

# PROCESS CONTROL FOR DIMETHYL SULFIDE IN BEER: WHIRLPOOL THROUGH FERMENTING OPERATIONS

## Whirlpool/Wort Strippers

**"Wort Precooling"**....reduce temperature of wort before hits whirlpool to 89°C with plate & frame heat exchangers or the wort cooler....reduces DMS by 30% says Huppmann.

Beck's use of vacuum evaporation from the whirlpool...avoids build up of off-flavors during hot wort stand in the whirlpool.

BCOJ: studied [DMSP] vs. temperature over 90 minutes. For 80 vs. 90 vs. 98°C saw 63 vs. 55 vs. 29 ppm DMSP, respectively.....more converted to DMS as temperature increased.

Wort stripping (+) e.g. via vacuum or low pressure.

**Cooling wort to 88-89°C before whirlpool to restrict *de novo* DMS formation, while keeping a robust/solid break...any lower the break becomes too amorphous and difficult to separate (+)**

Wort stripping columns (+)

**Extended hot wort tank times (-)**

Wort pH (-)....worts with higher pH's lead to beers with higher [DMS].....at wort pH's of @ 4.8 vs. 5.3 vs. 5.8, see increases of @ 7.4, 50 and 90 ppb in [DMS] over fermentation.

**[Methionine sulfoxide] (+)**.... competing substrate with DMSO for reduction by yeast reductases.....enzyme has much greater affinity for MSO vs. DMSO.

Glycol valve failures which lower fermentation temps, less vigorous fermenter increases DMS

[Wort DMSO] ..@ 10-20% of DMSO reduced to DMS by yeast? (-)

Beck's: Claim 50% of beer DMS from yeast reduction of DMSO.

Yeast after shutdowns, holdovers (-)

Excessive fermenter tank back pressure, prevents DMS release in CO<sub>2</sub> (-)

Fermentation temperature (+)

Extent of decrease of [CO<sub>2</sub>] during fassing..... try to obtain at least a decrease of 0.25 volumes of CO<sub>2</sub> (+)

Wild yeast contamination (-)

Multibrew vs. smaller fermenters (-)

Fermenter CO<sub>2</sub> rings to purge DMS before [EtOH] builds up to enhance DMS solubility (+)

## Fermenting

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Underpitching (-)

**[Phenylethanol]**...the more yeast produces, the more DMS can be masked ...BALANCE between higher alcohols and DMS therefore crucial as process control goal.

Gram - wort spoilers (-)

CO<sub>2</sub> Purging (+)

Tuborg yeast (+). Due to increased RDF (therefore CO<sub>2</sub> production) or increased nucleation sites for CO<sub>2</sub> release?

Poor yeast vitality/viability (-)

Culture yeast reduction of DMSO by methionine sulphoxide reductase (-). Interbrew says 80% of beer DMS from yeast reduction of DMSO.

Slow/sluggish fermentations (-)

Low fermentation temperatures (-)

*Hafnia*, *Enterobacter* contamination (-)

Culture yeast strain (+/-)...can absorb SMM and oxidize to DMSO?

Duprise claims @ 80% of beer DMS from yeast.....greater at lower fermentation temps, higher wort OG's and pH's.

**Wort contaminated with thermic bacteria can quickly generate up to 2,000 ppb DMS in beer!!**

Open FVs (+). Better stripping than with closed FVs.

## Reducing DMS Levels in Beer

**Huge US brewer process survey:** level of DMS in first wort @ 275 ppb....last is @ 50 ppb....@ 200 ppb at kettle full....@ 20 ppb at kettle knock out....wort strippers remove @ 30-50% of DMS entering....achieve @ 35 ppb in fermenter, with no production by yeast...see @ 15-20 ppb in finished beer after dilution.

## Process Survey

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