

**Original**

## **Inactivation of Feline Calicivirus, a Norovirus Surrogate, by Chlorine Dioxide Gas**

**HIROFUMI MORINO<sup>1\*</sup>, TOSHIÁKI FUKUDA<sup>1</sup>, TAKANORI MIURA<sup>1</sup>,  
CHEOLSUNG LEE<sup>1</sup>, TAKASHI SHIBATA<sup>1</sup> AND TAKESHI SANEKATA<sup>2</sup>**

<sup>1</sup>*Taiko Pharmaceutical Co., Ltd., Uchihonmachi 3-34-14, Suita, Osaka 564-0032, Japan*

<sup>2</sup>*Laboratory of Veterinary Infectious Disease, Faculty of Agriculture, Tottori University  
4-101, Koyama, Tottori 680-8553, Japan*

Received 31 March, 2009/Accepted 15 July, 2009

The efficacy of gaseous chlorine dioxide (ClO<sub>2</sub>) against feline calicivirus (FCV), a norovirus surrogate, in the dry and the wet states on a hard surface was evaluated. We demonstrated that low-concentration ClO<sub>2</sub> gas (mean 0.08 ppm, 0.22 µg/l) could inactivate FCV in the wet state with 0.5% fetal bovine serum (FBS) within 6 h in 45 to 55% relative humidity (RH) (>3 log<sub>10</sub> reductions) and FCV in the dry state with 2% FBS (percentage of FBS in the viral suspension) within 10 h in 75 to 85% RH (>3 log<sub>10</sub> reductions) at 20°C, respectively. Furthermore, a <0.3 ppm concentration of ClO<sub>2</sub> gas (mean 0.26 ppm, 0.73 µg/l) could inactivate (below the detection limit) FCV in the dry state with 5% FBS within 24 h in 75 to 85% RH at 20°C. In contrast, in 45 to 55% RH at 20°C, ClO<sub>2</sub> gas had little effect even when the FCV in the dry state was exposed to high-concentration ClO<sub>2</sub> (mean 8 ppm, 22.4 µg/l) for 24 h. These results suggest that humidity plays an important role in the inactivation by ClO<sub>2</sub> gas of FCV in the dry state. According to the International Chemical Safety Card, threshold limit values for ClO<sub>2</sub> gas are 0.1 ppm as an 8-h time-weighted average and 0.3 ppm as a 15 min short-term exposure limit. From these data, we propose that the treatment of wet areas of human activity such as kitchens, toilets, etc., with low-concentration ClO<sub>2</sub> gas would be useful for reducing the risk of infection by noroviruses (NV) without adverse effects. In addition, we believe that the application of a combination of a <0.3 ppm concentration of ClO<sub>2</sub> gas and a humidifier in places without human activity may make it possible to inactivate NV in the dry state on any surface within a contaminated room without serious adverse effects.

*Key words* : Chlorine dioxide/Gas/Feline Calicivirus/Norovirus/Disinfectant.