Biological Acidification

Overview

1. Which possible technological improvements unfold through the application of biological acidification?
2. The Mash acidification
3. The Wort acidification
4. Technical and technological requirements

Preface

In comparison to the usage of technically manufactured acids, the acidification with biologically produced lactic acids offers extensive advantages:

1. Higher nutrition physiological values
2. Better growth opportunities for the yeast (zinc, biotin)
3. Redox Potential

Biological Acid wort are added to:

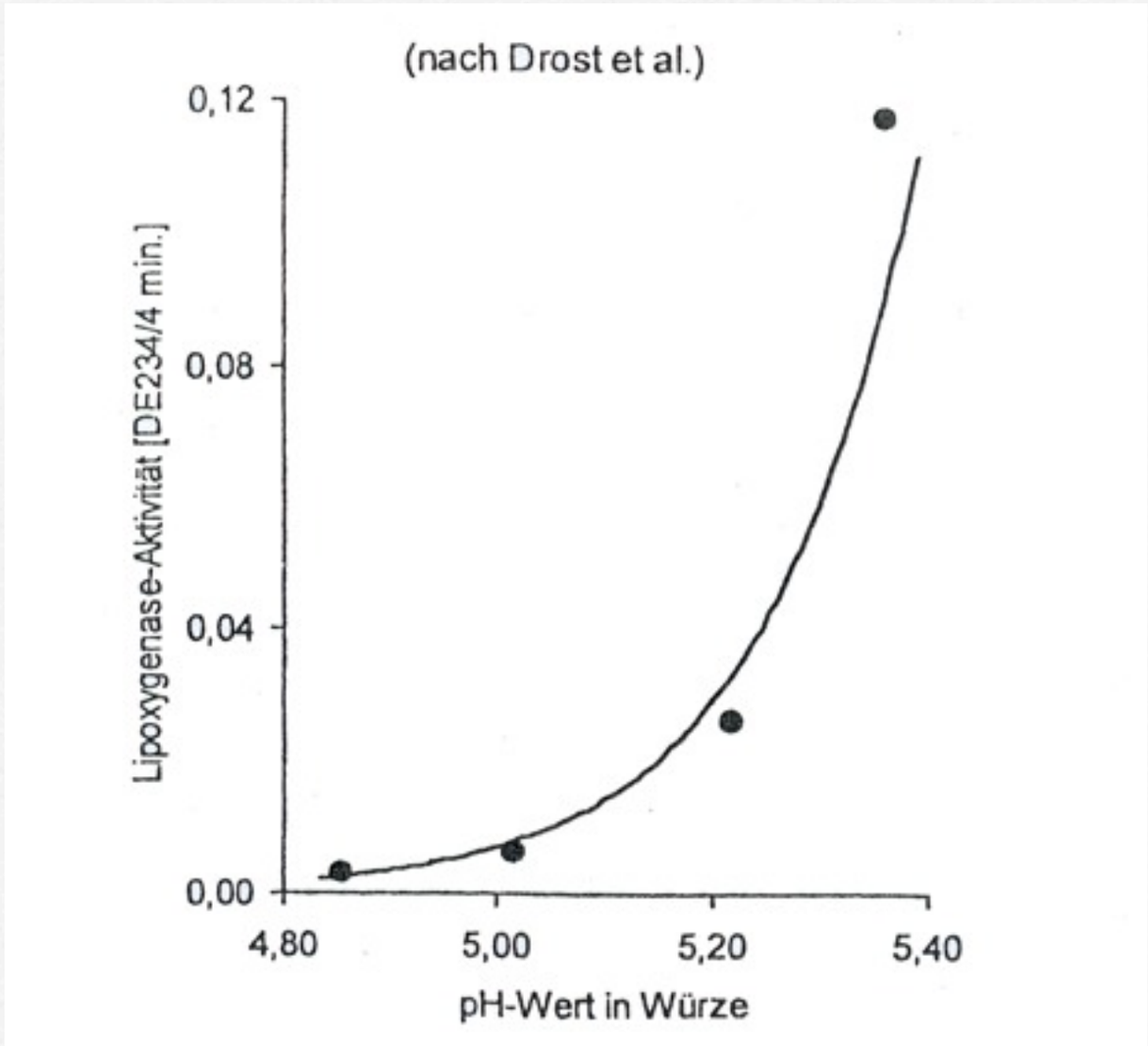
1. Mash acidification: balancing of deficits in the Malt quality
2. Wort acidification: Generally to reduce the raw material PH-value

Technological Perfecting

1. Higher cell growth (Zinc, Biotin)
• Better Flocculation
• Intensive enzymatic degradation when mashing (except iodine normality)
• intensification of the fermentation (faster pH-collapse, better haze elimination, higher degree of attenuation after fermentation)
• Higher Redoxpotential (less oxygen sensitivity)
• Enhancement of the collodial-, the taste- and foam stability.

Lipoxygenas Activity

Dependency of the Lipoxygenase activity of Mash rather Wort pH:



Organoleptic Improvement

- Taste: taste formation well-rounded, fuller bodied and a softer palate
- Hop bitter: pleasant, not indulging
- Review: fresh, lively Character
- Foam: fine bubbles, stable
- Colour: lighter and fresher

Physiological and Health Advantages

- Metabolism: encouragement of the metabolic activity
- Digestion: positive impact of the lactic acids
- Defence mechanism: better protection against illnesses, pathogenic bacteria is pushed back.

Gradual Reduction of the Biological Sensitivity of the Beers

1. Lower pH-value
2. Pectinatus and Megasphera growth is not able at pH-values under 4,4 (4,5)

- Potential beer spoiling micro organisms growth is mainly not below the pH-values of 4,5
- For obligate beer spoiling micro organisms it is more difficult to grow especially when the PH-value is lower.
- The higher the attenuation limit the lower the supply of fermentable carbohydrates for the beer spoiling micro organisms
- Growth advantages for the yeast and the surging of the beer spoiling micro organisms back as competitors.

Mash Acidification

- Increasing the Amylolysis, Proteolysis and Cytolysis during the mash creates:

  1. Higher colloidal Stability

  2. Possible shorter Mash times

  3. Higher Brew house yield

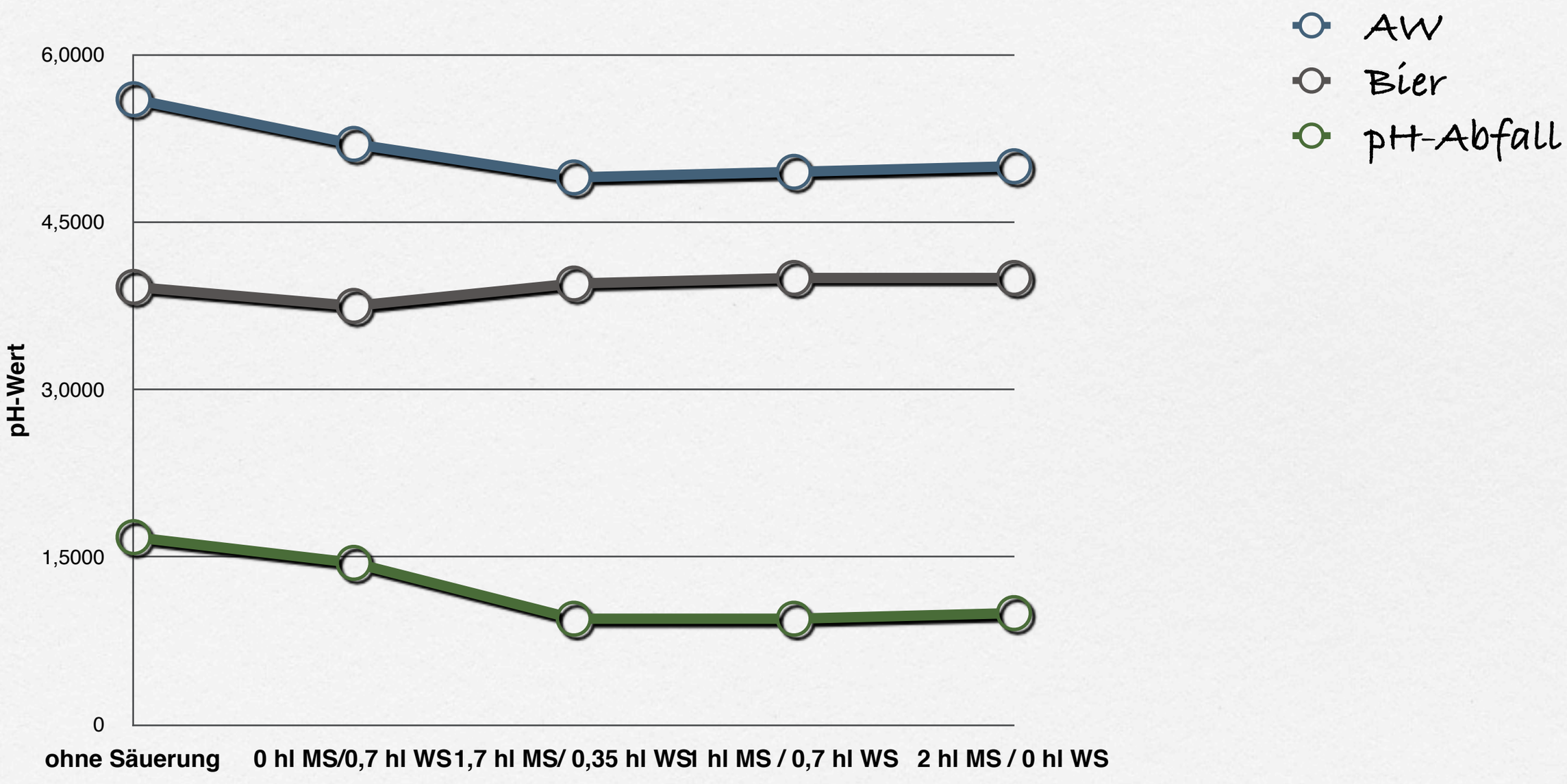
- Stronger activation of the Phosphatases can increase the buffering of the Wort

- Reduction of the Alpha-Amylase-activity can cause Problems with the iodine iodine normality

Possible analytical Impacts of a Mash acidification (100 % Malt)

pH Mash (after mashing)	5,73	5,59	5,40	5,20
pH after mashing	5,67	5,55	5,39	5,26
saccharification [min]	8	8	12	18
hochmol. N [mg/100ml]	23,8	23,1	24,7	25,2
FAN [mg/100ml]	21,5	22,1	24,8	26,5
Anthocyanogene [mg/l]	79	83	86	92
Viscosity [mPas]	1,83	1,82	1,81	1,80
ß-Glucan [mg/l]	253	249	242	230
Bier				
Colour EBC]	7,8	7,5	7,2	6,9
hochmol. N [mg/100ml]	18,0	18,0	19,2	20,1
Bitterness Unit [EBC]	31	30	28	27
Foam [RSC]	130	131	131	132
Taste DLG ∅	4,0	4,2	4,4	4,3

Buffering with a Mash Acidification

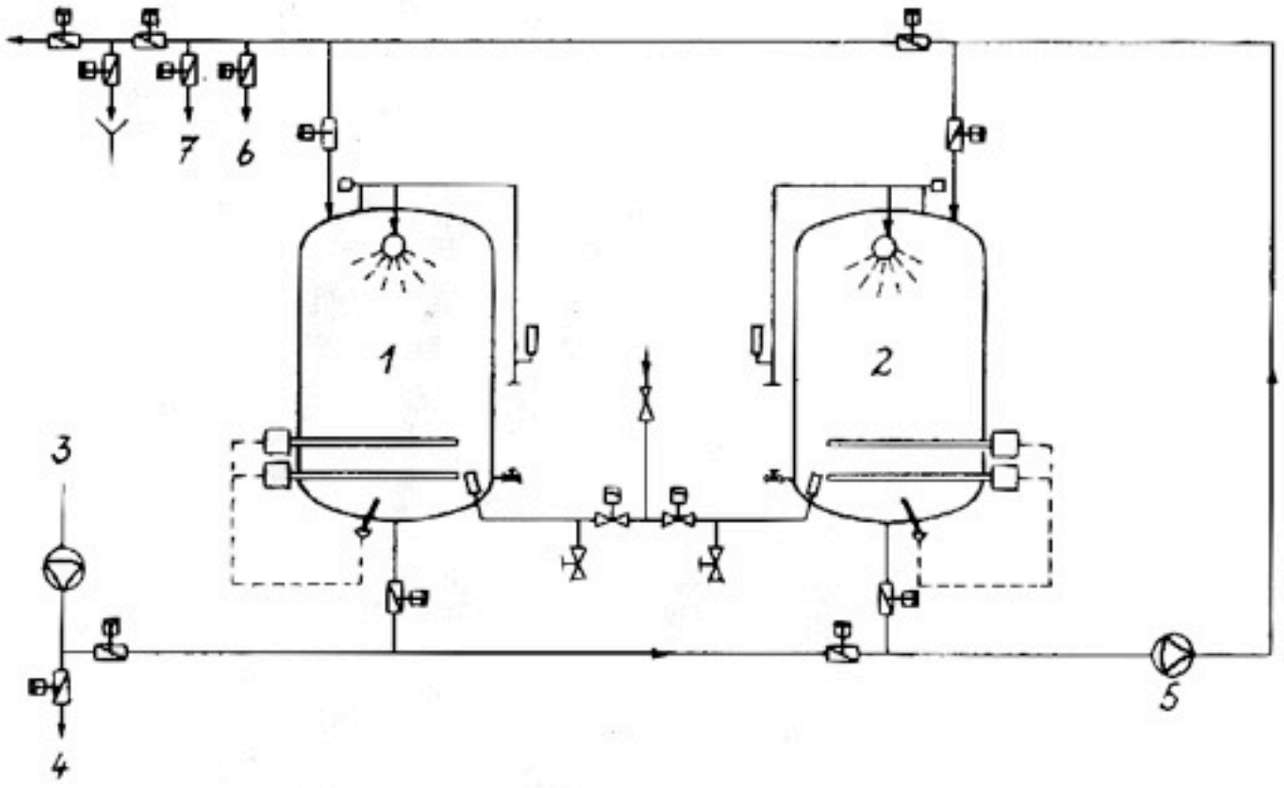


MS – Mash Acidification
WS – Wort Acidification

Lactobacillus amyloysis, amylovorus

- Faster accumulation in the Beer Wort
- Higer acidification abilities (up to 2% MS, pH <3,0)
  - Homo fermentative MS-accumulation (2 mol M s from 1 mol Glucose)
  - Growth at high Temperatures up to 52 °C
  - fermentation of Dextrin
  - Higher proportion an L(+)-Lactate
- higher hop sensitivity, less growth at temperatures above 30°C
  - No formation of Amines (Histamine) and other toxins
  - No Diacetyle formation
  - Easier handling of the cultures

Example Explanation



Biologische Säuerungsanlage

(1) Gärtank für Sauergut,
(2) Lagertank für Sauergut,
(3) vom Vorlaufgefäß,
(4) zur Würzepfanne,
(5) Sauergutpumpe,
(6) zum Maischbottich,
(7) zur Würzepfanne

Control parameters

1. Determintion of the lactic acid contents:

- 25 ml Substrate + Bromethymole blue as an Indicator against n/10 NaOH Tritation;
- Consumed ml NaOH x 0,036 = % Lactic Acid
- Temperature: 47-49 °C
- Sensoric and flavor checks
- Dosage:
  - for 100 kg Malt at the starting mash 40 – 100 g MS
  - for 1 hl Wort (10 min. before end of boiling) 9 – 16 g MS

Driving parameter

- The production of the acidic Wort is normally (9 - 12 % Stw) diluted first Wort utilization (in an emergency an un-hopped Wort concentrate can be used)
- Before the induction of a fresh wort the fermenter should be if possible 2/3 emptied. This reduces the acidic stress upon the lactic acid bacteria's and the beer spoiling micro organisms and speeds up the following acidification
- In the case of a contamination with a film forming yeast - temperature with a short approx. 50 °C increase
- The Storage
  - The stacking of the MS can take place in none heated hollow-ware.
  - The continuation over the weekend is without any issues possible. .
  - Using a longer storage the cultures should be taken from the log phase and be stored at 10 °C

Pro´s und con´s

Advantages	Disadvantages
1. where applicable shortening/ Optimization of the Mashing process 2. rapid lautering • less additional colouring in the wort preparation process • eventually better extract yields • Better stabilization of the zinc contents • where applicable a faster fermentation and maturing (FAN, Trub) • better foam stability (+/-), colloidal	1.Bitterness loss 2-2,5 % higher • higher TBZ • worse DMS-P cleavage • where applicable for stronger degradation of protein substances •(ELG of the Malt is to be considered)