



**NACIONALNI LABORATORIJ ZA
ZDRAVJE, OKOLJE IN HRANO**

CENTER ZA OKOLJE IN ZDRAVJE

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TESTING OF ClO_2 IN AIR OF THE TEST ROOM CAUSED BY THE OPERATION OF THE SALUS 210 DISINFECTION DEVICE

Maribor, March 2022

Oddelek za zrak, hrup, PVO in aerobiologijo

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1 INTRODUCTION

At the request of Valdo Cafe System Kft, we tested the incidence concentrations of chlorine dioxide in the air of the test room caused by the operation of the Salus 210 disinfection device.

2 DATA OF DISINFECTION DEVICE SALUS 210

Why is the Salus air and surface disinfection device unique and different from other air purification machines?

The technology has long been used safely in industry, but there is no other such machine on the market in its mobile and mainly fully automated form, which can be used for air and surface disinfection and does not emit hazardous gases such as ozone.

Why is automation important? Because this way no trained technician is needed to operate the machine!

The unique cleaning process as the machine does its job:

1. Both the water and the air that enters the machine go through a serious cleaning process. The water is first mechanically filtered by a 1 micron pre-filter and then softened. The air enters the machine through a 3-phase filtration: (pre-filter, then an industrial 16.5m² expanded HEPA 13 filter, finally illuminated by 3 55W Philips UVC lamps with reflection technology.)
2. Humidification is performed using the prepared filtered air and clean water.
3. Chlorine dioxide at a concentration of 0.1 ppm is added to this dry 3 micron vapor (0.1ppm/m³/h, ppm=part per million)
4. Chlorine dioxide is the disinfectant that has been used to disinfect drinking water for decades. The maximum permissible health concentration in drinking water according to the strictest controlled standards is 0.05-0.2 ppm (EN:12671:2016). It is clear that only 50% of the maximum allowable value is used. Chlorine dioxide should not be confused with chlorine. It also differs from it in its molecular structure and effect. Chlorine dioxide is safe to use because if it encounters any other molecule (virus, dust, pollen, etc.) it will react and decompose. Its effect is based on the natural oxidation process, after which the chlorine dioxide decomposes into small amounts of oxygen, salt and water, making it biodegradable. **Chlorine dioxide is a broad-spectrum biocidal compound.**
5. Reliable dosing is guaranteed by a magnetic diaphragm pump that can dispense the adjusted compound to the nearest 0.2 ml. (22 Bar pump that dispenses through a 0.15 mm diameter atomizer)
6. Chlorine dioxide is released into the air in 10 equal parts over 1 hour, thus ensuring that it has the desired effect in all parts of the room and is evenly distributed. This also precludes incorrect dosing. After 1 hour of dosing, the unit operates for 1 hour like a normal industrial air purifier.
7. Simple air purifiers only suck in the air in the room, filter it out and blow it back into the air. **SALUS inactivates bacteria, viruses, fungi, spores, legionella and other pathogens**

with chlorine dioxide in infected air. (More information is available from the National Library of Medicine in the United States and the European Union.)

8. The machine offers the option to turn on the intensive mode when the chlorine dioxide compound is added at a concentration three times that of the continuous mode. In this case, no person or animal should be allowed in the room until 4 hours after cleaning or after half an hour of ventilation. (in FFP2 mask)). In this way, the machine environment is disinfected! The efficiency of the device has already been proven by laboratory tests.



Picture 1: Device

Features and additional functions:

- High-performance fan (1600 m³ / h) with speed control
- NDIR intelligent CO₂ sensor. This is how we find out how polluted the air is! This is also a very important factor in assessing air quality.
- Humidity and temperature display
- Possibility of application of humidification and aromatherapy
- Low power consumption (320 watts at maximum use)
- Quiet operation 36-66 dBA
- The recommended maximum room size is 750 m³

3 TESTS PERFORMING

3.1 TEST ROOM

Testing was performed in the test room. The test room was equipped with furniture and a large desk with a computer and ten chairs. There is no forced ventilation in the room. The windows and doors of the room were closed during testing. The room is heated with classic hot water radiators. The room air temperature was in the range of 23 to 25 °C during testing. Room CO₂ concentrations were between 500 and 1000 ppm. The Salus 210 disinfection device regulated the relative humidity in the room in the preset range. The Salus 210 device operated in the test room on February 4, 2022, continuously for 6 hours, starting at 8:30 a.m., and also on February 7, 2022

The dimensions of the test room were 4.85 m x 4.95 m x 2.85 m (68 m³).

3.2 TESTING METHODS

For sampling the air of the test room we used the principles from the method SIST EN 1911: 2011: Stationary source emissions - determination of mass concentration of gaseous chlorides expressed as HCl - standard reference method. The absorbent fluid was demi water. The volume of absorbent fluid in the gas wash bottle (impinger) was 50 ml. SKC INC air pump serial no. 944289; gas volume meter: Elstar BK-G4. The method is accredited by Slovenian accreditation.

ClO₂ concentrations in the absorption solution were measured by the method: SIST EN ISO 7393-2: 2018: Water quality - Determination of free chlorine and total chlorine - Part 2: Colorimetric method using N, N-dialkyl-1,4-phenylenediamine, for routine control purposes (ISO 7393-2: 2017). The method is accredited by the Slovenian accreditation for field measurements. In the analysis, we assumed that the only chlorine oxidized compound in the sample is ClO₂. LOQ of testing method is 0,01 mg ClO₂ / l absorption solution.

3.3 TESTING RESULTS

Testing results are presented in table 3.3.1

Table 3.3.1: Testing results

<u>Sample Nr.</u>	<u>Date of testing</u>	<u>Sampling flow rate (l/min)</u>	<u>Volume of air sampled. (l)</u>	<u>Measured concentration of ClO₂ (mg/m³)</u>
1	04.02.2022	1	50	< 0,01
2	04.02.2022	1	130	0,008
3	07.02.2022	1	220	0,006
4	07.02.2022	2	200	0,008

4 LIMIT FOR ClO₂ CONCENTRATION IN WORKING ATMOSPHERE

As criteria for ClO₂ acceptable concentration in working atmosphere we choose value from:

Bundesanstalt für Arbeitsschutz und Arbeitsmedizin- Bekanntmachung zu den Maximalen Arbeitsplatz-Konzentrationen (MAK) und zu den Biologischen Arbeitsstoff-Toleranzwerten (BAT)- (MAK- und BAT-Werte Liste) vom 28 Juli 2021 (Mitteilung 57)

Limit for ClO₂ concentration is 0.1 ppm (0,28 mg/m³)

Several EU and non EU countries have same limit.

5 CONCLUSION

From comparison of testing results (see table 3.3.1) and limit value for ClO₂ (see chapter 4) we can conclude that Disinfection device Salus 210 by common operation reached ClO₂ concentrations in working atmosphere that are ten times smaller than limit value.