

A New Direction in Beer Stabilization

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INTRODUCTION

A novel single stabilizer, Polyclar® Plus 730, is introduced - it is an optimized composite of polyvinylpyrrolidone (PVPP) and a selected silica xerogel. Use of this proprietary composition will enable a safe treatment for combined stabilization of beer by simultaneous removal of both haze-active components, i.e. polyphenols (both monomeric, polymeric and tannoids) and haze-active proline rich proteins. The stabilizer is usually added to the beer stream prior to primary filtration, in a single addition.

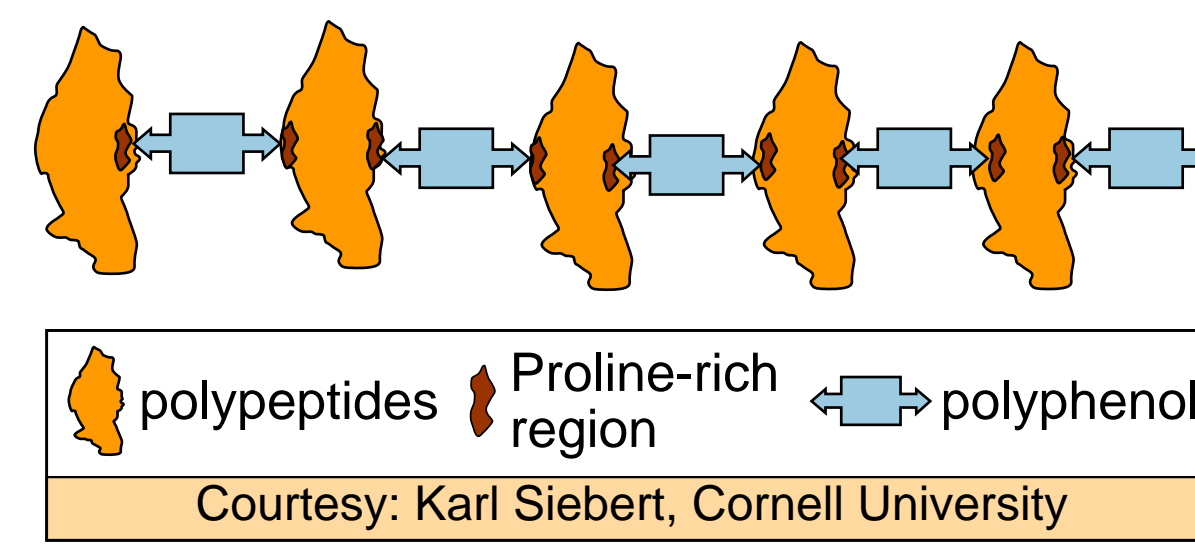
The results of laboratory and brewery trials with German Pilsner, European Lager and an American lager from a microbrewery, indicates a synergy in the adsorption of haze producing proteins and haze giving polyphenols. Results of trials will be discussed and the benefit of Polyclar® Plus 730 will be demonstrated.

Drivers for Improving Colloidal Stability

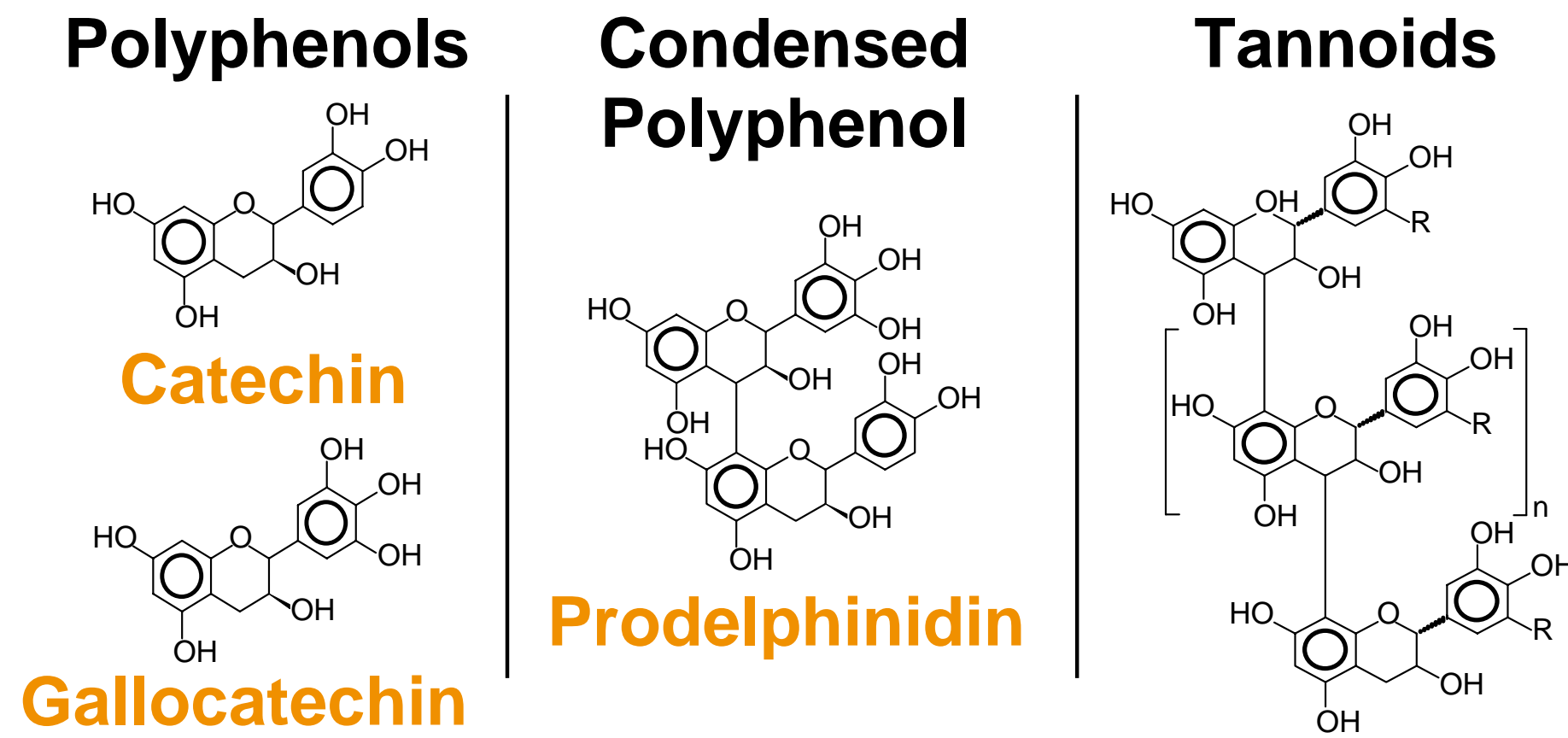
- Quality parameters and shelf-life
- Distribution chains
 - High ambient temperatures
 - Shake haze during transport
 - Export beer verses domestic
 - Keg beer - shorter shelf-life needed than packaged
- Growth of franchised beers
 - Competition - quality required to maintain market share or grow

Model for Protein - Polyphenol Interaction

Polyphenols are depicted as having two ends that can bind to protein. Polypeptides are depicted as having a fixed number of polyphenol binding sites.

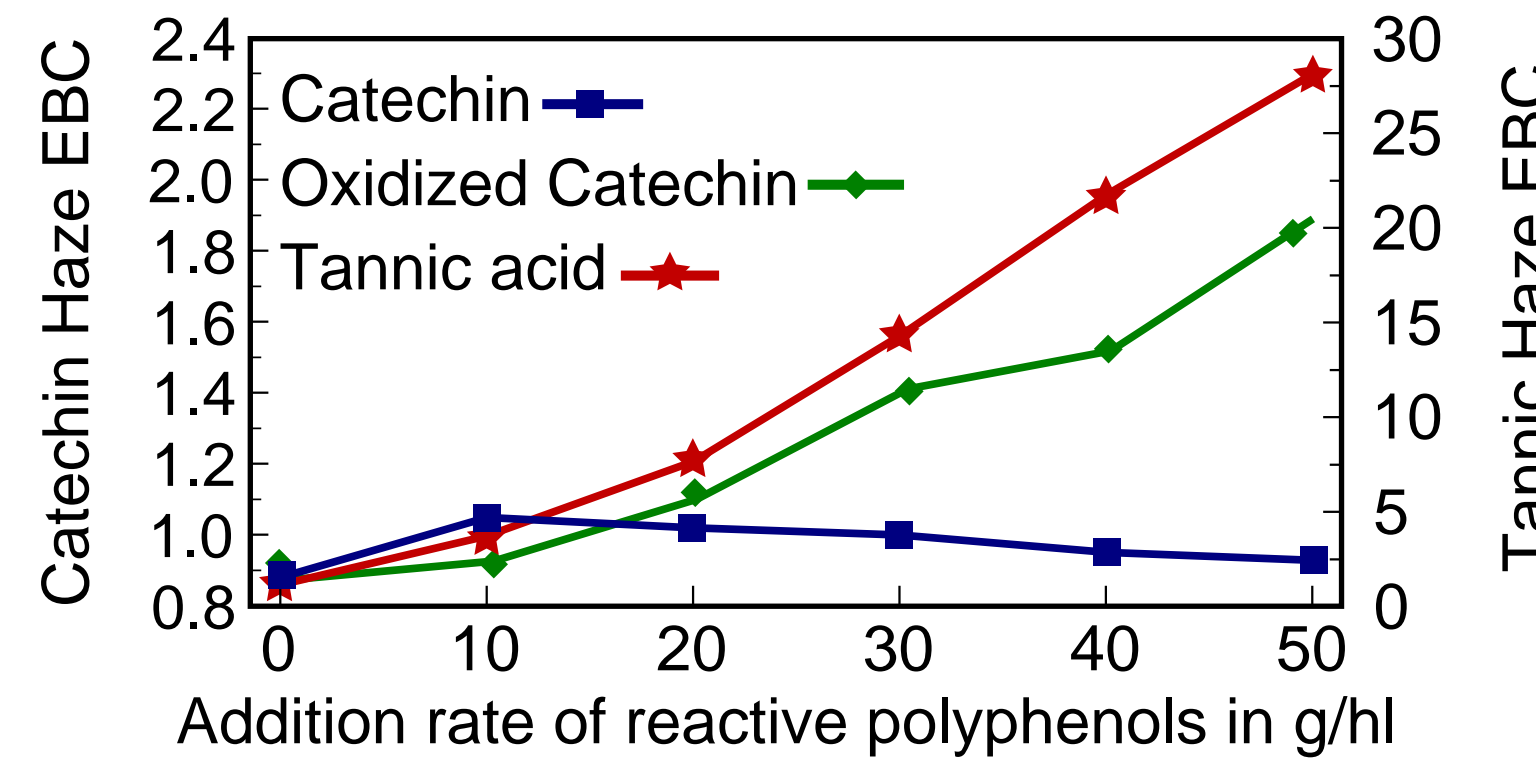


Haze-Active Polyphenols



Relative Haze Formation

Beer stabilized with 100 g/hl PVPP to remove reactive polyphenols

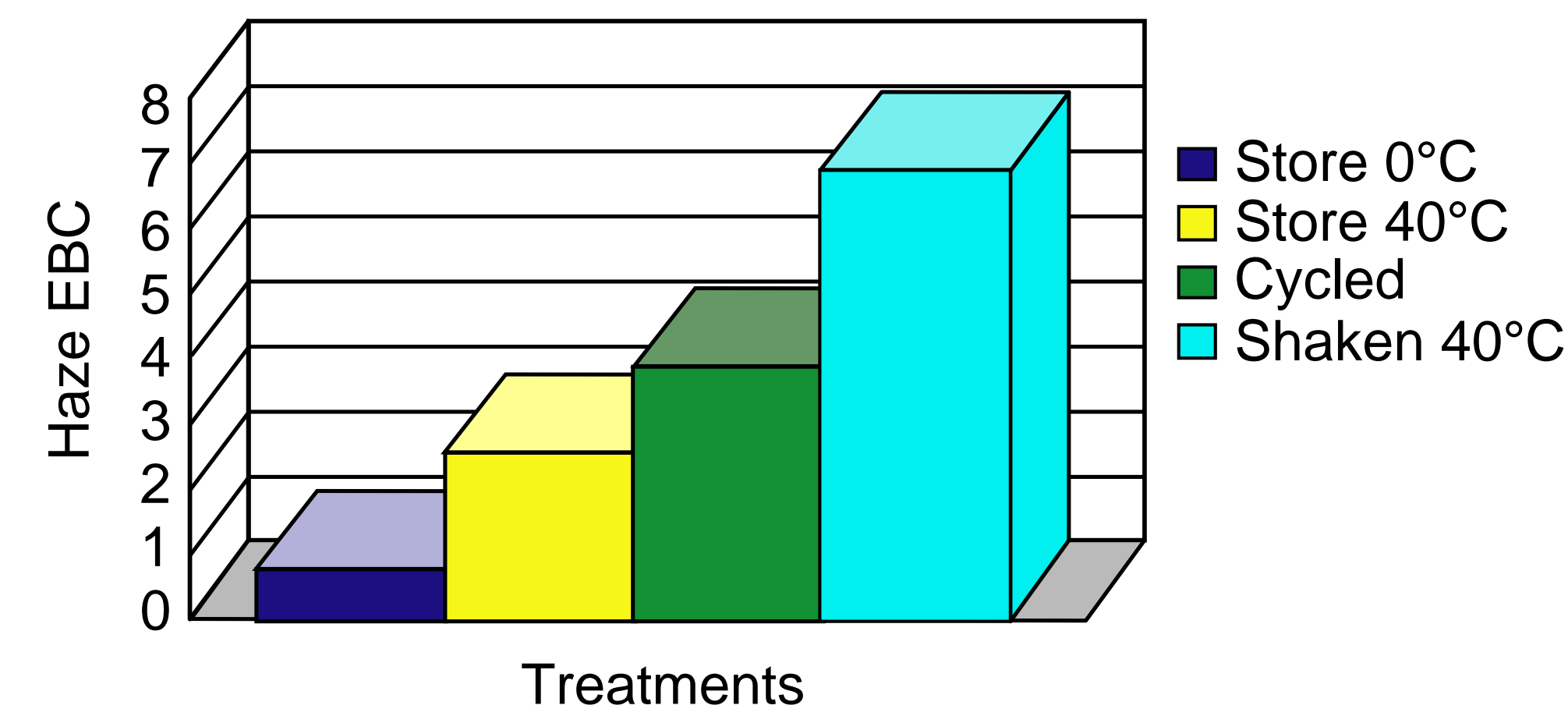


Material and Processes to Optimize Colloidal Stability

Process	Polyphenol Reduction	Protein Reduction	Process Optimization
Raw material selection	Low proanthocyanidin malt Hop extract	Low protein (N) barley	Low malt modification Coarse grind of malt
Brew house	High adjunct ratio Avoid weak worts	Mashing process, pH and temperature Good hot break	Vigorous kettle boil for >60 min. Avoid excess mineral salts Cold wort filtration
Fermentation and Maturation	Rapid onset to fermentation	Early yeast removal	Minimum 7 days maturation at -1°C Low solids count
Filtration			Filter at -1°C Avoid O ₂ pick-up

Colloidal stabilization requires a systematic approach

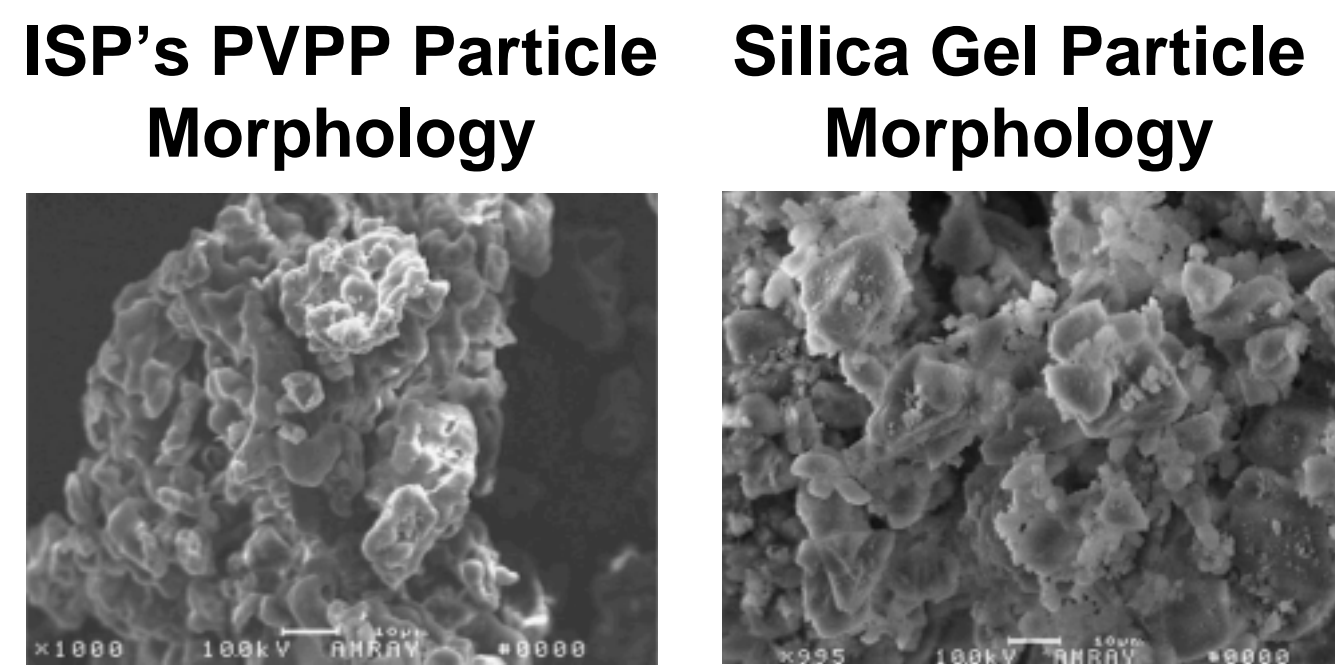
The Effect of Temperature and Shaking on Forced Haze



TECHNICAL DESCRIPTION

What is Polyclar® Plus 730?

A proprietary composite of micronized Polyvinylpyrrolidone (PVPP) and selected Silica Xerogel

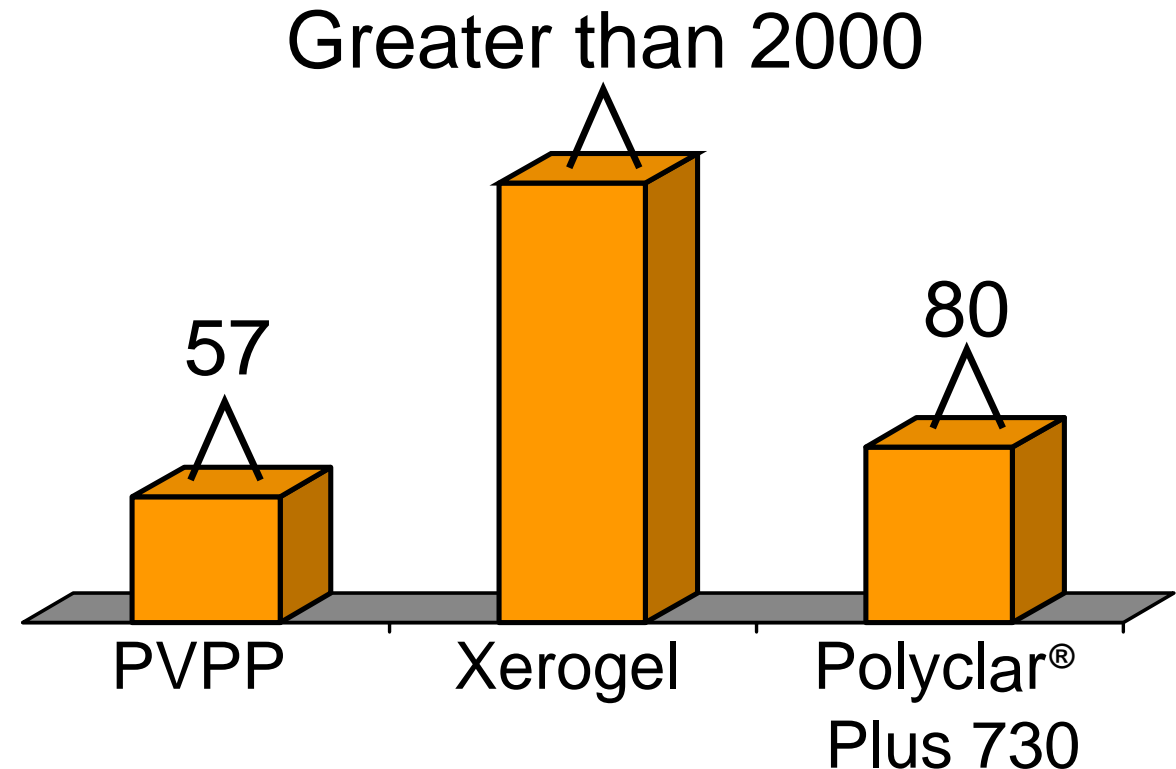


Properties of Polyclar® Plus 730

- Simultaneous removal of haze forming precursors i.e. proteins and polyphenols
- PVPP enables flocculation of hydrated xerogel particles
- Improves material dispersion and transfer
- Avoids settling at the bottom of slurry tanks

Re-dispersion of Polyclar® Plus 730

Greater than 2000



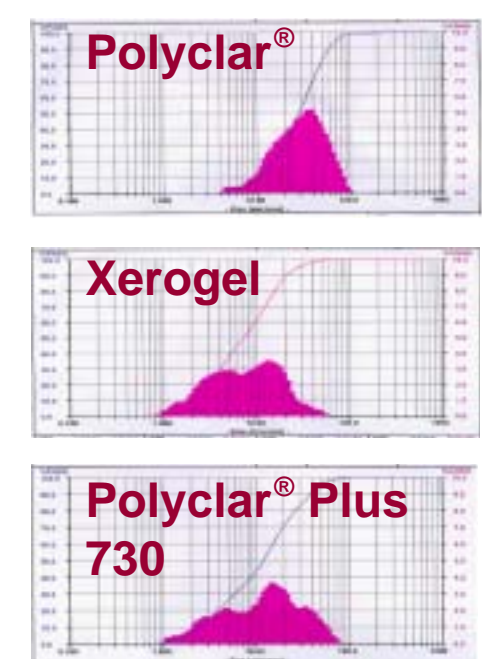
Inversions required to re-disperse 10% slurries after 24 hours of sedimentation.

- Improved dispersion results in a more homogeneous dosing into the beer.

Particle Size Distribution of Polyclar® Plus 730 - Dry

Comparison With Components

SAMPLE	Percentiles (µm)			Mv
	10%	50%	90%	
Polyclar®	11.2	28.8	60.8	33.3
Xerogel	2.1	7.3	21.0	10.1
Polyclar® Plus 730	2.4	12.0	39.0	16.7

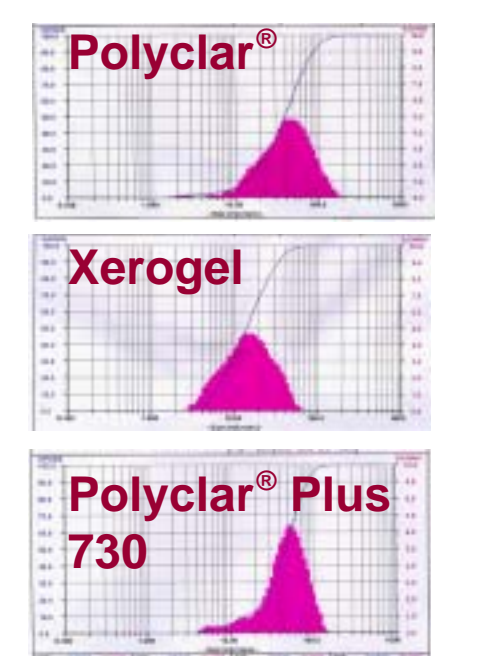


Typical particle size distribution of Polyclar® Plus 730, denoted by Mv (mean volume), falls between the particle size distribution of the component constituents, Polyclar® and Xerogel.

Particle Size Distribution of Polyclar® Plus 730 - 10% Hydrated

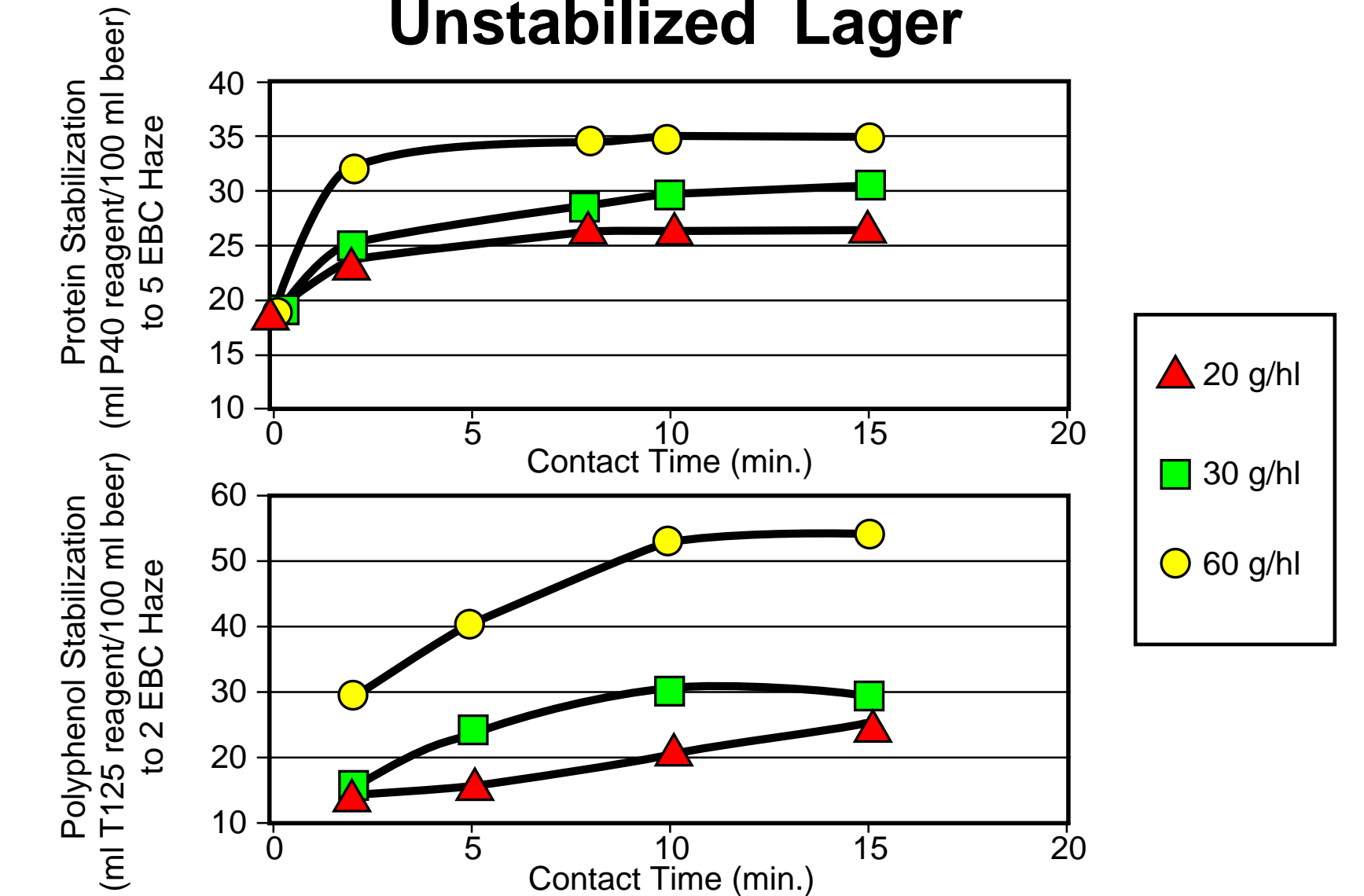
Comparison With Components

SAMPLE	Percentiles (µm)			Mv
	10%	50%	90%	
Polyclar®	13.3	39.4	87.6	45.8
Xerogel	5.3	14.1	33.7	17.1
Polyclar® Plus 730	15.4	46.7	86.8	49.8

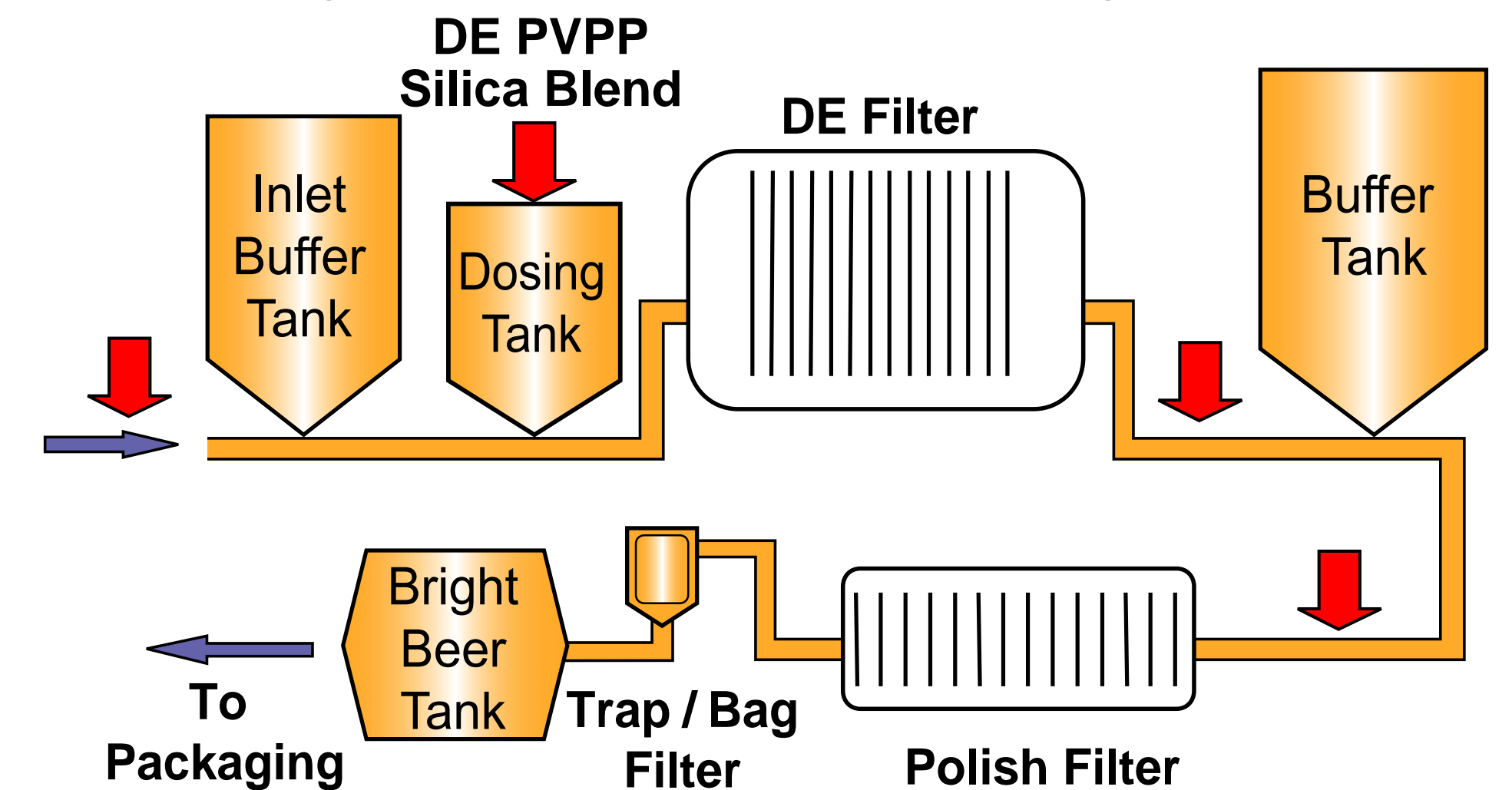


The particle size of hydrated Polyclar® Plus 730 is larger than both its constituents. These larger particles do not compact easily. This non-compaction gave improved filter runs in the brewery. At the same time, the adsorption of polyphenol or protein was not affected. In fact, in some instances the adsorption was enhanced.

Protein and Polyphenol Reduction with Polyclar® Plus 730 Unstabilized Lager



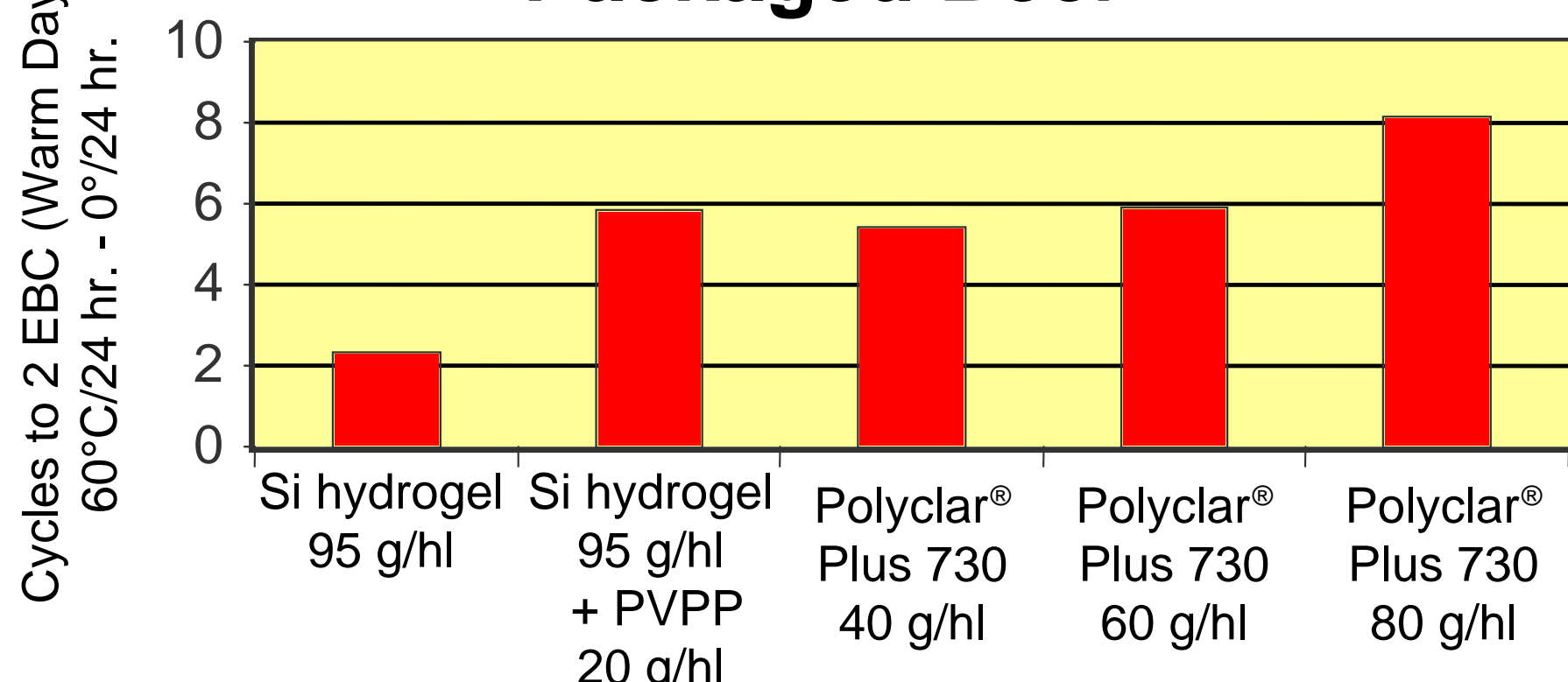
Possible Injection Points for Polyclar® Plus 730



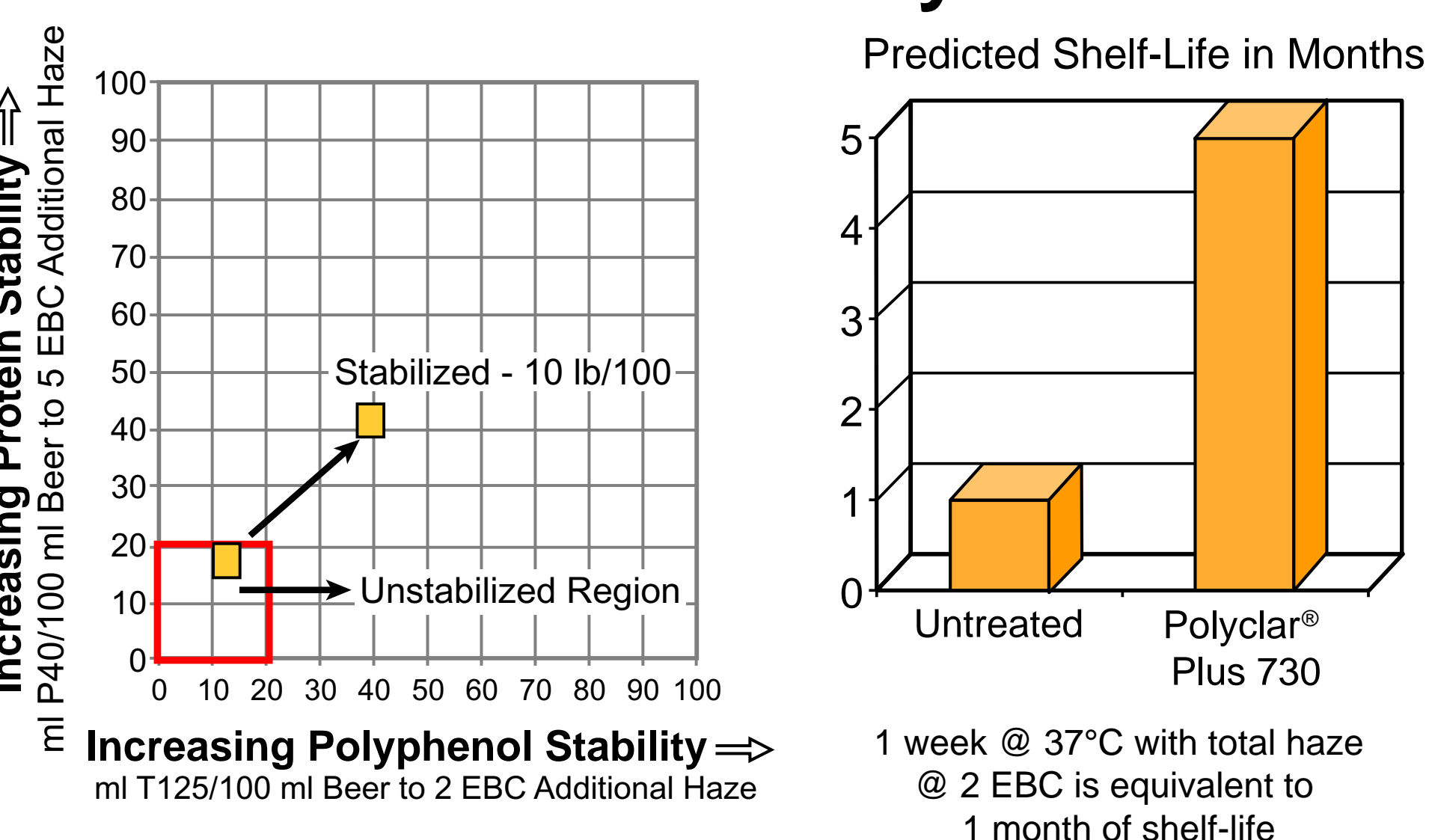
BREWING TRIALS

Trial A - European Brewery

Forced Haze Development in Packaged Beer



Trial B - US Microbrewery



Trial C - Ale Stabilization

2 Stage Stabilization

T125 & P40 - high values indicate better stabilization

	FV	MV	BBT
Tannoids (mg/l)	35.0	<12	<12
T125 Polyphenols (ml/100ml)	11.9	55.0	123.0
P 40 Proteins (ml/100ml)	21.2	49.4	51.6

Polyclar® Plus 730 (40 g/hl) Polyclar® 10 (20 g/hl)

Stage 1 - complete tannoid removal & substantial protein and flavanoid reduction

Stage 2 - further flavanoid reduction

• **Very effective stabilization**

Heat Forcing Test* 1.1 EBC

*60°C for 5 days and 0°C for 1 day measured at 0°C.

Trial D - Benefits in Filter Operation

Filter Pressures, Run Lengths and Beer Stability

Stabilizer	Dose rate g/hl	ΔP/hr*	Filter Run Time (hr)	Total Haze** (EBC)
Xerogel only	35.8	0.49	6.4	6.9
PVPP only	12.6	0.35	7.4	3.6
Polyclar® Plus 730	33.0	0.25	12.0	1.2

*Pressure increase at steady state

**Total haze measured at 0°C after 5 days incubation at 60°C

SUMMARY

A New Direction in Stabilization with Polyclar® Plus 730

- Customized stabilization
- Selectively remove haze-causing proteins & polyphenols
- Utilize existing equipment
- Lower addition rates
- Applicable to all beer types
- Excellent handling and performance
- Cost-Effective

Acknowledgement

We thank International Specialty Products for permission to present this poster

