Efficacy of O3 as Virucidal Agent Against Coronaviruses

Numerous cited studies have shown the efficacy of O3 as a virucidal agent against SARS and many other coronaviruses. As such there is great potential to slow the COVID-19 pandemic by deactivating the novel coronavirus with its disruptive properties. SARS and COVID-19 viruses are from the same virus family, using the ozonation process to help contain the 2019 COVID-19 pandemic as well as help prevent future viral pandemics is very promising. The ozonation process also allows for poorly accessible spaces to be disinfected. Contaminated areas that carry critical amounts of viral infection agents, such as hospital rooms, clinic and/or treatment rooms, spa/fitness centers, large commercial and public facilities, etc. are ideal environments to be ventilated by ozone gas at certain concentrations and contact times, in order that viral elimination is achieved [11].

In the ozone treatment process, ozone gas or O_3 is used to kill viruses as a result of it's powerful oxidizing capability. Additionaly, ozone is a well-known disinfection agent in water treatment plants worldwide and has been using successfully to produce clean and safe drinking water [1].

There are many studies that demonstrate how ozone successfully inactivates an array of viruses for human and/or animal health. In particular, viruses existing as droplets are killed within seconds of the O3 exposure [2]. Another study concludes, after parameters (concentration, exposure, and humidity) were optimized, 99% of viral disinfection was achieved after ozone gas was applied [3]. Additionaly, Jiang *et al.* successfully inactivated poliovirus type 1 (PV1) by damaging viral nucleic acids and capsids by O_3 [4]. Ozone breaks the capsids of viruses and therefore the viral reproductive cycle is stopped. To eliminate murine norovirus (MNV), which is resistant to extreme environmental conditions, ozone is again victorious as a disinfectant [5]. Enteric viruses (Norwalk virus and other noroviruses) were also disinfected through ozone when the exposure time and ozone concentration are increased appropriately [6, 7]. For example, 0.23 ppm of ozone was used for 40 minutes to inactivate norovirus at an 85% rate [8].

In the case of the airborne viruses, which can cause deadly diseases like severe acute respiratory syndrome (SARS) and the new coronavirus pandemic (COVID-19), ozone disinfection method is suggested as an effective solution. One such study concluded, when using higher concentrations of ozone (27.73 ppm), 4 minutes of exposure killed 100% of SARS viruses. Moreover, lower concentrations of ozone were still successful in the deactivation of SARS viruses but at longer periods [9]. Elvis and Ekta show that ozone is an ideal alternative therapy for HIV and SARS viruses in the clinics as well [10].

Ozone can be produced in an ozone generator and then mixed with air. Ozone-containing air moves to every corner of a quarantine location, and as a consequence effectively eliminates airborne viruses and contaminated surfaces. Such treatment systems can be managed and controlled conveniently in various indoor spaces such as schools, cafes, restaurants, intensive care units, airports, airplanes, buses, fitness centers, public stations, or any other public space at risk [12]. It is worth noting that ozone should not be inhaled directly by humans. After ozone ventilation is completed, humans can enter the sterilized indoors [13].

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