The Influence of Hydrogen Peroxide Sterilisation on Plastic Surface

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1. Introduction

Hydrogen peroxide (HP) sterilisation is generally considered to be clinically effective and safe as a germicidal procedure, as it is decomposed to oxygen and water easily.
However, the results of our previous studies (Yoshida & Kobayashi, 2013) revealed various problems concerning to hydrogen peroxide (HP) gas sterilisation, such as problems of environmental exposure of higher concentration, residual HP on sterilised items, deterioration of the items, false reaction of the chemical indicator (CI), and residual hydrogen peroxide on plastic materials after sterilisation[1-5].
In addition to those problems, this time the situation of the plastic surface after hydrogen peroxide sterilisation is examined by scanning electron microscope.

2. Methods

The influences of low-temperature hydrogen peroxide gas plasma steriliser (LTHPGPS) (STERRAD® NX™, Johnson & Johnson) and low-temperature hydrogen peroxide vapour steriliser(LTHPVS) (AMSCO® V-PRO® maX, STERIS) on the surfaces of plastic materials (eleven kinds of plastic panels) were evaluated by scanning electron microscope findings (SEMF). The Plastic panels tested were polyetherimide (PEI), polyethylene (PE), polytetrafluoroethylene (PTFE), nylon6 (PA6), nylon 66(PA66), polyethylene terephthalate (PET), polyetheretherketone (PEEK), thermoplastic polyurethane (TPU), polymethylmethacrylate (PMMA), polypropylene (PP), and polycarbonate (PC). 10×10×6mm blocks of them were evaluated by SEM. When the influence of sterilisation on the surface was apparent, other one or two blocks were re-evaluated to confirm the influence.

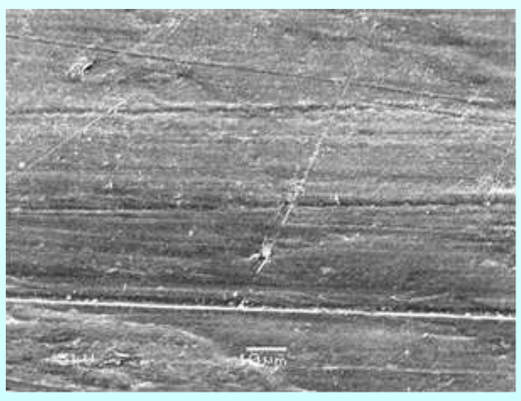


Figure 1-1. SEMF of PA6 panel-surface before sterilisation (×1000)

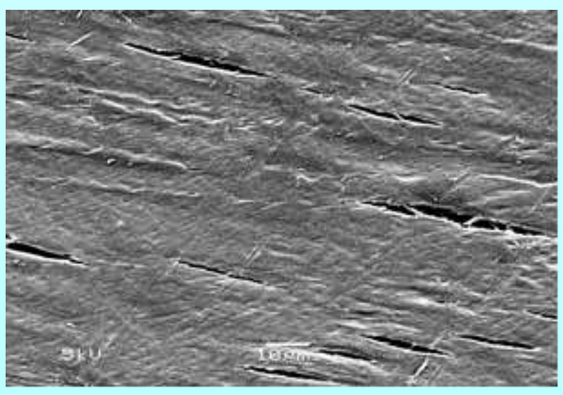


Figure 1-2. SEMF of PA6 panel-surface after once of sterilisation by LTHPGPS (×1000)

Figure 1-3. SEMF of PA6 panel-surface after five repeated procedures of sterilisation by LTHPGPS (×1000)

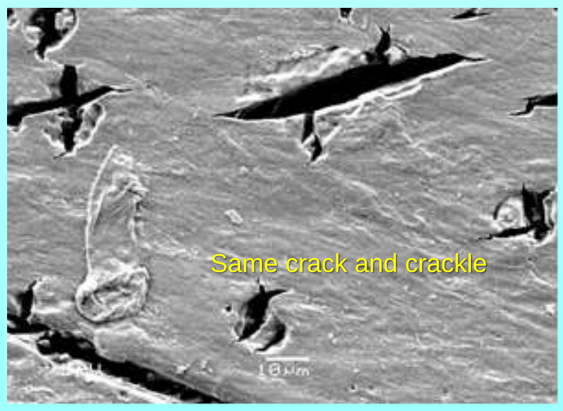


Figure1-4. SEMF of PA6 panel-surface after once of sterilisation by LTHPVS (×1000)

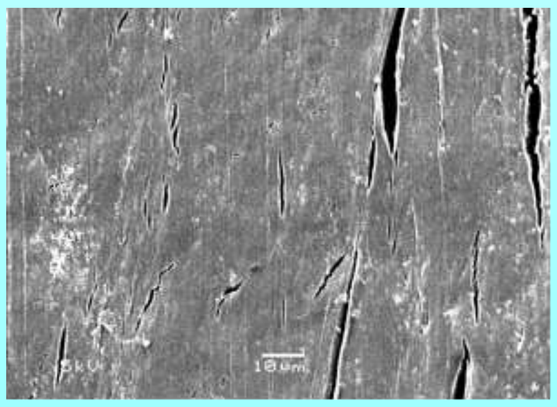


Figure1-5. SEMF of PA6 panel-surface after five repeated procedures of sterilisation by LTHPVS (×1000)

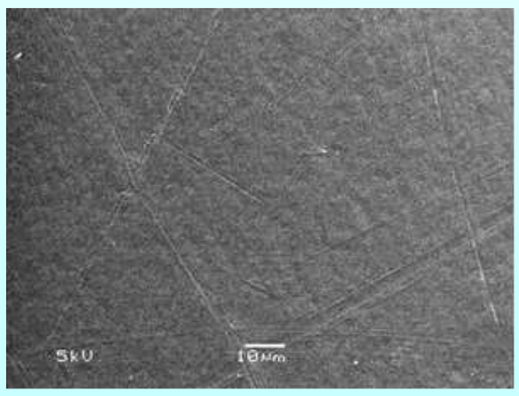
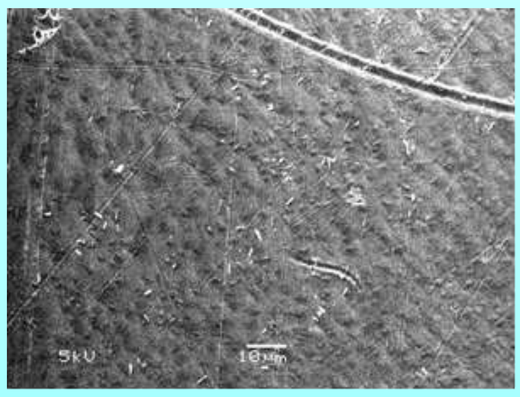
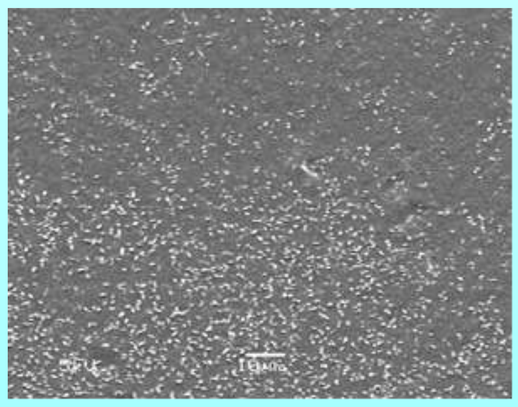


Figure3-1. SEMF of PP panel-surface before sterilisation (×1000)



Many scattered seed-like changes.

Figure3-2. SEMF of PP panel-surface after five procedures of sterilisation by LTHPGPS (×1000)



More scattered seed-like changes

Figure3-3. SEMF of PP panel-surface after five procedures of sterilisation by LTHPVS (×1000)

3. Results

The results of the scanning electron microscopic finding (SEMF) are shown in Figures 1 to 4. On the surfaces of PA6 after the two types of sterilisations crack and crakle are occurred as shown Figure 1-2 to 1-4 after the sterilisations. On the surfaces of PP, many scattered seed-like changes as were observed as in Figure2-2 and 2-3. On the surfaces of other plastic panels, no apparent changes were observed after the sterilisations.

4. Discussion

The crucial factors causing the changes on some plastic panels after LTHPGPS and LTHPVS sterilisations could not be confirmed . However, at this moment it is speculated that chemical effect of HP vapour or physical reaction of pre-vacuum(the recent study demonstrated no influence of pre-vacuum) may play a role to some extent. HP sterilisation procedures cause the changes of the plastic surfaces, even in a single procedure, and there may have influenced the plastic strength and structure in some cases. Though a further study is necessary to explain the cause, this study offers significant phenomena resulting from the sterilisation in medical setting.
Conflict of interest statement: None declared.

5. Conclusions

LTHPGPS and LTHPVS sterilisation procedures have caused the structural changes of the plastic material surfaces. A further study is required to clarify the causes.

References

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