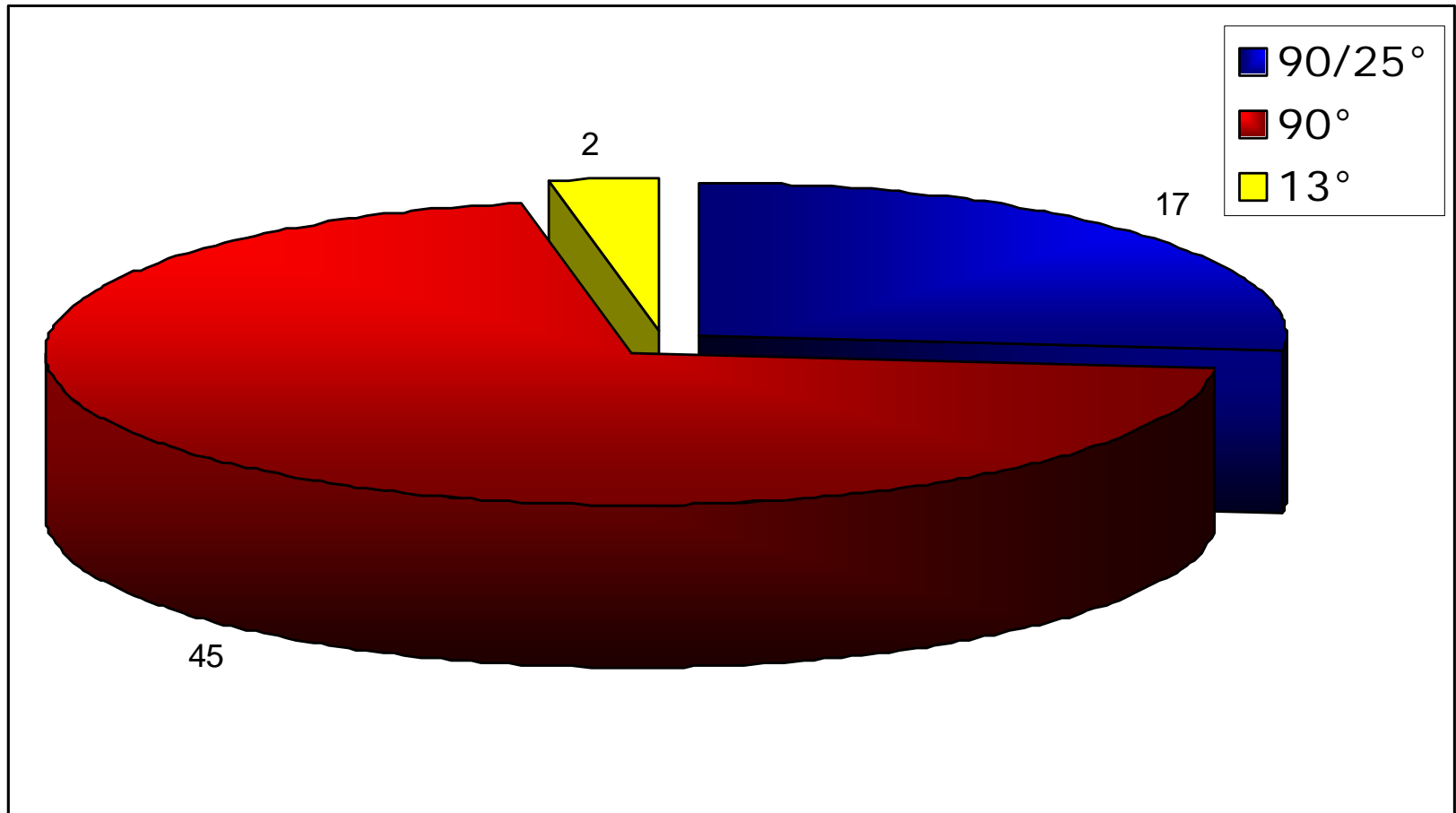
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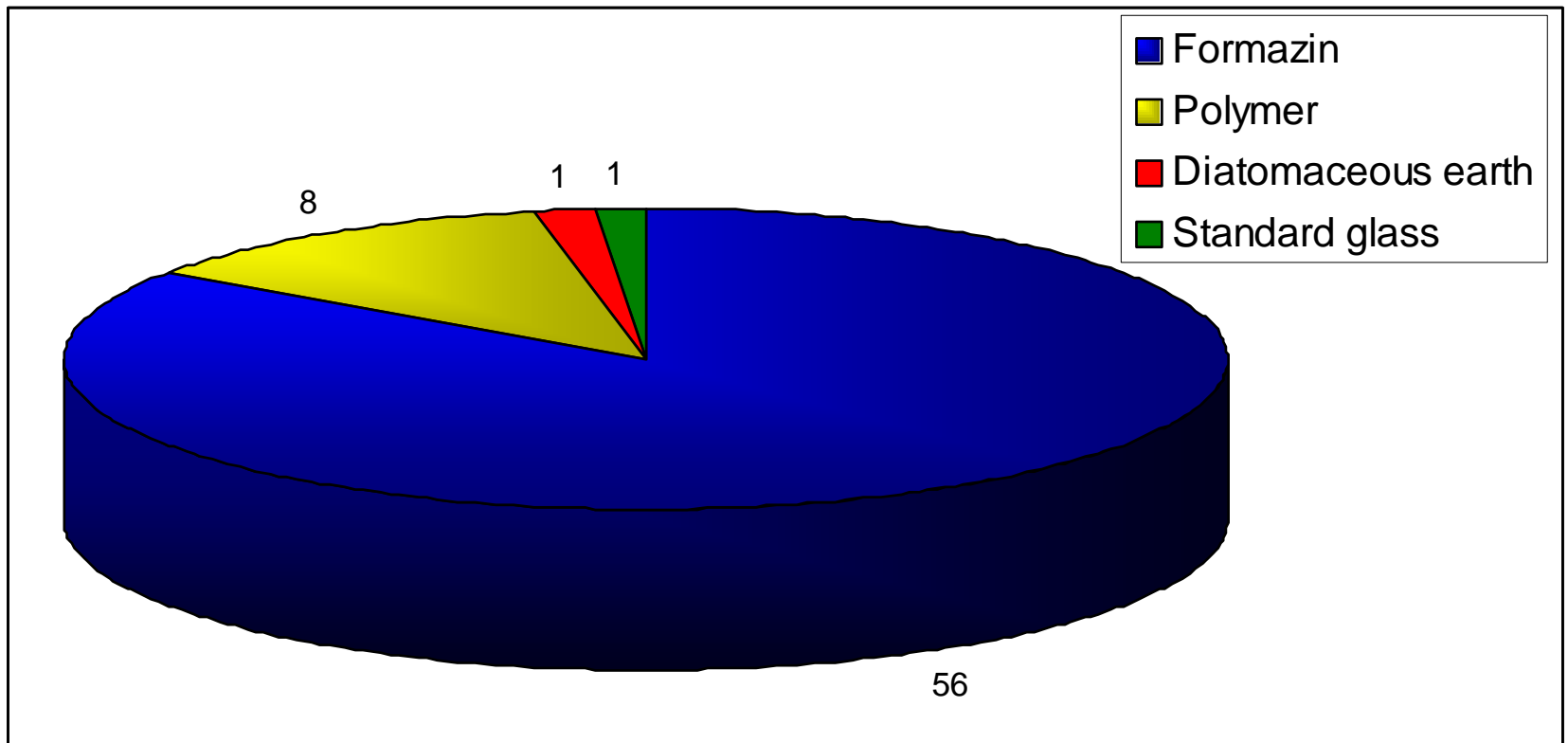
Measurement angle - 1



Measurement angle - 2



Calibration standards



Causes of haze in beer

- 'Natural' hazes
 - precipitates & colloids
- Process aids
 - Poor quality
 - Incorrect use
- Contaminants
 - Foreign bodies
 - Microbial infection

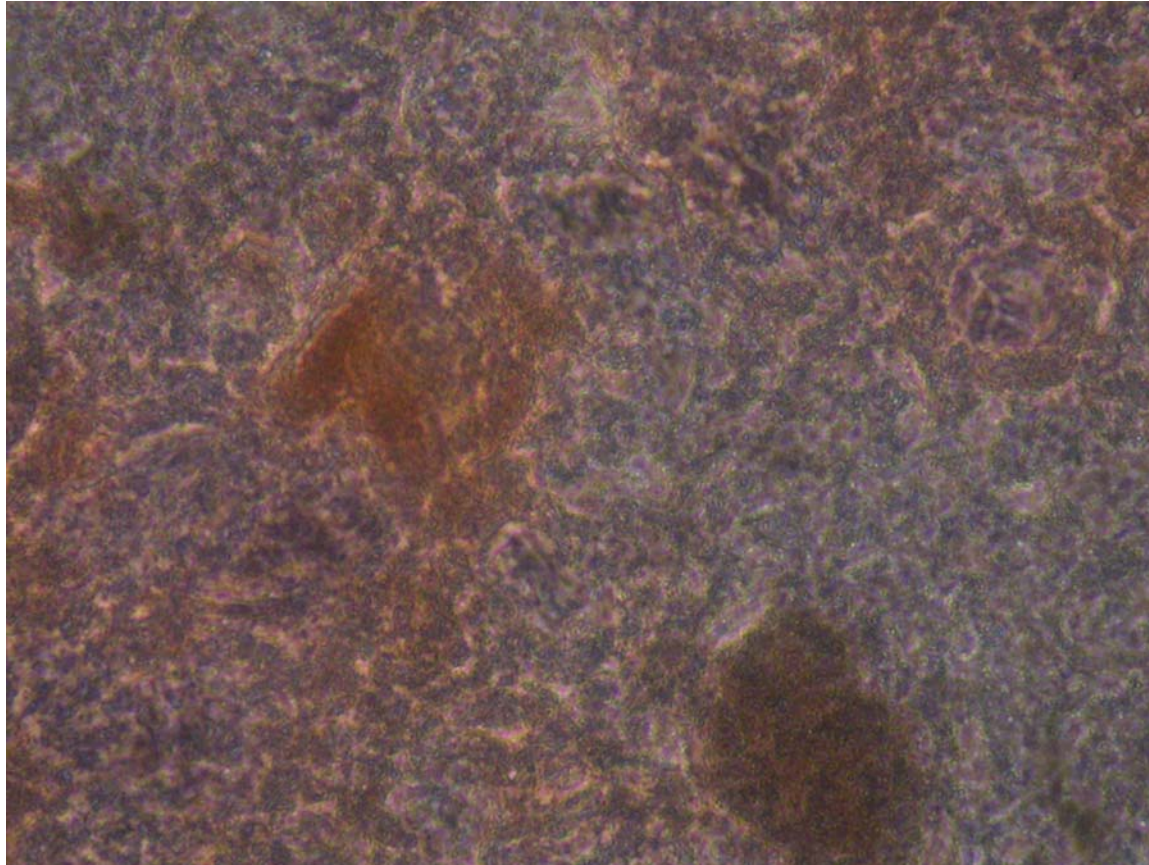
Protein hazes

- Protein-PGA
- Protein-polyphenol
- Chill haze: Tannoids and protein
- Permanent polymerisation
- Protein-pentosan
- Protein-carbohydrate
- Protein-mannose

Large Proteinaceous Skins



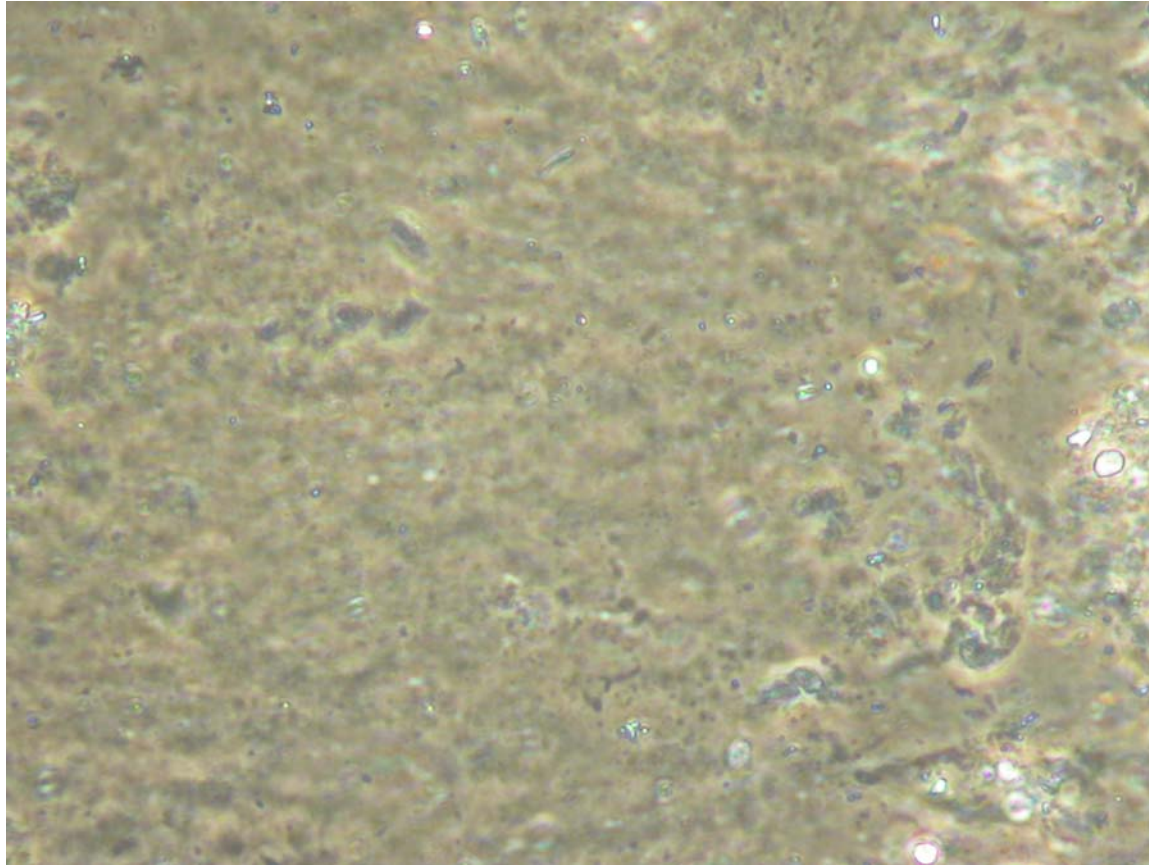
Protein-polyphenol



Carbohydrate hazes

- Beta Glucan
 - Chill haze
 - Permanant particles
- Starch, dextrans
- Pentosans

Sub-visible carbohydrates



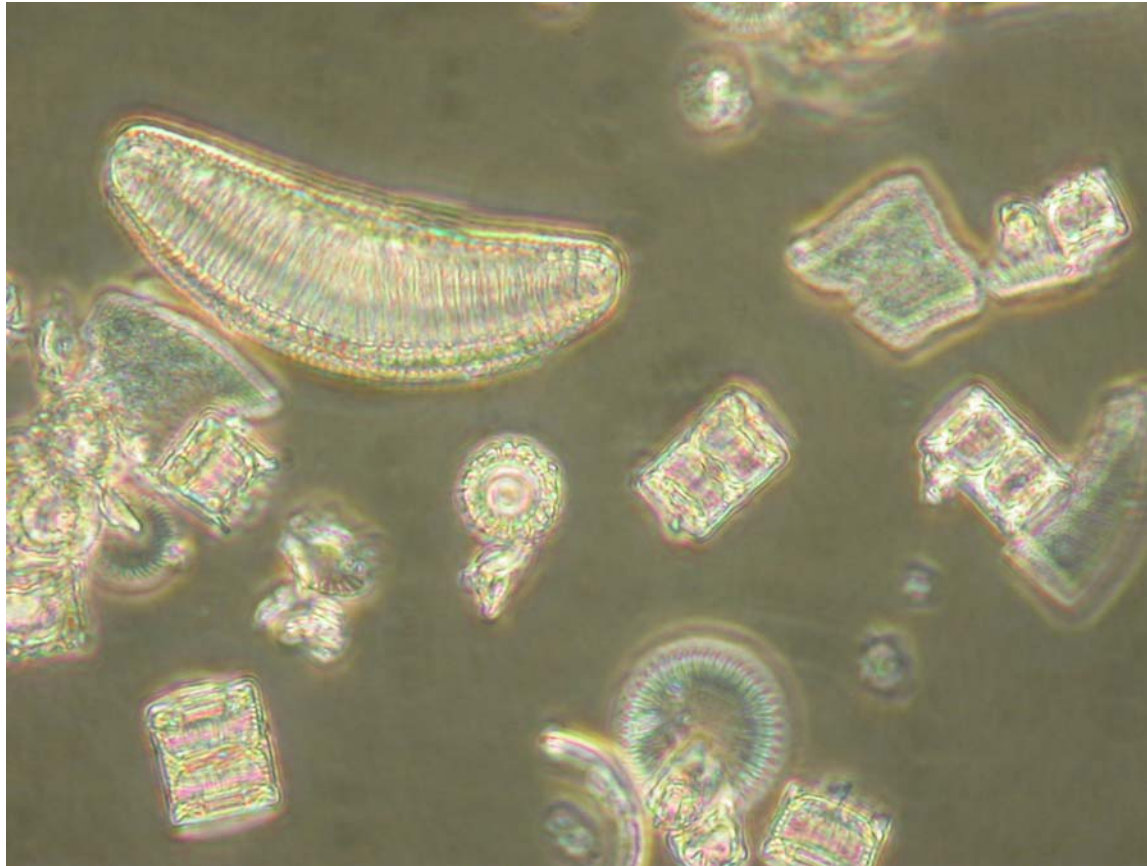
Other 'natural' hazes

- Hop constituents
 - Polyphenols
 - iso-alpha acids, reduced hop acids
- Calcium oxalate
- Glycerol phosphate monomers

Process aids

- Diatomaceous earth & clay
- Polyamides
- Silica, and silicates
- Cellulose fibres
- Finings
- Alginates & their esters (PGA)

Process aids



Contaminants

- Man-made
 - Detergents; oil; can lacquer; glass; silicates and phosphates.
- Microbiological hazes
 - yeast: wild or brewers
 - bacteria: *cocci* or rods
 - moulds: mycelium/filaments
 - algae & fungi

Beer Colour

- Some red and darker beers can give artificially high results
- Only on certain instruments
 - Light wavelength is key factor
- Most brewers set specifications accordingly
- A ratio measurement compensates influence of beer colour

Summary

- Haze in beer is a key quality parameter
- There is no international standard for the analysis
- Ring trials and collaboration are beginning to harmonise methods
- Ultimately individual brewers work with what is best for them