



WEYERMANN®

Sour Wort - The new member in our product family



WEYERMANN® SPECIALITY MALTS

July 2018



Intention of the Weyermann® / Doehler Sour Wort cooperation for Beer Brewing



Natural and flexible pH-value adjustment to optimise the brewing process and beer quality in accordance with the German Purity Law

→ **Easy availability and usage - significant benefits**



Agenda



- 1. Biological Acidification**
- 2. Sour Wort – Production**
- 3. Sour Wort – Specification**
- 4. Sour Wort – Application**
- 5. Dosage Quantities in Mash/Wort**
- 6. Pilot Tests under Practice Conditions**
- 7. Conclusion – Product Advantages**
- 8. Sales information**



Significant Improvements in Brewing Process and Beer Quality by biological acidification

- **Biologically produced lactic acid for acidifying mash and/or wort**
 - Optimization of the brewing process and beer quality
- **Biological acidification represents a natural way to adjust mash and wort pH**
 - In compliance with the German Purity Law (clean labelling)
- **The reduction of mash and wort pH leads to an improvement of ...**
 - ... brew house yield (high enzyme activity)
 - ... fermentation performance (reduced fermentation time)
 - ... filtration performance (lower viscosity)
 - ... beer quality (increased flavor stability)



Naturalness



Process Optimization



Product Optimization



State-of-the-Art Fermentation Technology and Aseptic Filling



Malt is produced from barley through steeping, germination and kilning in order to completely break down cell walls, partially break down proteins and generate enzymes.

Steeping
Germination
Kilning

Using a classical infusion mashing process, the valuable substances of malt grist are brought into solution. The final mash is filtered resulting in the so-called wort.

Milling
Mashing
Lautering
Boiling
Separation

Activities DöhlerGroup

Under CO₂ atmosphere, the sugar in the wort is converted into lactic acid by a pure culture of lactic acid bacteria, namely *L. amylolyticus*.

LAB Fermentation

The sour wort is concentrated by performing a gentle vacuum evaporation (water).

Evaporation

With the help of an aseptic filling machine, the sour wort is filled in optimal packages (Bag-in-Box 20 kg).

Filling

Products

Malt

Wort

Weyermann® / Döhler Sour Wort



Our Product – specification in accordance with the German Purity Law

- Raw materials used for sour wort production
- Sour wort fermentation
- Concentration of produced sour wort

} conform to the German Purity Law

Weyermann® / Doehler Sour Wort - Specification		
Parameter	Unit	Value
Lactic acid	g/L	52 – 58
pH	-	2.9 – 3.2
Density	g/cm ³	1.271 – 1.311
Brix	°Bx	58.0 – 63.0

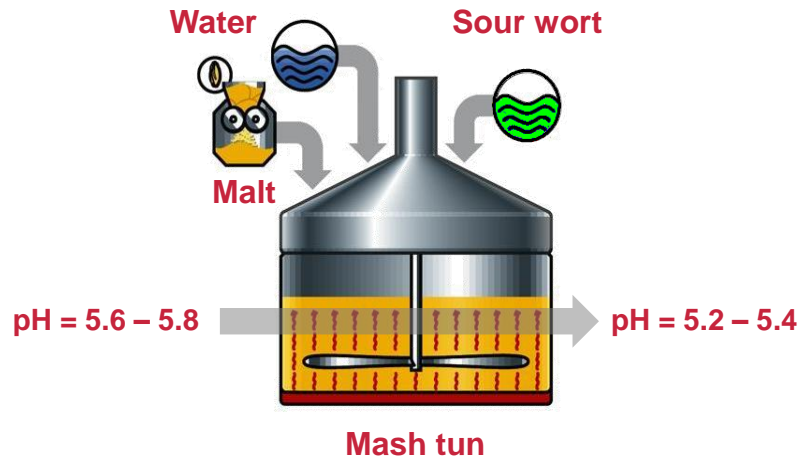


Shelf-life (unopened package): 360 days – Storage at 20°C



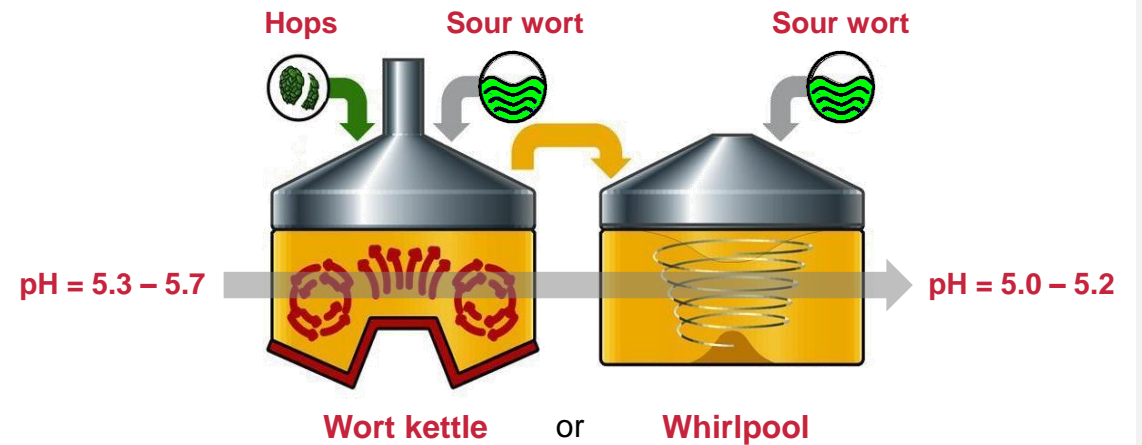
Biological Mash and/or Wort Acidification in the Brewhouse

Mash acidification



AND / OR

Wort acidification



- Enhanced enzymatic degradation of materials
- Higher levels of growth-promoting substances
- Suppression of lipoxygenase activity
- Better lautering performance
- Enhanced redox potential, i.e. reduced susceptibility to oxygen

- Less color formation
- Enhanced protein coagulation/precipitation
- Improved sensory quality
- Increased chemical-physical stability
- Enhanced microbiological stability



Efficient Dosage of Lactic Acid by means of Weyermann®/Döhler Sour Wort

Mash acidification	Δ pH	Needed quantity of lactic acid (80%)		Use of sour wort (0.8% lactic acid)		Use of Weyermann®/Doehler Sour Wort (5.5% = 55 g/L lactic acid)	
		[L/t Malt]	[L/hL SB]	[L/t Malt]	[L/hL SB]	[L/t Malt]	[L/hL SB]
	- 0.1	0.6	0.01	60	1	10	0.2
- 0.2	1.2	0.02	120	2	19	0.3	
- 0.3	1.8	0.03	180	3	29	0.5	
- 0.4	2.4	0.04	240	4	38	0.7	

Wort acidification	Δ pH	Needed quantity of lactic acid (80%)		Use of sour wort (0.8% lactic acid)		Use of Weyermann®/Doehler Sour Wort (5.5% = 55 g/L lactic acid)	
		[L/t Malt]	[L/hL SB]	[L/t Malt]	[L/hL SB]	[L/t Malt]	[L/hL SB]
	- 0.1	0.4	0.007	36	0.7	6	0.10
- 0.2	0.7	0.013	73	1.3	12	0.21	
- 0.3	1.1	0.020	109	2.0	17	0.31	
- 0.4	1.5	0.026	145	2.6	23	0.42	



Practical test of the Sour Wort in a Medium-Sized Brewery

	Unit	Brew 1	Brew 2	Brew 3
Grist load				
Pilsner malt	kg	2,850	2,850	3,000
Sour malt	kg	150	150	0
Percentage	%	5	5	0
Cast-out wort				
Extract	%	12.0	11.9	12.1
Volume	hL	199	199	198
Weyermann® / Doehler Sour Wort				
Addition to mash	kg	0	0	51.5
Mash pH	-	5.35	5.36	5.35
Addition to wort	kg	0	57.6	62.2
Cast-out wort pH	-	5.32	5.02	4.98

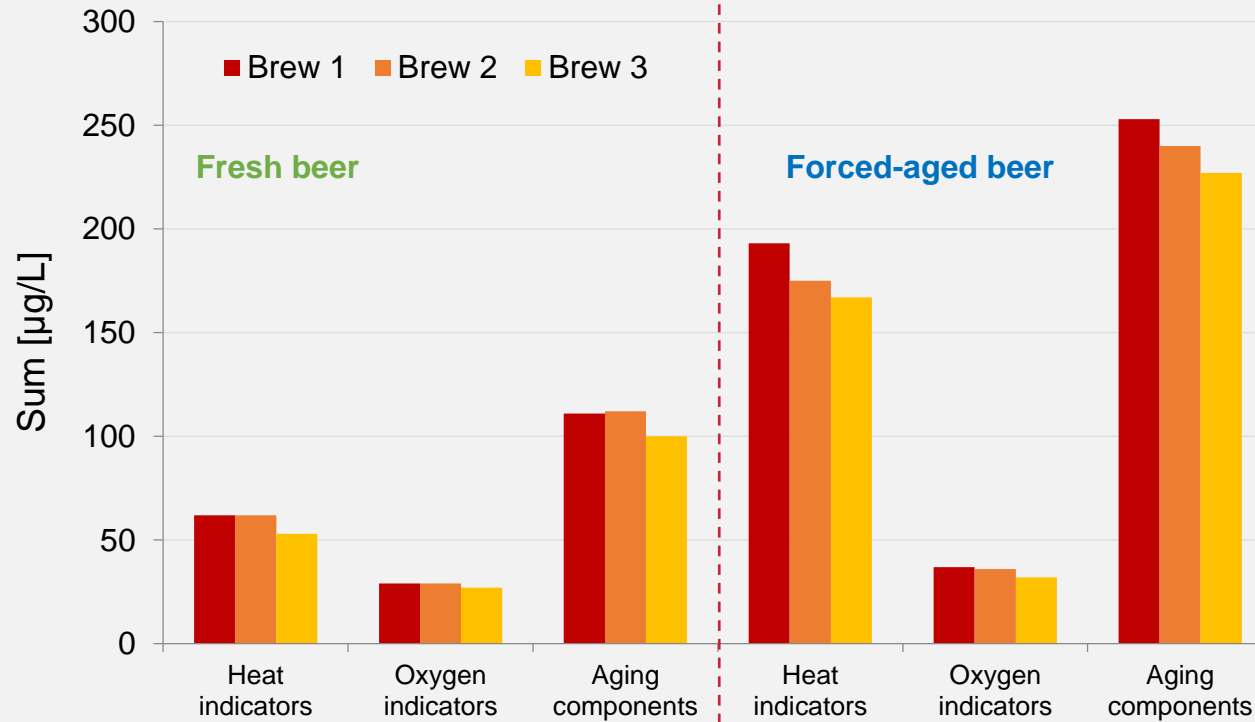
Brew 1: Mash acidification using sour malt (Reference)

Brew 2: Mash acidification using sour malt, wort acidification using Weyermann®/Doehler Sour Wort (boiling)

Brew 3: Mash and wort acidification using Weyermann®/Doehler Sour Wort



Results | Aging Indicators in Fresh/Forced-Aged Beer



Fresh beer

Brew 3 → lowest concentration of aging indicators

Forced-aged beer

Reduction of aging indicator levels by using Weyermann®/Doehler Sour Wort in mash and/or wort

Conclusion:

Application of Weyermann®/Doehler Sour Wort in mash and/or wort significantly increases the flavor stability of beer

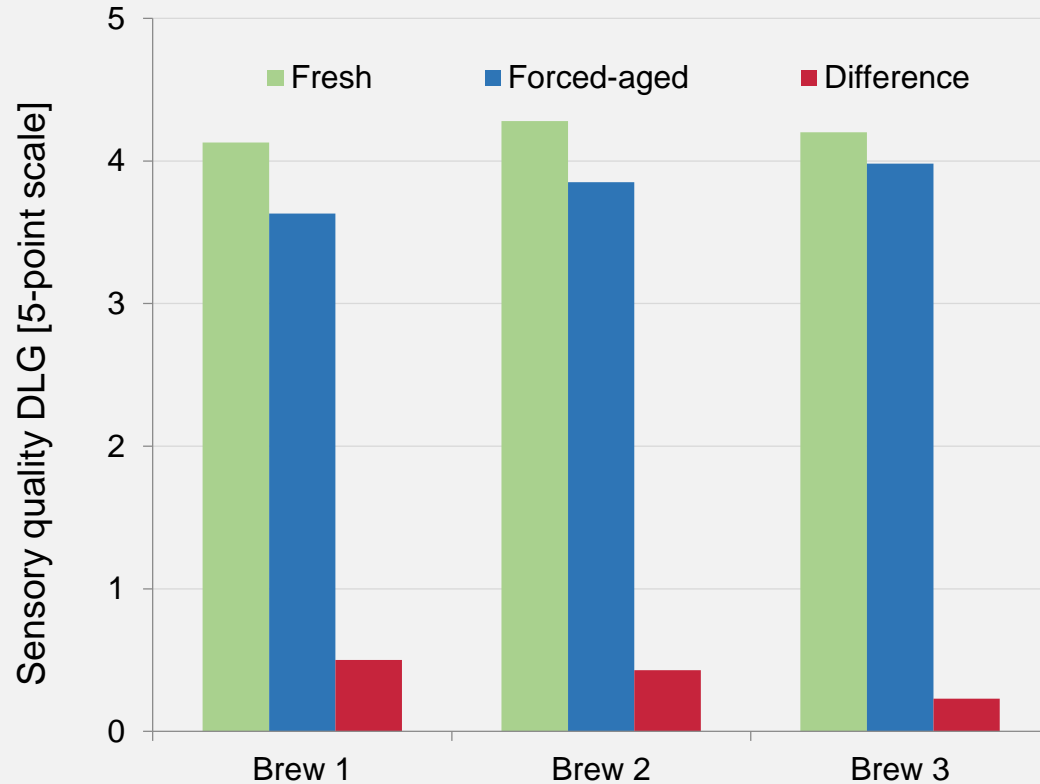
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Brew 3: Mash and wort acidification using Weyermann®/Doehler Sour Wort



Results | Sensory Analysis of Fresh/Forced-Aged Beer



Brew 1: Mash acidification using sour malt (Reference)

Brew 2: Mash acidification using sour malt, wort acidification using Weyermann®/Doehler Sour Wort (boiling)

Brew 3: Mash and wort acidification using Weyermann®/Doehler Sour Wort

DLG sensory evaluation

- Aroma
- Purity of taste
- Fullness of body
- Carbonation
- Quality of bitterness

Fresh beer:

Brew 2 and Brew 3 → better sensory quality compared to reference beer

Forced-aged beer:

Brew 3 → best sensory test result

Conclusion:

Application of Weyermann®/Doehler Sour Wort in mash and/or wort increases the „drinkability“ of beer



Conclusion: Our new Product – an efficient & flexible alternative or addition to Sour Malt or Self-Production

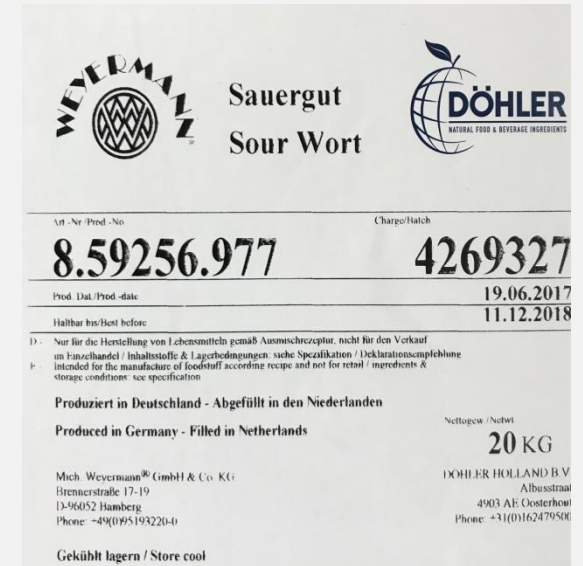
- **Standardised and cost-effective quality product:**
 - Production of Weyermann®/Döhler Sour Wort using state-of-the-art fermentation technology
 - No cost-intensive installations; no time-consuming handling of lactic acid bacteria cultures in the brewery, etc.
- **High microbiological stability and long shelf-life** of the Sour Wort due to aseptic filling
- **Easy handling and dosage** due to optimal, recloseable packaging type
- **Low dosage quantities:** Only 15% of the amount of traditionally used sour wort required
- **Application according to the German Purity Law** for naturally reducing the pH of mash and wort
- **Significant improvement of flavor stability and „drinkability“ of beer**





Sales unit



- Reclosable 20 kg Bag-in-box (16 liter Bibs)
box size (mm) = 28 x 28 x 25
- Full pallet = 48 x 20 kg BiBs/pallet





Specification sheet

- Includes all necessary information for you and your customer
 - Product description
 - Dosage recommendation
 - Product parameters
 - Shipping units and storage conditions
 - Shelf life information
 - HACCP explanation
- All in one reference sheet
- Batch-specific analyses available on request

 WEYERMANN® Specialty Malting Company Andreas Richter - Quality Manager Brennerstraße 17-19 D-96052 Bamberg phone: +49 (0)951 93 22 0 22 fax: +49 (0)951 -93220-970 or +49 (0)951 - 93 22 0 922 email: andreas.richter@weyermann.de 			
Product specification			
PRODUCT:	Sour Wort		
This biologically derived sour wort is usable during the beer production of the natural pH value adjustment of both mash and wort. It is a nonalcoholic fermented barley malt extract and shows a hazy, brown appearance as well as a typically malty, acidic taste.			
Usage	Brewing and beverage industry		
Recommended Quantities	Mash acidification: Addition of 10 l / to malt: pH 0.1 ↓	Wort acidification: Addition of 6 l / to malt: 0.1 pH ↓	
Data Analysis	The following values are subject to harvest-specific variations.		
Parameter	MIN	MAX	UNIT
lactic acid	52	58	g/l
pH value	2.9	3.2	
density	1.271	1.311	g/cm ³
refraction	58.0	63.0	°Bx
Shipping units and storage conditions	The product is aseptically packed in a bag in a box (16 l, 20 kg). It should be stored cool, dry and protected from extreme heat and cold.		
Shelf life	In unopened original packaging a shelf life of 540 days (at 4 - 8 ° C) or 360 days (at 20 ° C) is given.		
HACCP	<p>All of our products and packaging meet the requirements of DIN EN ISO 9001:2008 and the HACCP (Hazard Analyses of Critical Control Points) food safety management system. They also conform to all applicable government food and health regulations that are currently in force.</p> <p>All Weyermann® products are in compliance with VO (EG) Nr. 1829/2003, 1830/2003, 49/2000, and 50/2000, and do not contain any genetically modified raw materials, ingredients, or additives.</p> <p>All raw materials are meticulously tested for traces of pesticides, mycotoxins, and heavy metals, and meet the requirements of VO (EG) 165/2010 and 396/2005. The nitrosamine content of our malts is below allowable thresholds.</p>		
Valid after: 2017-07-03	approved: Andreas Richter (Quality Manager)		



Specification

WEYERMANN® SOUR WORT	Data Analysis			
<p>This biologically derived SOUR WORT can be used during the beer production for the natural pH value adjustment of both mash and wort. It is a nonalcoholic fermented barley malt extract and shows a hazy, brown appearance as well as a typically malty, acidic taste.</p> <p>USAGE: Brewing and beverage industry.</p> <p>Recommended Quantities: <u>Mash acidification:</u> Addition of 10 l / 1000 kg malt (USA: 1.2 US-gallon / 1000 lbs.): 0.1 pH ↓ <u>Wort acidification:</u> Addition of 6 l / 1000 kg malt (USA: 0.72 US-gallon / 1000 lbs.): 0.1 pH ↓</p> <p>Shipping units and storage conditions: The product is aseptically packed in a bag in a box (16 l / 4.23 US-gallon, 20 kg / 44.09 lbs.). It should be stored cool, dry and protected from extreme heat and cold.</p> <p>Shelf life: in unopened original packaging a shelf life of 360 days (at 20 °C / 68 °F) is given.</p>	<p>The following values are subject to harvest-specific variations:</p>			
	PARAMETER	MIN	MAX	UNIT
	lactic acid	52	58	g / l
	pH value	2.9	3.2	
	density	1.271	1.317	g / cm ³
	refraction	58.0	65.0	°Bx



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and Food Department

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Thank you very much for your attention!