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PROJECT «REMOVAL OF LIME IN WATER PIPES»

DATE:

Report written: July 5, 2022.

GOAL:

Effects of DabV units in dissolving lime deposits on the inside of water pipes.

SAMPLING:

Erik Kilaas, Microhelse AS and Linn Kuremyr, Laborant Denofa Lilleborg following the procedure given in **Appendix 1**. Sampling date: 22 June 2022

METHOD:

Sampling procedure is described in detail in **Appendix 1**. The assignment with the analyses of the water samples was performed by ALS Laboratory Group Norway AS, which has forwarded the samples for chemical analyzes to: ALS Czech Republic, s.r.o., Na Harfe 336/9 Prague 9 - Vysocany. (**Appendix 2**), The analyzes were performed in anonymized randomized order.

Statistical processing is performed by analysis of variance where the p-value is adjusted for multiple comparisons using false detection rate.

RESULTS:

Analyses of water before the onset of DabV, and 2 and 4 minutes after installing DabV outside the waterpipes are given in **Appendix 3**. There were significant increases in the parameters: Calcium, magnesium, hardness, calcium hardness, magnesium hardness and hardness such as CaCO_3 over the time period of 2 and 4 minutes resulting from the effects of DabV.

The results are presented as a box plot in **Figure 1**, showing clear increases over time with little spread between the replicants. In **Figure 2**, the average values within each time point are presented as changes in percentage of the initial value before the installation of DabV. These results indicate that DabV has led to dissolving coating of limescale on the inside of the pipes, and that significant changes occurs after only a few minutes.

CONCLUSION:

The discovery that DabVs can dissolve limescale on the inside of the water pipe will have practical consequences for various purposes - in washing machines, in dishwashers, water heaters etc.



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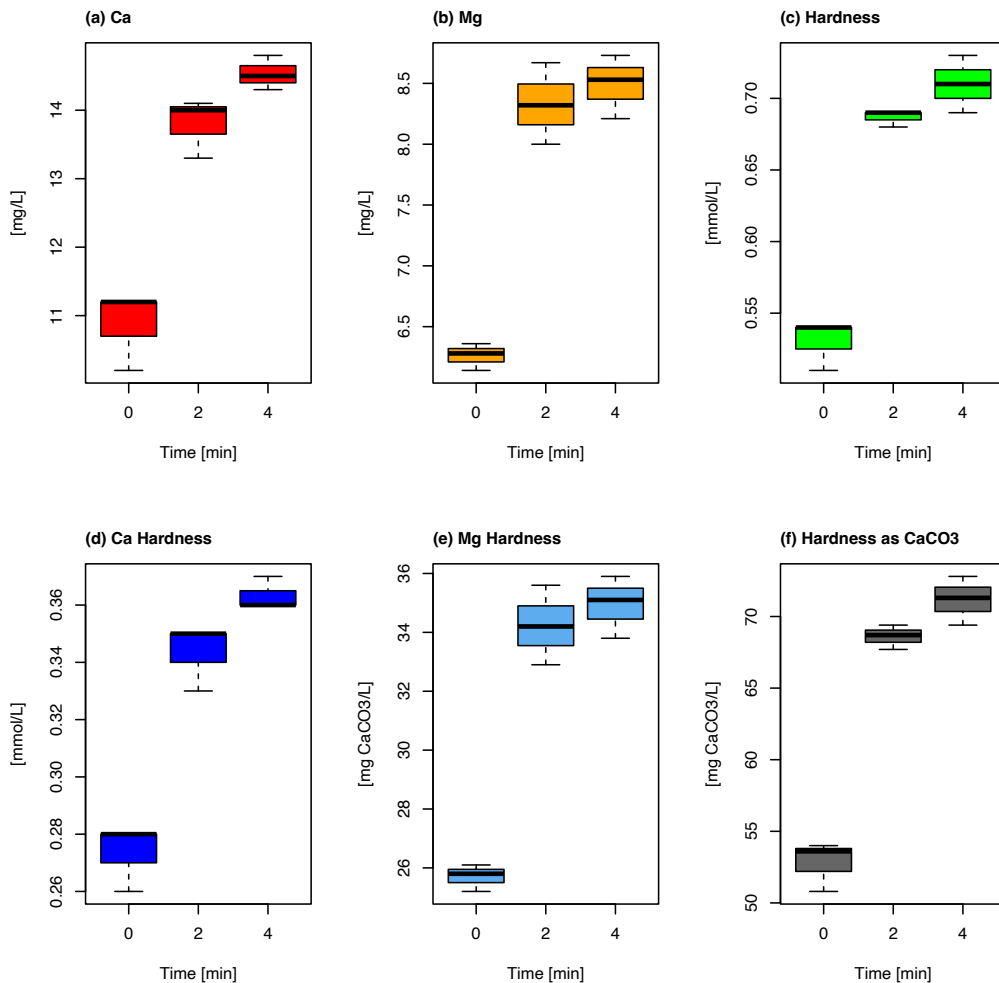


Figure 1. Boxplot of changes in water due to DabV placed outside the water pipe reveals increases in the parameters calcium (Ca), magnesium (Mg), hardness, calcium hardness, magnesium hardness and hardness such as CaCO₃. Time 0 is before DabV was applied, and times 2 and 4 show results of samples taken 2 and 4 minutes after DabV was applied. Within each time point, the spread between the three replicates at each time point are displayed.



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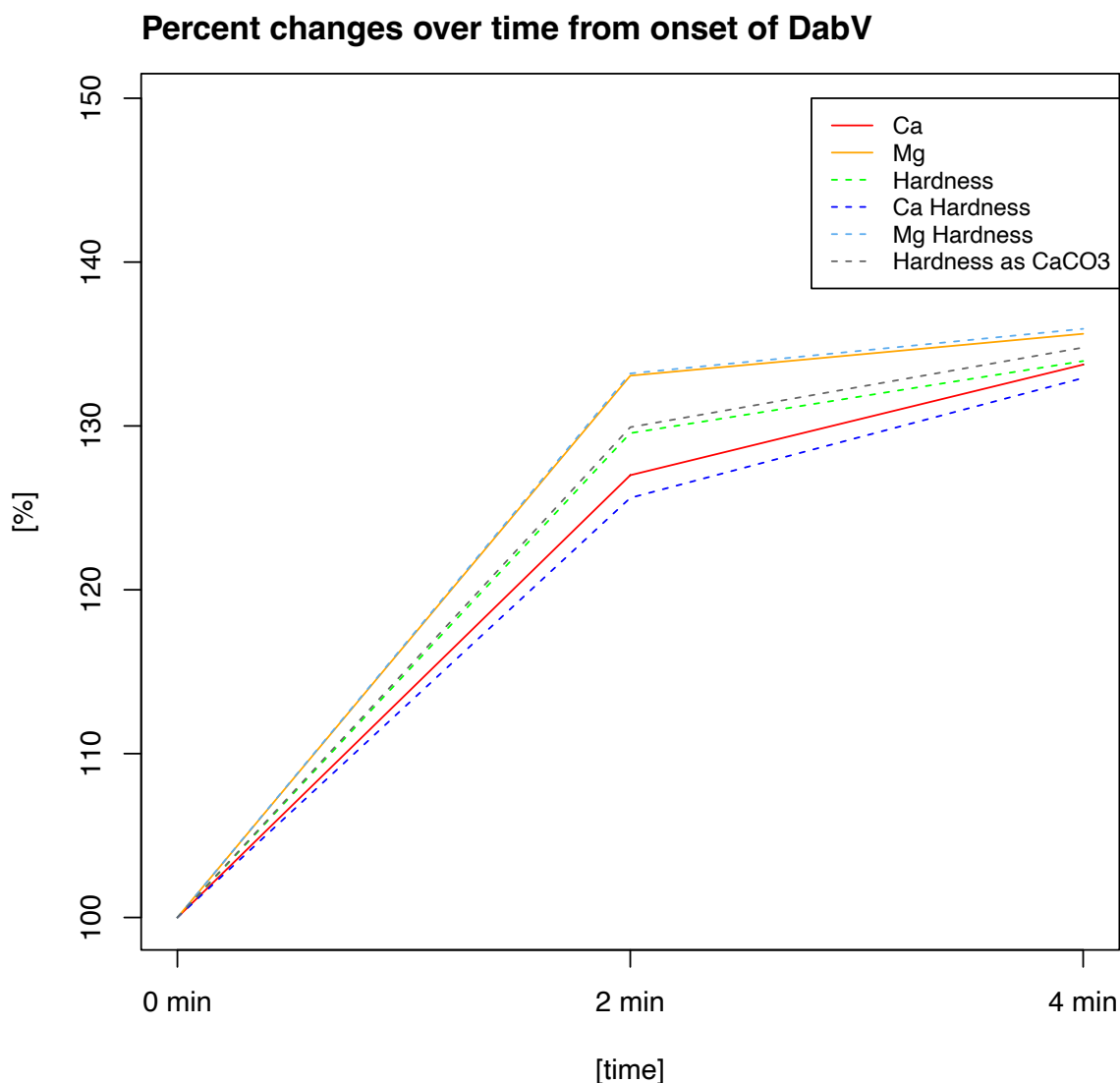


Figure 2. Line plot of increases caused by DabV placed the outside the water pipe for the parameters calcium (Ca), magnesium (Mg), hardness, calcium hardness, magnesium hardness and hardness such as CaCO₃. Time 0 is before DabV was applied, and times 2 and 4 show results of samples taken 2 and 4 minutes after DabV was applied. The lines show percentage increases from the initial value before DabV was applied (0 min) as average values at each time point.



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Appendix 1.

Procedure for sampling for project Lime 2

- 1) Bring 3 60ml, 3 100ml and 3 500ml bottles marked no. 1022-1035-1012 from the car to enter the test site, open the cold-water tap, wait 2 minutes and fill the bottles.
- 2) Take all the bottles out to the car and place them in cooler bag no. 1 in the front of the car.
- 3) Then bring 1 DabV water improver into the sample room and mount it on the cold-water pipe under the same sink. Also bring cooler bag no. 2 with bottles marked no. 1019-1025-1015-1032-1021-1018 in.
- 4) Then open the cold water tap to let the water run for 2 minutes at the same time as you take out 3 pcs 60 ml, 3 pcs 100ml 3 pcs 500ml bottles marked no. 1019-1025-1015.
- 5) After 2 minutes, fill the 9 bottles while the water is still flowing and place them in cooling bag no. 2.
- 6) Wait another 2 minutes and fill 3 pcs 60ml, 3 pcs 100ml 3 pcs 500ml bottles marked with no. 1032-1012-1018 while the water is still flowing. Then place them in cooling bag no. 2
- 7) Then close the tap and remove the DabV unit from the pipe.
- 8) Take cooler bag no. 2 and the DabV unit out in the car and place them at the opposite end of the car as cooler bag no. 1 was placed.
- 9) Drive to ALS Laboratory Group Norway AS Drammensveien 264 0283 Oslo



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Appendix 2. Analyze certificate from ALS Laboratory Group Norway AS,

| | | | | | |
|---|--|---|--|--|--|
| Work Order Reference NO 22211437 | | Bestillingsadresse: Audette Oslo Drammensveien 264 0283 Oslo Audette Norge AS Tromsøen 17 | | Avringsnett (vanntilføring) Oslo: 0800 - 1700 Sørlandet: 0800 - 1600 Kontakt: Tlf: +47 22 13 18 00 e-post: info@alshydro.no | |
| Analysedokument FYLLES UT AV ALS | | FYLLES UT AV KUNDE | | | |
| Kunde nr: DABVA-NO | | Tilbuds nr: OF220612 | | | |
| Firma: Det Aller Beste Vann AS | | | | | |
| Kontakt person: Rune Nilsen | | | | | |
| Adresse: Austre Vardane 5B, 5306 Erdal | | | | | |
| Telefon: | | Mobil: 94832830 | | | |
| E-post: rune@detallerbestevann.com | | | | | |
| Faktura adr: allerbestevann@krfaktura.no | | | | | |
| (epost): | | | | | |
| Prosjekt nummer: 100 | | | | | |
| Prosjekt navn: K4012 | | | | | |
| Opplysninger om prøven(e): | | | | | |
| Prøvetakingsdato: 13.06.2022 | | | | | |
| Andre opplysninger: | | | | | |
| Bruk rett analysekode for hardhet (skal til PR) | | | | | |
| Ekstra e-post sendes også til: | | | | | |
| Rapporteringstid | | | | | |
| Ekspres må avleses spesielt. Pris avhenger av antall dager fra ankomst hos ALS til ønsket rapporteringstid, og teknisk analysestid. | | | | | |
| Rapporteringstid for en ekspresanalyse kan være på ettermiddagen. | | | | | |
| <input type="checkbox"/> Ingen hast <input checked="" type="checkbox"/> Standard rapporteringstid <input type="checkbox"/> Delt standard rapporteringstid <input type="checkbox"/> Ekspres! Ønsket rapporteringstid: | | | | | |
| MERK: Rapporteringstid regnes i arbeidsdager fra dagen ALS mottar prøven. Staan hast: 10-15 dagers rapporteringstid (evt. lenger dersom teknisk analysertid stoler på). Standard rapporteringstid: analysen med lengst rapporteringstid avgjør rapporteringstid. Delt standard rapporteringstid: ulike rapporter evertgitt av analysens rapporteringstid. | | | | | |
| Dato: Signatur: | | | | | |
| FORSENDELSE AV PRØVER | | | | | |
| TIL OSLO | | | | | |
| Fakker og brevpost: ALS Laboratory Group Norway AS Postboks 643 Skøyen 0214 Oslo | | Bring bedriftspakke: ALS Laboratory Group Norway AS Drammensveien 264 0283 Oslo | | | |

| | | | | | | | | | |
|---|------|------------------|--|-----------------|-----------------|---|---|---------------------------------------|--|
| Analysedokument (bruk bokstavs-koden for ønsket analyse etter prøvetype på skjema under) | | | | | | | | | |
| Kode | | | | | Analysen | | | | |
| A <input type="checkbox"/> A1 - Dekan <input type="checkbox"/> A3 - Filtr. <input type="checkbox"/> C Karbonat [CO ₃] i vann | | | | | D KOF-Mn | | | | |
| <input type="checkbox"/> A2 - Homogen <input type="checkbox"/> A4 - Blandgr. <input type="checkbox"/> E BOF-S | | | | | | | | | |
| B Hardhet (W-HARD-FX/PR) | | | | | F | | | | |
| Informasjon om metodene, akkrediteringsstatus og utførende lab finnes på www.alsglobal.no | | | | | | | | | |
| Merke (benytt tallkode etter prøvetypen i skjema under) | | | | | | | | | |
| 1. Saltvann 2. Sjøvann 3. Lensevann 4. Osevann 5. Sjøvann | | | | | | | | | |
| 6. Rent vann 7. Grunnvann 8. Elv/bekk 9. Brønn 10. Oljeskille 11. Fettutskiller | | | | | | | | | |
| Prøvenavn | | Prøvetype | | Analysen | | | | ALS intern prøver (ikke skule) | |
| 1 | 1012 | | | B | C | D | E | | |
| 2 | 1015 | | | B | C | D | E | | |
| 3 | 1018 | | | B | C | D | E | | |
| 4 | 1019 | | | B | C | D | E | | |
| 5 | 1021 | | | B | C | D | E | | |
| 6 | 1022 | | | B | C | D | E | | |
| 7 | 1025 | | | B | C | D | E | | |
| 8 | 1032 | | | B | C | D | E | | |
| 9 | 1035 | | | B | C | D | E | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| Work Order Reference NO 22211437 | | | | | | | | | |
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kunde@dabv.no
<https://detallerbestevann.com>

Bankgiro Handelsbanken
Konto nr. 9521.36.52738
Org. nr. 925 665 975 Mva



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Appendix 3. Results of water analysis sorted by time

| Time [min] | Short names | Units | 0_1012 | 0_1022 | 0_1035 | 2_1015 | 2_1025 | 2_1019 | 4_1021 | 4_1018 | 4_1032 |
|---|-------------------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Time [min] | Time | [min] | 0 | 0 | 0 | 2 | 2 | 2 | 4 | 4 | 4 |
| Sample names | Id | Sample names | 1012 | 1022 | 1035 | 1015 | 1025 | 1019 | 1021 | 1018 | 1032 |
| Bicarbonate (HCO ₃) [mg/L] | HCO ₃ | [mg/L] | 270.00 | 271.00 | 270.00 | 272.00 | 269.00 | 271.00 | 272.00 | 268.00 | 273.00 |
| Ca (Calcium) [mg/L] | Ca | [mg/L] | 10.20 | 11.20 | 11.20 | 14.10 | 13.30 | 14.00 | 14.80 | 14.50 | 14.30 |
| Mg (Magnesium) [mg/L] | Mg | [mg/L] | 6.14 | 6.36 | 6.28 | 8.32 | 8.67 | 8.00 | 8.73 | 8.53 | 8.21 |
| Alkalinity pH 4.5 [mmol/L] | Alk | [mmol/L] | 4.42 | 4.44 | 4.42 | 4.46 | 4.41 | 4.44 | 4.45 | 4.40 | 4.48 |
| Hardness [mmol/L] | Hardness | [mmol/L] | 0.51 | 0.54 | 0.54 | 0.69 | 0.69 | 0.68 | 0.73 | 0.71 | 0.69 |
| Calcium Hardness [mmol/L] | Ca Hardness | [mmol/L] | 0.26 | 0.28 | 0.28 | 0.35 | 0.33 | 0.35 | 0.37 | 0.36 | 0.36 |
| Magnesium Hardness [mg CaCO ₃ /L] | Mg Hardness | [mg CaCO ₃ /L] | 25.20 | 26.10 | 25.80 | 34.20 | 35.60 | 32.90 | 35.90 | 35.10 | 33.80 |
| Hardness as CaCO ₃ [mg CaCO ₃ /L] | Hardness as CaCO ₃ | [mg CaCO ₃ /L] | 50.80 | 54.00 | 53.60 | 69.40 | 68.70 | 67.70 | 72.80 | 71.30 | 69.40 |
| KOF-Mn [mg/L] | KOF-Mg | [mg/L] | 0.86 | 0.89 | 1.49 | 1.19 | 1.13 | 1.64 | 0.95 | 1.25 | 1.07 |
| Carbon dioxide (CO ₂) [mg/L] | CO ₂ | [mg/L] | 200.00 | 200.00 | 199.00 | 201.00 | 198.00 | 201.00 | 201.00 | 199.00 | 202.00 |
| Carbon dioxide-free CO ₂ [mg/L] | CO ₂ free | [mg/L] | 5.94 | 4.71 | 4.75 | 4.80 | 4.00 | 5.06 | 5.41 | 5.37 | 5.02 |

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