Adapting water to beer style

how to turn "raw" water into "perfect" water

(case studies)

brewing ideas

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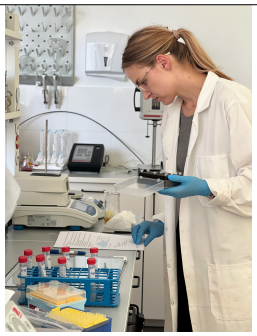
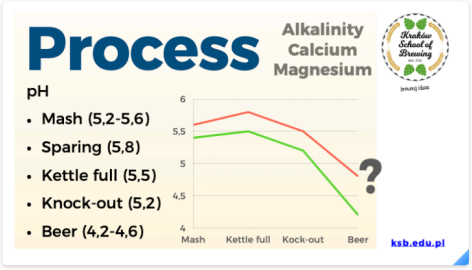
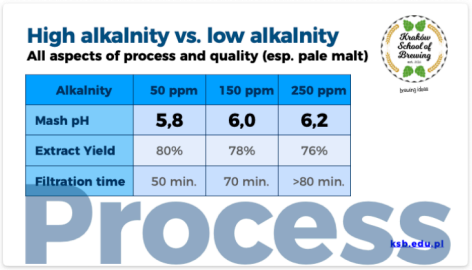
- Education
- Training
- Laboratory
- **Consulting**
- Microbrewery
- Conference



Karlovac 2025

- 1st part of „water talk”





Agenda

1. **Why water matters?**
2. Practical objective and step by step approach
3. Water adjustement (adapting to the style)

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4. Conclusions

GOOD BEER

No off-flavors

In style

Consistent

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Designing GOOD BEER what comes first?

1: SELECT
→ **malts** → **hops**

2: ADJUST
→ 💧 **(water)**

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Water is not NEUTRAL

We are not just adjusting water. We are shaping flavor.

- 90–95% of beer is water (functionally active)

It impacts:

- mash pH → enzymatic performance
- process stability
  (eg. isomerisation yield, hot trub, DMS, flavor, etc.)
- hop perception (sharp vs soft bitterness)
- malt expression (roundness vs dryness)

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Copying historical profiles

Water profiles are not recipes. They are outcomes.

- Burton ≠ target
- Pilsen ≠ universal lager solution
- **Raw replication ignores:**
  - grist composition
  - modern malts quality
  - evolution of process conditions

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Practical objective

From water → to function

- **Instead of:**
  - Ca = 100 ppm
  - SO4 = 200 ppm
- **Think:**
  - what bitterness quality do I want?
  - what mouthfeel is expected?
  - what fermentation outcome do I want?

Step-by-step approach

From water → to function

1. Define beer style functionally
2. Analyze raw water
3. Decide target ion effects
4. Adjust:
   - acidification
   - calcium
   - salts
5. Validate (pH + sensory)

Water report numbers (functional role of key ions)

Ion	Practical effect	UNIT / range
HCO_3^-	buffering → risk of high mash pH	ppm HCO3 (x0.82) 0-200 ppm CaCO3
Ca^{2+}	mash pH ↓, enzyme stability, yeast flocculation	50-150 ppm
SO_4^{2-}	dryness, bitterness sharpness	0-400 ppm
Cl^-	fullness, sweetness, body	0-200 ppm

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Alkalinity (as $CaCO_3$)

Heat Map

°P ↓ / EBC →	<20 EBC	20–40 EBC	>40 EBC
<10 °P	🟦 LOW	🟨 MED	🟥 HIGH
10–15 °P	🟦🟨 MED	🟨 MED	🟥 HIGH
>15 °P	🟦 MED	🟥 HIGH	🟥 HIGH

🟦 <50 mg/L 🟨 50–120 mg/L 🟥 >120 mg/L

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Case 1 – Hop-forward Pale Ale

Too alkaline. Too soft for ‚hops'.

- Ca: 40 mg/L
- SO_4: 30 mg/L
- Cl: 25 mg/L
- Alkalinity $CaCO_3$: 150 mg/L

GOAL:

- crisp bitterness
- dry finish
- stable mash pH

Strategy:

- reduce alkalinity
- increase sulfate
- moderate calcium

Case 1 – Hop-forward Pale Ale

Too alkaline. Too soft for ‚hops'.

- Ca: 40 mg/L → Ca: 90-120
- SO_4: 30 mg/L → SO_4: 150-200
- Cl: 25 mg/L → Cl: 50-60
- Alkalinity $CaCO_3$: 150 mg/L → <80

ADJUSTMENT

- Dilution (e.g. 50%) → reduce alkalinity
- Add $CaSO_4$ (gypsum)
- Minor $CaCl_2$ (balance)

Strategy:

- reduce alkalinity
- increase sulfate
- moderate calcium

Case 2 - LAGER

This water is the opposite problem – too hard, too bitter.

- Ca 120
- SO_4 180
- Cl 50
- Alkalinity $CaCO_3$: 270

GOAL:

- soft bitterness
- round palate
- low mineral impression

Strategy:

- strong dilution
- minimal salts
- acidification

Case 2 - LAGER

This water is the opposite problem – too hard, too bitter.

- Ca 120
- SO_4 180
- Cl 50
- Alkalinity $CaCO_3$: 270

→ Ca: 40

→ SO_4: <50

→ Cl: 50

→ <50

ADJUSTMENT

- Dilution (e.g. 75-80%) → reduce alkalinity
- Acidification (eg. lactic acid)
- Minor $CaCl_2$ (balance)

Strategy:

- strong dilution
- minimal salts
- acidification

Case 3 - One water-> two directions

IPA (sulphate driven) | Helles (soft and low mineral)

	IPA	Helles
• Ca 70	110	40
• SO_4 50	200	10
• Cl 20	50	50
• $CaCO_3$: 270	50	30

GOAL:

- hops forward vs. delicate and round
- higher sulphates vs. lower sulphates
- medium alkalinity vs. very low alkalinity

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Water is not good or bad.
It is appropriate or not.

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Common mistakes
These are the real problems

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1. **treating water only as a solvent**
2. over-mineralization
3. ignoring pH
4. chasing ratios
5. no validation

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Perfect water does not exist.

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You can turn your water
into a perfect one
that fits your beer.

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Calcium (Ca^{2+})

Heat Map

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°P ↓ / EBC →	<20 EBC	20–40 EBC	>40 EBC
<10 °P	🟨 MED	🟨 MED	🟨 MED
10–15 °P	🟨 MED	🟥 HIGH	🟥 HIGH
>15 °P	🟥 HIGH	🟥 HIGH	🟥 HIGH

🟨 40–80 mg/L 🟥 80-150 mg/L

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Chloride (Cl^-)

Heat Map

°P ↓ / EBC →	<20 EBC	20–40 EBC	>40 EBC
<10 °P	🟨 MED	🟨 MED	🟥 HIGH
10–15 °P	🟨 MED	🟥 HIGH	🟥 HIGH
>15 °P	🟥 HIGH	🟥 HIGH	🟥 HIGH

🟦 <40 mg/L 🟨 40–100 mg/L 🟥 100-180 mg/L

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Sulphate (SO_4^{2-})

Heat Map

°P ↓ / EBC →	<20 EBC	20–40 EBC	>40 EBC
<10 °P	🟨 MED	🟨 MED	🟦🟨 MED
10–15 °P	🟥 HIGH	🟥 HIGH	🟦 LOW
>15 °P	🟨 MED	🟨 MED	🟨 MED

🟦 <50 mg/L 🟨 50–200 mg/L 🟥 200-400 mg/L

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How much do I add?

Acid | calcium chloride | calcium sulphate

Lactic acid (88%)	85 ml / 10 hL	170 ml / 10 hL	255 ml / 10 hL
lower alkalinity	50 ppm	100 ppm	150 ppm

CaCl2 x 2H20	100 g / 10 hL	250 g / 10 hL	500 g / 10 hL
increase Ca	27 ppm	68 ppm	136 ppm
increase chlorides	48 ppm	120 ppm	240 ppm

CaSO42 x 2H20	100 g / 10 hL	250 g / 10 hL	500 g / 10 hL
increase Ca	23 ppm	58 ppm	115 ppm
increase sulphates	55 ppm	138 ppm	275 ppm

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- If you want to improve your process and beers and correct your water contact us:

1. we will analyze your water to get precise results
2. we will do calculations and prepare the ready to use correction plan for each beer style
3. validate your results after your brew (if it needs more adjustments)

All this at affordable price ca. 40 Euro per quality analysis and 30 Euro per each beer style correction plan.

Thank you!

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„Water is the driving force of all nature”
Leonardo da Vinci

SZTF

XXII School of Fermentation Technology

6-8 May, 2026
Kocierz Hotel

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