Environmentally friendly disinfection of air and surfaces in medicine

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Abstract

Hospitals are faced with increasingly resistant strains of microorganisms. When it comes to disinfection, individual parts of electronic equipment of angiology diagnostics such as patient couches of computer tomography (CT) and magnetic resonance imaging (MRI) scanners prove to be very hard to disinfect. Disinfectants of choice are therefore expected to possess properties such as rapid, residue-free action without any damaging effect on the sensitive electronic equipment. This paper discusses the use of the neutral electrolyzed oxidizing water (EOW) as a biocide for the disinfection of diagnostic rooms and equipment, without residues and environmental effects.

Keywords: disinfection, electrolyzed oxidizing water, air, surface, microbial resistance

1. Introduction

With the ever-growing number of diagnostic examinations, the possibility of hard surface contamination with micro-organisms from infected patients is increasing as well. Such surfaces may represent a possible source of infections for other patients and medical staff (Baffoy-Fayard et al., Buerke et al., Grabsch et al.). Today, there are altogether 250 substances that are known to have biocidal effect. According to the World Organisation for Animal Health (OIE), a total of 154 are used independently or in combination with other biocides. The highlighted problem becomes so much greater once we take into account the increase of the hospital infections (such as MRSA for instance) and the growing number of patients infected with the infectious disease causing agents (Kim et al., Zhang E, Garcin et al.) Patient couches of computer tomography (CT) and magnetic resonance imaging (MRI) scanners are very hard to access when it comes to cleaning and disinfection. Mechanism of action, neutral electrolyzed oxidizing water (EOW) has been considered as a possible biocide of the new generation (Meakin et al.,, Rahman et al., Wu et al., Landa-Solis et al., Vorobjeva et al.). EOW is characterized by a marked deficiency of electrons due to which it has a tendency for electro-neutral environment that can be achieved only through the abstraction of electrons from the surrounding environment (Sun et al., Moretro et al., McCarthy – Burkhardt, Ayebah et al., Kim et al.).

2. Material and Methods

The possibility of the air aerosolisation with the EOW was tested. The research involved 6 diagnostic rooms, 600 air samples collected in the liquid medium and 50 samplings on exposed mediums. The purpose of the research was to establish the efficacy of the applied EOW biocidal action on the present bioaerosol. The identification of the micro-organism presence in the air was carried out to establish the level of the contamination in order to be able to determine the importance of the reduction of the micro-organisms present in the air with the EOW aerosolisation. The air sample collection method involved Coriolis Air Sampler (Coriolis, France) using cyclone technology. With the air flow rate of 300 litres per minute, altogether 1,200 litres of air were pulled through the liquid collection media during the collection time of 4 minutes. As a liquid medium, the sterile physiological saline was used in which the bioaerosol from the air was collected. All collected samples from the 6 diagnostic rooms were taken while the air ventilation system was off and they were transported to laboratory for further treatment at the temperature of 4° C. Air samples collected in the suspension of the physiological saline were first diluted and then sown to a medium. Depending on the cultures grown, further determination was carried out (ISO 4833/2003). What followed was the counting of micro-organisms and the determination of their actual total number.

3. Results

As anticipated, the number of micro-organisms present in the diagnostic room air was low. Clearly, to get a more reliable confirmation of the decrease in the number of micro-organisms it is preferable – from the point of view of the aerosol biocide action efficiency – to ensure as high initial number of micro-organisms as possible. However, this research was determining the reliability of action in actual conditions. The main reason for that is controlled diagnostic room ventilation through air conditioning systems. A comparison of data for all rooms

together before and after the EOW aerosolisation shows a 78.99–92.50% decrease in the total number of micro-organisms. Log comparisons display a reduction between 0,71-0,96 $\log_{10}$ CFU/m3 (Figure 1).

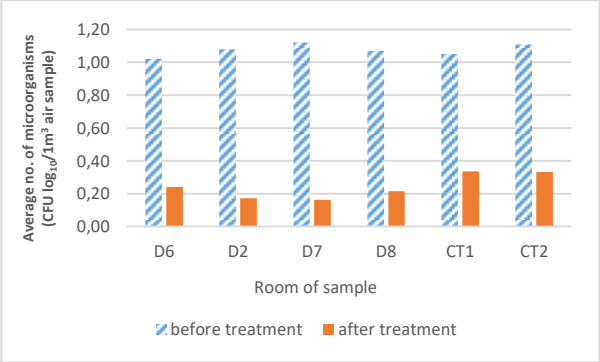

Figure 1. Total number of micro-organisms in diagnostic room (calculated on log10)

4. Discussion and Conclusion

Based on the research data gathered, one can conclude that there is a constant presence of micro-organisms in all diagnostic rooms, which is most likely a result of the air condition room ventilation that is based upon forced overpressure system. The use of EOW proved to be efficient and safe in all applied ways. Also, no eventual damage to exposed devices or staff was recorded. The results have shown that the diagnostic room aerosolisation reduced the total number of micro-organisms as much as 80.19–92.14%. No unwanted effects on material means or people were recorded. Its application is recommended also from the economic point of view. While its applicability has certainly been proved, a further benchmark research comparing efficiency of EOW with the usual disinfecting agents used in the hospital would be advisable.

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