- Product data sheet
- Application and recommendations

Akdolit® Magno-Dol CM

Neutralisation

1. General Overview

Akdolit® Magno-Dol CM is a dolomitic filter material with splinter shaped grains. It is used for neutralization of water by filtration up to the calcite saturation (pH_C), according to the German drinking water regulation (TrinkwV). During the process an increase in concentration of calcium, magnesium and hydrogen carbonate ions, which are physiologically and chemically advantageous in terms of corrosion, occurs.

Akdolit® Magno-Dol CM meets the requirements of the standard DIN EN 1017 Grade A, the German drinking water regulation TrinkwV and DIN 2000. When respecting the recommended guidelines for use, completion of insertion and continuous operation, no substances are emitted that could lead to an exceedance of limit values determined in the German drinking water regulation TrinkwV (see also DVGW worksheet W 214).

Akdolit® Magno-Dol CM guarantees safe and economic use and requires little maintenance due to its stable structure and its high chemical and microbiological purity.

2. Applications

Akdolit® Magno-Dol CM is used as a chemically reacting filter material in both open and closed fixed bed filters according to DIN 19605 for:

- Neutralisation and filtration of well, spring and surface water.
- Neutralisation and filtration in connection with deferrisation and demanganisation
- Neutralistion and filtration of pool water.
- Hardening of destillate and permeate for their use as drinking water.

3. Recommendations

3.1 The filter plant has to be designed in such a way that continious operation at a given flow rate can be achieved. A short-term underload of a maximum of 30% is tolerated.

3.2 The separation of high amounts of ferrous and manganese compounds or other suspended matter can lead to a partially blocked grain surface of Akdolit® Magno-Dol CM, resulting in an obstructed neutralisation process.
Therefore, at iron contents > 0.2 mg/l and/or manganese contents > 0.05 mg/l as well as at high contents of suspended solids, an additional filtration step should be foreseen.
If complex compounds of iron and manganese, or colloids and/or reducing ingredients are present in the water, please contact our engineering department for individual advices.

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4. Chemical and physical data

4.1 Chemical composition

- Calcium carbonate……$CaCO_3$ ca. 68.9%
- Calcium oxide…… CaO ca. 1.4 %
- Magnesium oxide.....MgO ca. 25.4%
- Magnesium carbonate.....$MgCO_3$ ca. 0.5%
- Iron oxide……Fe_2O_3 ca. 0.5%
- Aluminium oxide……Al_2O_3 ca. 0.2%
- Silicic acid……SiO_2 ca. 0.4%
- Water……H_2O ca. 2.7%

The values represent an average of regular analyses carried out over several years.

4.2 Grain size

- Grain size 1……0.5 – 2.5 mm
- Grain size 2……2.0 – 4.5 mm

4.3 Bulk density (storage density)

- Grain size 1 - 2…….... approx.1.1 t/m^3

4.4 Consumption

- per g CO_2*…….....approx. 1.3 g
- per mol $K_{B\ 8,2}$*……approx. 57.0 g

(including backwash losses)

4.5 Hardening

- per g/m³ CO_2*……approx. 0.1°dH
- per mol/m³ $K_{B\ 8,2}$*……approx. 0.33 mol/m³ Ca^{2+}
- per mol/m³ $K_{B\ 8,2}$*……approx. 0.33 mol/m³ Mg^{2+}
- per mol/m³ $K_{B\ 8,2}$*…..approx. 1.33 mol/m³ HCO_3^-

*bound

5. Technical data

5.1 Filter material layers

Based on the water analyses, the calculated specific quantity and taking into consideration the filtration rate:

- Open filters……...1,000 – 2,000 mm
- Closed filters……1,500 – 3,000 mm

5.2 Filtration rate

Depending on the scope of treatment and considering the hydraulic conditions:

- Open filters……..……up to 15 m/h
- Closed filters…… ……up to 30 m/h

5.3 Head loss

The head loss depends on:

- Grain diameter
  Head loss increases exponentially with the decrease of grain diameter.
- Height of layer
  Head loss increases linearly at higher layers of material.
- Filtration rate
  Head loss increases at higher filtration rates.
- Temperature
  Head loss increases at lower water temperatures.

Respecting the given filtration rates in 5.2, the additional maximum head loss caused by the filter material averages 0.1 bar/m filter material layer.

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5.4 Backwash (recommendation)

Depending on the load, the filters need to be backwashed regularly in accordance to the DVGW work sheet W 213-3.

Combined water and air backwash phases

1. Air scouring with approx. 60 m/h

- Duration……approx. 1 - 5 min

2. Combined air and water backwash

- Air……approx. 60 m/h
- Water……approx. 8 - 12 m/h
- Duration.....approx. 1 - 5min

Recommendation: If the water level rises up to the drain, the backwash sequence should be changed from combined water and air backwash to simple water backwash according to point 3.

3. Water backwash
The actual cleaning effect is achieved by final backwashing with water. The backwashvelocity should be selected so that at least the fluidization velocity is reached. Backwash velocities below this fluidization velocity are not suitable to reliably remove impurities.

- Duration: until the water is clear

4. Filtration - first filtrate discharge
The optimization of the individual backwashing steps should always be adapted to the specific filtration process.

5.5 Freeboard height

Under the above mentioned backwashing conditions, bed stretching will occur. The freeboard height should be adjusted accordingly, but should always be at least 25% of the filter material height.

5.6 Backwash water and first filtrate

Backwashing water and first filtrate with pH values >8.5 should not be discharged into waters with fish stocks, as it can cause fish damages.
High pH values are to be expected when treating very soft raw water with low CO_2 content by filtration with Akdolit® Magno-Dol CM.

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6. Quantities to use

6.1 General

A specific contact time between water and filter material is required in order to obtain the pH value of the calcite saturation (pH_c) by filtration with Akdolit® Magno-Dol CM.

Empty Bed Contact Time refers to empty filter bed volume and is dependent on the type and grain size of the filter material as well as the chemical and physical properties of the water to be treated.

6.2 Range of application

6.2.1 Base capacity up to pH 8,2 ($K_{B\ 8,2}$)
Diagrams 1 illustrates the base capacities up to pH 8,2, for which a filtrative deacidification with Akdolit® Magno-Dol CM is recommended, taking into account the carbonate hardness already present. Both, the increase in carbonate hardness required for soft waters and an acceptable increase in hardness for medium-hard waters are taken into account.

For medium-hard water with a high content of carbon dioxide, the specified optimum range can be adjusted by using an upstream mechanical deacidification step.

6.2.2 Acid capacity up to pH 4,3 ($K_{S\ 4,3}$)
Diagram 1 applies for the molar ratio:
$[HCO_3^-]:[Ca^{2+}] = 1 : \text{max. } 2$

6.2.3 Temperature

Diagram 1 is based on a water temperature of 10 °C. For other temperatures in the range between 5 °C and 15 °C, quantities to use shown in the diagram need to be multiplied by the factor given in table 1 below.

Table 1:

Water temperatur [°C]	Factor
5	1.48
6	1.35
7	1.24
8	1.15
9	1.07
10	1.00
11	0.94
12	0.88
13	0.84
14	0.79
15	0.75

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6.2.5 Iron and manganese content

With simultaneous neutralisation, deferrisation and demanganisation, the iron and manganese content in raw water should not exceed 0.2 mg/l and 0.05 mg/l respectively.
For raw water with higher contents of iron and manganese a pre-filtration with subsequent neutralisation should be planned. For plants with low treatment capacity, a single step treatment for iron contents up to 2 mg/l may be allowable. Under these circumstances the quantity to use has to be increased by up to 100 kg per m³/h of treatment capacity.

6.2.6 Application of diagram 1

For values of $K_{B\,8,2}$ < 0.10 mmol/l, a content of 0.10 mmol/l has to be used.
For values of $K_{S\,4,3}$ < 0.36 mmol/l, a content of 0.36 mmol/l has to be used.

6.2.7 Calculation of quantity to use

From diagram 1, the required contact time is determined with the value for $K_{B\ 8,2}$ and the intersection with the curve for $K_{S\,4,3}$.
For the plant design, the necessary quantity can be calculated using this method (see example of calculation).
Alternatively, the necessary quantity can also be read in kg per m³/h of treatment capacity and converted into the required space. Contact times for grain size 2 are calculated individually on request.

6.2.8 Example of calculation

Raw water:

Temperature	11°C
Total hardness	6 °dH
Total alkaline earth	1.07 mol/m³
Calcium	21.5 mg/l
$K_{S\,4,3}$	1.4 mol/m³
$K_{B\,8,2}$	0.65 mol/m³
(free carbon dioxide)	28.6 mg/l

Space required:

EBCT for 10°C of Diagram 1	12.5 min
Factor for 11°C water temperature	x 0.94
Factor	÷ 60 min/h
Factor	x 1,000 l/m³
Space required	**= 196 l/m³/h**
Bulk weight	x 1.1 kg/l
Quantity to be used	**= 216 kg/m³/h**

respectively

Quantity to be used:

For 10°C of Diagram 1	230 kg/m³/h
Factor for 11°C Water temperature	x 0.94
Quantity to be used	**= 216 l/m³/h**
Bulk weight	÷ 1.1 kg/l
required space	**= 196 l/m³/h**

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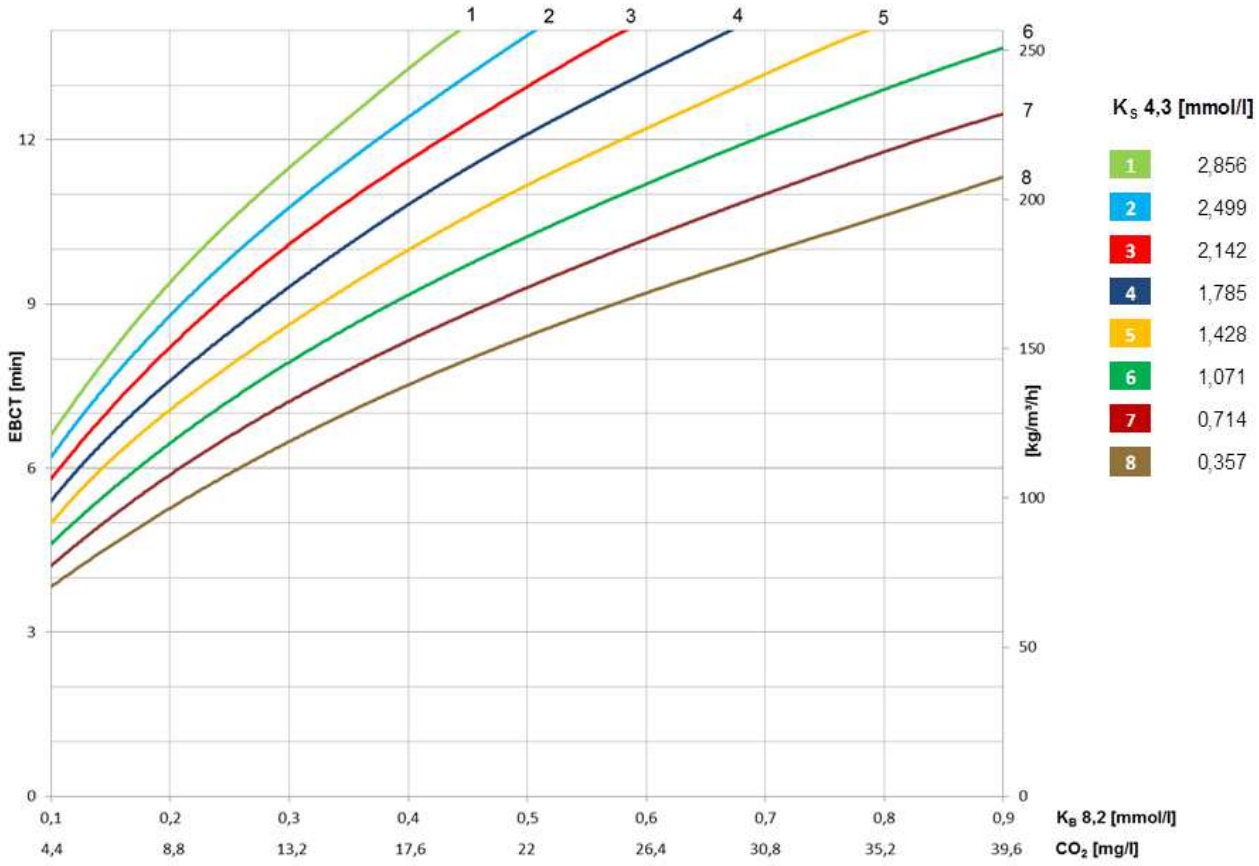
Diagram 1:

Empty Bed Contact Time for **Akdolit®** Magno-Dol CM, grain size 1

pH = pH_C (T = 10°C)



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7. Operating instructions

7.1 Initial filling

7.1.1 Preparation

Before filling materials, the nozzle floor and the backwash conditions have to be checked carefully. In order to do this, the filter should be filled with water to about 15 - 20 cm above the nozzle floor and the air blower is put into operation. Rinsing air must flow evenly across the whole area.

7.1.2 Supporting layers

The layer heights and grain sizes of the support layer material specified by the supplier of the filter system must be adhered to. If several different grain sizes are used, each individual layer must be levelled after it has been filled in. Since bacteriological contamination cannot be excluded during handling, the support layers and the complete filter system should be disinfected.
(see DVGW work sheet W 291).

7.1.3 Filling and starting-up

After the support layers have been placed, levelled and disinfected, the filter is filled with water from below by up to 2/3. Under no circumstances should water be applied to the filter from above, as this may change the position of the support layer and thus impair the backwash effectiveness. Before filling the filter, the sludge water flap must be opened so that the water introduced during filling can drain off. Akdolit® Magno-Dol CM is then flushed in or applied manually.
In the first step, a maximum of 1/3 of the calculated application quantity should be filled in. Afterwards, the filter should be intensively backwashed several times to even out the filter layer surface and to loosen it up.

With correct handling, a disinfection of Akdolit® Magno-Dol CM is not required due to the high alkalinity of the grain surface at the start of the process.
The filter must then be put into operation directly at full power. After the pH value has stabilized at the filter outlet, further filling takes place in two steps, each with 1/3 of the calculated application quantity.

Explanation: During the running-in period, the filter material is hydrated, which causes an over-alkalization of the filtrate. This condition can last for several weeks in very soft waters with low CO_2 content. The continuous full-load operation and the input of the filter material in part amounts (e.g. 1/3 at a time) make a decisive contribution to reducing the running-in effect. The same procedure should be followed for subsequent refills of filter material.

7.2 Loading the filter

If the planned load is maintained and if the filters are refilled on time and properly backwashed at regular intervals, then the required pH value will automatically be reached.
In the event of water overload of the filter plant, the target pH is not reached. A short-term underload of a maximum of 30% is tolerated.

7.3 Refilling

The consumption of Akdolit® Magno-Dol CM depends on the amount of carbonic acid in the water. An adequate treatment is ensured as long as the filling is at least 90% of the calculated layer height.

The more frequently the filter material is refilled, the more constant the deacidification results will be. The system must be backwashed after each refilling in order to remove fine particles and to prevent excessive turbidity.

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7.4 Storage

Akdolit® Magno-Dol CM must be stored in a dry and frost-free place. To limit the risk of material contamination, it is important to prevent damages to the packaging or contamination of the transport and storage silos. Refills should only be made from original bags or silos. If stored properly, the material has an unlimited shelf life. Possible aging effects of the outer packaging must be taken into account.

7.5 Shutdown and restart

7.5.1 Shutdown

Before shutting down, the filter needs to be backwashed intensively. The filter can be kept filled with water for short-time standstills (3 - 4 weeks). Before longer periods of standstill, water will need to be drained off via the bottom drain after washing with open sludge water drain. After the water has drained off, the filter material will require drying for 15 minutes with rinsing air. In order to prevent condensation, the upper manhole should remain open until restart.

7.5.2 Restart

The filter is backwashed before it is put back into operation. If necessary, the microbiological harmlessness of the filter system must be checked.

8. Delivery

Ex works

a) In poly-bags of 25 kg each
b) Loose in silo vehicles
c) In big bags (filling quantities by arrangement)

9. Disposal

The disposal of filter materials should be undertaken by specialized companies. In this context, a chemical analysis of the filter material is required, of which the scope must be agreed with the waste disposal company. Depending on the local regulation, the waste code number of the filter material should also be indicated.

10. Individual advice

Due to the specific nature of each individual case, advice and recommendations can only be given on a case by case basis. To determine the treatment efficiency and the adaptation to the customer-specific requirements, Lhoist always recommends carrying out pilot tests before commissioning in order to be able to make a firm statement.
The information, indications and advices contained in this datasheet are therefore legally non-binding. Individual proposals will be made on request.

All the data given are guide values or average values with production and storage-dependent tolerances. They serve as a product description and should not be considered as warranted characteristics. It is the user's responsibility to check the suitability of the product for its intended use.

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