

## ACTIVITY OF CHLORINE DIOXIDE AGAINST VIRAL INFECTIONS IN THE AIR AND ON SURFACES, IN THE LIGHT OF SCIENTIFIC RESEARCH

Due to the unique electron properties of chlorine dioxide molecules, this compound oxidizes (destroys) elements of the protein structure of the virus envelope [1,2].

**Safety in use.** A particularly valuable advantage of  $\text{ClO}_2$  is the high virulence activity in the air and on surfaces in concentrations lower than those harmful to humans. While the maximum safe concentration of  $\text{ClO}_2$  in the air remains at the level of 0.3 ppmv (NDS) as a harmless concentration during exposure of 8 h [3], the virucidal effective concentrations reach levels below 0.1 ppmv.

**Biocidal efficacy in air disinfection (in vitro model tests).** In scientific studies [4], the results of  $\text{ClO}_2$  disinfection efficiency in the air at the concentration of 0.01–0.1 ppmv against model viruses (the so-called bacteriophages) were documented, where the efficiency was 99.99% for 0.01 ppmv at 120 min, for 0.02 ppmv at 60 min and for 0.1 ppmv at 30 min.

**Biocidal efficacy in air disinfection (rodent tests).** In virological efficacy studies on living organisms (mice) against influenza virus type, a zero-mortality rate of the influenza virus-infected population was obtained at  $\text{ClO}_2$  air concentrations of 0.03 ppmv, compared to the mortality rate of 70% of the population not treated with disinfection [5].

**Biocidal efficacy in air disinfection (studies in schools and barracks).** Particularly valuable conclusions seem to be drawn from the observation of effects of low concentrations of gas  $\text{ClO}_2$  in natural human environments. The paper [6] presents the results of experimental and statistical studies on the effects of systematic disinfection of school classrooms with chlorine gas dioxide on sickness absence of students. The research was conducted among a population of primary school students particularly exposed to viral infections. The results of the study showed a 3-fold decrease in sickness absence in the area of the population of pupils remaining in rooms disinfected with gas  $\text{ClO}_2$ . The obtained result was supported by carefully conducted statistical significance tests.

Similar results were obtained in studies conducted among soldiers of selected military units [7].

Recent studies show that the coronavirus can remain in the air for 3 hours and on plastic for several days [8].

**Biocidal efficacy in surface disinfection.** The virucidal efficacy of  $\text{ClO}_2$  gas against the SARS-CoV-2-like enveloping influenza A virus was also confirmed on the surface at the reduction level exceeding 5 log10 at 0.05 ppmv, at a duration of 3h at 21°C and 54% relative humidity [9]. Similar efficiency was also obtained under the same conditions on the surface loaded with organic pollutants. Thus, the applied effective concentration of  $\text{ClO}_2$  is below the maximum permissible concentration of 0.3 ppm in the air, i.e. in conditions of use safe for human presence.

According to European recommendations and formulated on the basis of the list of the Chinese Pharmaceutical Association and the opinion of the International Pharmaceutical Federation (FIP), chlorine dioxide is on the list of virucidal substances, effective against COVID-19, on surfaces and as an aerosol.

### Conclusion.

The results of scientific studies on the biocidal properties of chlorine dioxide indicate that its use, at concentrations lower than those harmful to the human body, is an effective method of controlling viruses in the air and on surfaces.

### Literatura

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