TU Dresden Institute of Hydrochemistry	Chemical Deacidification with Calcium carbonate and semiburnt Dolomite	E 1 2010

Practical Course: Basics of Hydrochemistry

1. Subject: Lime-Carbonic acid-Equilibrium
Chemical Deacidification of Water by Filtration over Calcium carbonate and semiburnt Dolomite

2. Aim: A bed process for the deacidification of water with different filter materials will be demonstrated. Thereby observed chemical reactions should be discussed by using of the Lime-Carbonic acid-Equlibrium.

3. Completion and evaluation of the experiment:

- As model water tap water mixed with commercial carbonated mineral water (Corp. MARGON) will be used
- A parallel treatment of this carbonate solvent water will be performed in four reactor tubes. The reactors are filled with several filtermaterials of the company AKDOLIT GmbH. This materials are used in large water treament plants (10.000 m^3/d).

Reactor 1: HYDRO-CALCIT, a globe-shaped material made of calcium carbonate ($CaCO_3$),
Reactor 2: HYDRO-KARBONAT, a microcrystalline material made of calcium carbonate ($CaCO_3$),
Reactor 3: AKDOLIT-GRAN, a porous, dolomitic material ($CaCO_3$,/ MgO),
Reactor 4: MAGNO-DOL, a splinter dolomitic material ($CaCO_3$,/ MgO).

- Respectively one Liter of water will be used for feed the reactor tubes. The filter materials have to cover by water permanently. The first 300 mL of outlet (void fraction = 300 mL) will be rejected.
- The volumetric rate of flow of the Reactors 1 - 4 should be about 40 mL/min. Therefore fast dropping has to be adjusted.
- The following parameters of the raw and the treated water should be determined corresponding to the instructions (I/II):
  - temperature,
  - pH value,
  - electrical conductivity κ,
  - total hardness of water,
  - calcium hardness,
  - magnesium hardness,
  - acid capacity $K_{S\,4,3}$ (+m-value),
  - base capacity $K_{B\,8,2}$ (-p-value),
- comparison and discussion of the results
  Describe the reasons of the observed parameter differences!
  Designate advantages and disadvantages of the used filter materials!

Tab. 2: Summary of the experimental results

Parameter	raw water	HYDRO-CALCIT	HYDRO-CARBONAT	AKDOLIT-GRAN	MAGNO-DOL
pH-value					
Temperature ϑ [°C]					
el. conductivity κ [μS/cm]					
Acid capacity $K_{S\ 4,3}$ [mmol/L]					
Base capaity $K_{B\ 8,2}$ [mmol/L]					
Calcium-conc. [mmol/L]					
Magnesium-conc. [mmol/L]					
Total hardness [°d H]					
Saturation index S_I					

4. Generale Information for employment protection:

- A smock and protecting glasses should be dressed inside the lab!
- The number of emergency alarm is 112!
- The regulations are given by the scientific staff should be followed!
- The security officer is to inform about happened accidents and injuries!
- Eating, Drinking and Smoking are prohibited in the lab!
- Protecting gloves should be dressed by working with acids, bases and other dangerous materials!
- Never use your mouth to transfer liquids with a pipette!
- You have to inform about the location of the fire extinguishers, the emergency showers, the eye showers, the first-aid kits and the escape routes before starting the experiment!
- First-aid rules:
  - chemical burns: flushing your skin with much water,
  - eye burns: flushing your eyes with an eye shower,
  - cutting wounds: cover steril, don´t wash with water,
  - consultate a doctor
- Liquid wastes should be disposed in marked bottles,

- Clean your hands thoroughly after working in the lab!

Continuative Literature *[Signature of the research library]*

Deutsche Einheitsverfahren DIN 38 406 E 3 und DIN 38 409 H 7

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Hütter, L. A. (1990) Wasser und Wasseruntersuchung. 4. Aufl., Salle & Sauerländer, Frankfurt am Main, Aarau, S. 90-94, 294-299 [AR22620 H880(6)]

Kittner, H.; Starke, W.; Wissel, D. (1985) Wasserversorgung. VEB Verlag für Bauwesen, Berlin, 5. Aufl., S. 148-149, 155-158, 207-210 [AR22340K62(6)]

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Stetter, D.; Overath, H. (1997) Das Rösrather Verfahren - ein neues Hochleistungsverfahren zur Entsäuerung von Wasser mit Kalkmilch. bbr 48 (9), 32-35.

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Wiegleb, K. (2001) Planungskriterien zur Enteisenung und Entsäuerung durch Filtration über halbgebrannte Dolomite. Gas-Wasserfach, Wasser-Abwasser 142(6), 417-422.

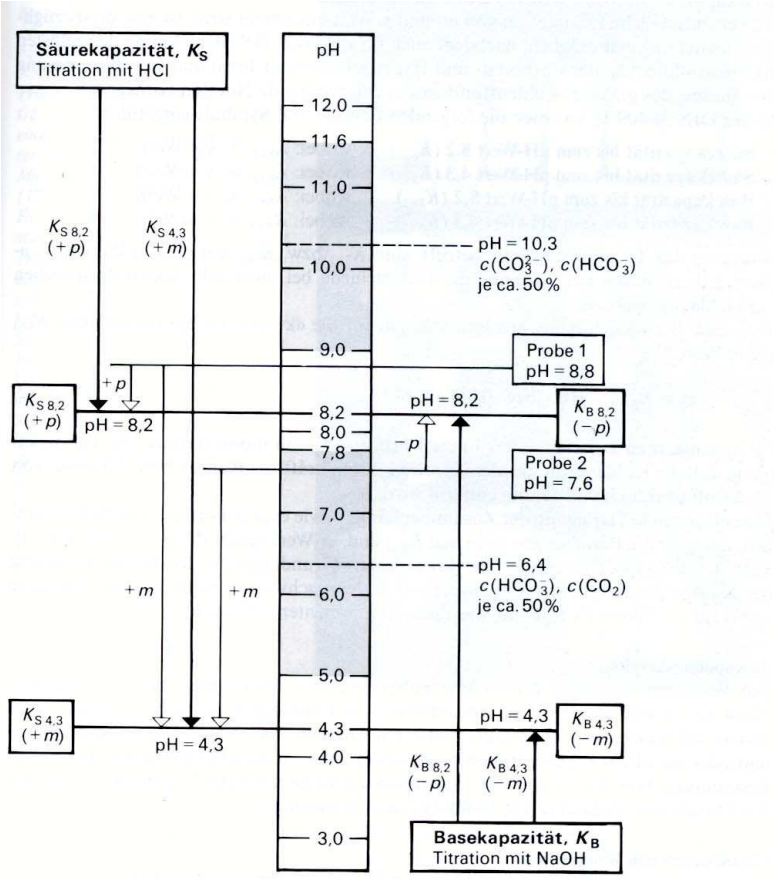

Abb. 2.3.4a *Schematische Darstellung der Bedeutung von Säurekapazität, K_S, und Basekapazität, K_B, bzw. der m- und p-Werte auf der pH-Skala (graue Bereiche: Pufferzonen). Der Abbildung kann entnommen werden, welche K_S- und K_B-Werte (m- und p-Werte) aufgrund des pH-Wertes eines zu untersuchenden Wassers zu bestimmen sind, z. B.:*
Probe 1: pH = 8,8; zu bestimmen: $K_{S8,2}$ (+p) und $K_{S4,3}$ (+m)
Probe 2: pH = 7,6; zu bestimmen: $K_{B8,2}$ (−p) und $K_{S4,3}$ (+m)

Hütter (1990) S. 295

<u>Please answer the following questions:</u>

- Explain the following terms:
  Total hardness, carbonat hardness (temporary hardness), permanent hardness, acid capacity, base capacity
- Which analytical parameters are usefull to determine the aggressivity of water?
- Explain the effect of deacidification materials calcium carbonate and semiburnt dolomite (chemical equation)!