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Mini Review

Keywords

Antimicrobial silane coupling agent,
Contact-active antimicrobial effect,
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Antimicrobial activity of a novel silane coupling agent having quaternary ammonium salt using polymicrobial biofilm model

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Abstract

The purpose of investigation was to evaluate the antimicrobial activity of a novel quaternary ammonium silane coupling agent, *N*-allyl-*N*-decyl-*N*-methyl-*N*-trimethoxysilylpropylammonium iodide (10-I), against early-stage biofilms using a polymicrobial biofilm model that simulates oral plaque-like biofilm formation on a solid phase.The cover glasses immersed in 10-I for 1 hour to modify the surface.

The polymicrobial biofilm was prepared as reported by Exterkate et al., we calculated colony forming unit (CFU). CFU of the 10-I group was about 80% lower than that of the control group, demonstrating strong antimicrobial activity. The surface modification with 10-I represents an effective means for treatment of oral indigenous bacteria-related dental diseases found in the elderly and immunocompromised people and possible systemic complications such as aspiration pneumonia.

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We have also studied their application for prevention of caries and periodontal disease through suppression of adhesion and formation of plaque and decalcification of dentine[1-3)]. We synthesized a new quaternary ammonium-based antibacterial silane coupling agent, *N*-allyl-*N*-decyl-*N*-methyl-*N*-trimethoxysilylpropylammonium iodide (10-I; Tokyo University of Science), for imparting the immobilized antimicrobial activity to substrate surfaces[4)].

In this study, we evaluated the antimicrobial activity of 10-I against earlystage biofilms using a polymicrobial biofilm model[5)], in which oral plaque-like biofilms can be formed on a solid phase.

10-I was prepared at 800 ppm with ethanol. The chemical formula of the modifier is shown in Table. The polymicrobial biofilm was prepared as reported by Exterkate et al.[6)]. The viable bacteria in each culture were then counted. Colony forming unit (CFU) counts in polymicrobial biofilms are shown in figure. CFU in the 10-I group was 3.4×10^4 CFU/disk, an 80% reduction

Table. Chemical formula and code of the surfactant used in this study

Formula	Code
$\left[CH_2{=}CHCH_2{-}\overset{\overset{(CH_2)_{10}H}{\vert}}{\underset{\underset{CH_3}{\vert}}{N^+}}{-}(CH_2)_3Si(OCH_3)_3 \right] I^-$	10-I

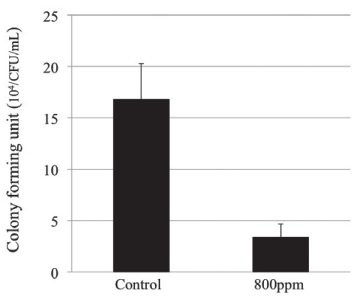

Figure. Colony forming unit of polymicrobial biofilms on the glass surface modified with 10-I.

CFU in the 10-I group was 3.4×10^4 CFU/disk, an 79.8% reduction compared to that of 16.8×10^4 CFU/disk in the control group, demonstrating strong antimicrobial activity.

compared to that of 16.8×10^4 CFU/disk in the control group, demonstrating strong antimicrobial activity.

In this study, we evaluated the antibacterial activity of 10-I against earlystage biofilms using a polymicrobial biofilm model, in which oral plaque-like biofilms can be formed on a solid phase. The result indicated that polymicrobial biofilm formation was strongly inhibited by 10-I modified glass plates.

This result suggests that the surface modification with 10-I is an effective means for suppression or prevention of not only oral indigenous bacteria-related dental diseases observed in the elderly and immunocompromised individuals but also possible systemic complications such as aspiration pneumonia.

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