Biofilm-Forming Activity of Bacteria Isolated from Toilet Bowl Biofilms and the Bactericidal Activity of Disinfectants against The Isolates

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To evaluate the sanitary conditions of toilets, the bacterial counts of the toilet bowl biofilms in 5 Kansai area and 11 Kansai and Kanto area homes in Japan were measured in winter and summer seasons, respectively. Isolates (128 strains) were identified by analyzing 16S ribosomal RNA sequences. The number of colonies and bacterial species from biofilms sampled in winter tended to be higher and lower, respectively, than those in summer. Moreover, the composition of bacterial communities in summer and winter samples differed considerably. In summer samples, biofilms in Kansai and Kanto areas were dominated by Blastomonas sp. and Mycobacterium sp., respectively. Methylobacterium sp. was detected in all toilet bowl biofilms except for one sample. Methylobacterium sp. constituted the major presence in biofilms along with Brevundimonas sp., Sphingomonas sp., and/or Pseudomonas sp. The composition ratio of the sum of their genera was 88.0 from 42.9% of the total bacterial flora. The biofilm formation abilities of 128 isolates were investigated, and results suggested that Methylobacterium sp. and Sphingomonas sp. were involved in biofilm formation in toilet bowls. The biofilm formation of a mixed bacteria system that included bacteria with the highest biofilm-forming ability in a winter sample was greater than mixture without such bacteria. This result suggests that isolates possessing a high biofilm-forming activity are involved in the biofilm formation in the actual toilet bowl. A bactericidal test against 25 strains indicated that the bactericidal activities of didecyldimethylammonium chloride (DDAC) tended to be higher than those of polyhexamethylene biguanide (PHMB) and N-benzyl-N,N-dimethyldecylammonium chloride (ADBAC). In particular, DDAC showed high bactericidal activity against approximately 90% of tested strains under the 5 h treatment.

Key words : Biofilm / Toilet bowl / Bactericidal Activity / Biofilm-forming bacteria.