1.1.2 Specification of test results

The reading, easy comprehension and simple comparability of different analysis, particularly when originating from different laboratories, calls for specification uniformity. For qualitative results the following specifications have to be used:

- Unverifiable:
  If, based on the named method, a substance or a substance class cannot be detected in the tested water volume.

- Traces:
  Concentrations, which are not detectable quantitatively with the named method.

- Detectable:
  If the quantitative detection is possible.

As a rule, the concentration specification of the ingredients is carried out in unit of weight or unit of capacity. The unit of weight has to be specified in mg = 10^{-3} g = 0.001 g. In case of particularly low concentrations the specification is carried out in µg = 10^{-6} g.
The unit of capacity is 1 l. Thus, the test results are specified in mg/l or in µg/l, which corresponds with "parts per million" (ppm) for mg/l or "parts per billion" (ppb) for µg/l.
The number of decimal places named in the test result for drinking water and mineral water varies according to the attainable precision. As a general principle, the penultimate place shall be exact while the last may show a different grade of accuracy.
Electrolytically dissociating components are listed as ions (anions or cations).
For data comparability using the millimol-equivalent-specification for electrolytically dissociated components and using the millimol-specification for non-electrolytes and dissolved gases is possible. Also, details on acid and base consumption (ml/l) are added. The specification for hardness is carried out in degree of German hardness and meq/l or mmol/l (SI-unit).
The data obtained from mineral water examinations is specified in ions, mg/kg, meq/l or mmol/kg and meq-percent. In general, 2 decimal places are specified for meq/l and for meq-percent 1 decimal place.
For the water analysis plausibility check the instruments of ion balance as well as the comparison between mineral content and evaporation residue

(after correction of the CO_2-loss) as well as between mineral content and conductivity should be used.

Literature

1. Praxishandbuch der Brauerei, Loseblattsammlung, Hrsg. H.-U. Heyse, Kap. 2.4: Wasser und Wasseraufbereitung, B. Behr's Verlag, Hamburg
2. Schildbach, S.: Interpretation einer Trinkwasseranalyse. BWelt Nr. 25, 2001, 946

Dimension details and conversion factors for the water analysis

Calcium (Ca^{2+})	1 mg/l =	0.0499 meq/l =	0.0250 mmol/l
Magnesium (Mg^{2+})	1 mg/l =	0.0822 meq/l =	0.0411 mmol/l
Sodium (Na^{+})	1 mg/l =	0.0435 meq/l =	0.0435 mmol/l
Iron (Fe^{3+})	1 mg/l =	0.0537 meq/l =	0.0179 mmol/l
Ammonium (NH^{4+})	1 mg/l =	0.0555 meq/l =	0.0555 mmol/l
Manganese (Mn^{2+})	1 mg/l =	0.0364 meq/l =	0.0182 mmol/l
Sulphate (SO_4^{2-})	1 mg/l =	0.0208 meq/l =	0.0104 mmol/l
Chloride (Cl^{-})	1 mg/l =	0.0282 meq/l =	0.0282 mmol/l
Nitrate (NO_3^{-})	1 mg/l =	0.0161 meq/l =	0.0161 mmol/l
Nitrite (NO_2^{-})	1 mg/l =	0.0217 meq/l =	0.0217 mmol/l
Bicarbonate (HCO_3^{-})	1 mg/l =	0.0164 meq/l =	0.0164 mmol/l
Carbonate (CO_3^{2-})	1 mg/l =	0.0333 meq/l =	0.0167 mmol/l
Carbon dioxide (CO_2)	1 mg/l =		0.0227 mmol/l
Silicic acid (H_2SiO_3)	1 mg/l		
Phosphate (HPO_4^{2-})	1 mg/l		
Oxygen (O_2)	1 mg/l		
Hardness	1 mmol/l =	2.00 meq/l =	5.60 °dH

1.1.3 Sampling

The correct sampling is prerequisite for obtaining faultless analytical findings. The sampling must be adapted to the respective examination purpose. As a rule, separate samples are taken for chemical and microbiological analyses, since different equipment and containers are required for the sampling and for the handling of the samples.

In principle being distinguished:

Random samples taken during examinations on possible contaminations or as orientation prior to more extensive sampling programs;

Periodical (discontinuous) samples (time, volume or flow rate proportional) as well as

Continuous samples, which serve the permanent monitoring of flowing waters for the compliance with quality standards. Samples taken continuously can be mixed to average samples and provide average data.

Test series (depths or area profile tests) are conducted during exploration of standing waters.

Equipment
For sampling glass or plastic bottles have to be used, which have been cleaned faultlessly with stoppers made of inert glass or synthetic material.
For physical chemical examinations (e.g. pH, conductivity measuring, determination of silicic acid content, substances of low concentration, which can be adsorbed by the bottle wall) bottles have to be used that are made of hardly hydrolysable glass with closures made of glass or polytetrafluorethylene. For sampling in greater water depths submersible equipment is being used that allows for the water to ingress into the sampling container in the desired depth.

Procedure

- Rinse bottles intended for sampling repeatedly with the water to be examined
- For qualitative examinations take 1 l
- For quantitative determinations generally take 3 l
- For examinations according to the German Drinking Water Ordinance draw sample of 10 l
- For the determination of dissolved gasses (if not conducted at the sampling place) and easily variable ions (e.g. Fe, Mn, Pb) as well as for most physical and physical-chemical examinations separate samples have to be taken
- For groundwater normally random sampling suffices; carrying-out of sampling preferably without gas exchange, flocculation and turbulences
- Sampling at new drill holes only after pump testing (determination of capacity); at drillings not having been used for a longer period of time prior to sampling pump slowly and evenly for 20 minutes; prior to sampling at shaft wells the renewal of the water out of the groundwater is required
- During sampling of well water neither particles floating on the surface nor troubled mud may get into the bottles; to lower or pond the water table is to be avoided
- From water pipes let the water run for 20 minutes directly prior to sampling in an approximately 5 mm strong water-jet; avoid opening taps in a jerky manner
- In order to determine heavy metals absorbed from conduit pipes collect the water that runs off first after a longer residence time (8-12-24 hrs)
- At lifting and suction pipes interconnect with special pipes and vessels
- Prior to sampling unscrew and remove possibly existing faucet aerators
- At containers, lakes and dams draw samples from 0.3 – 0.5 m below surface and use diving equipment if sampling in specified depths

Cleaned and sterilised glass bottles have to be used for microbiological examinations. Chlorinated water samples need to be pre-filled with 1 ml of sterile sodium thiosulphate solution $Na_2S_2O_3$ = 2 g/l per 1 litre water sample in order to instantly bind chlorine or chloramines present in water. The sodium thiosulphate filled in first shows no impact on the germs content or on germ growth in this concentration during the following examination.

Literature

1. DEV A3, A11 - A15, A 21
2. A-EBC

1.1.4 Odour and taste

The water used in the brewery and for lemonade production must be neutral in odour and taste just like drinking water.

Principle
The qualitative check is carried out after shaking in an odourless locked bottle. For quantitative determination the odour threshold of water carrying an odour is determined. For this, the odorous water is diluted with odour-free water such that the odour is only just discernible (from a minimum of 3 individuals). One describes the ratio of the total volume (water carrying odour + odour-free water) to the volume of the water sample contained in the mixture as odour threshold value. The taste examination needs to be carried out always after the odour examination since the sensation of odour is influenced by the taste.

Equipment
Sample bottles made of glass with glass stopper or with Teflon-coated closures

Procedure
Qualitative evaluation of the odour
- Fill water into an odour-free glass bottle and seal it
- Carry out examination possibly straight after sampling
- Fill bottle completely for dispatch
- For evaluation fill the bottle with 0.5-2 l content to one half, seal it and shake it strongly
- Evaluate odour immediately after taking off the stopper
- If the odour is not clearly definable at room temperature repeat examination at 60 °C

Specification of the results

Odour

1. According to the odour intensity:
   - none
   - weak
   - strong

2. According to the type:

a) general odour:
   - earthy
   - musty
   - putrefactive
   - sanious
   - fishy
   - aromatic
   - others

b) defined odour after:
   - Chlorine
   - Tar
   - Mercaptan
   - Phenol
   - others

The temperature of the water sample has to be indicated in the examination.

Qualitative evaluation of the taste:
- Taste only such water samples where there is no infection or poisoning danger
- Normally, carry out examinations at water temperature between 8-12 °C
- Repeat examination at 30 °C if taste is not clearly definable

Taste

Specification of the results

1. According to taste intensity:
   - none
   - weak
   - strong

2. According to the type:

a) general taste:	dull
	salty
	acidic
	alkaline
	bitter
	sweetish
b) defined taste after:	Chlorine
	Soap
	Fish
	others

Recommended guideline value according to WHO (World Health Organization):
Odour and taste: no value, but described as an indicator for presence of potentially harmful substances.

Limit value according to EU-Council Directive 98/83/EG):
Odour: no value, but "Acceptable to consumers and no abnormal change".
Taste: no value, but "Acceptable to consumers and no abnormal change".

Limit value according to TrinkwV 2001 (DE)/German Drinking Water Ordinance:
Odour threshold: 2 at 12 °C, 3 at 25 °C
Taste: no value, but "Acceptable to consumers and no abnormal change".

Literature
1. DEV, B 1/2/3