

## Research on Growth Inhibition of *Streptococcus pneumoniae*

(<sup>1</sup>Faculty of Biomedical Engineering, Toin University of Yokohama, <sup>2</sup>Graduate School of Engineering, Toin University of Yokohama) ○Keisuke Yamamoto<sup>2</sup>, Mayu Shimono<sup>1</sup>, Kiyoshi Saito<sup>1, 2</sup>

**Keywords:** *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, inactivation effects, coproporphyrin

Recently, *Streptococcus pneumoniae* has received attention for its production of hydrogen peroxide<sup>1</sup>. The fact that this species generates large quantities of hydrogen peroxide is extremely interesting since hydrogen peroxide is believed to be harmful to bacteria. Despite continued widespread vaccination against pneumococcal infection, transmission to elderly individuals and infants is problematic. Therefore, in the present study, we investigated effective methods to inhibit the growth of *S. pneumoniae*. The results of comparison with the inactivation effects on *Staphylococcus aureus* and *Staphylococcus epidermidis* are also reported.

The near-ultraviolet LED irradiance pattern showed a sharp peak at a wavelength of 399 nm and its integrated illuminance was 0.869 mW / cm<sup>2</sup>. Survival rate for *S. aureus* was 12% (range, 3 - 20 %) and survival rate for *S. epidermidis* was 39 % (range, 33 - 46) on repeated tests (n = 4 - 6) with light exposure under the same conditions (Figure). By the present, growth depression effect by the near-ultraviolet light was confirmed for *S.pneumoniae*.

On *S.aureus* and *S.epidermidis*, coproporphyrin existing in the cell wall <sup>1)</sup> may be involved, but since *S.pneumoniae* does not have a porphyrin biosynthetic pathway, the interest leans on the mechanism. At present, further examination is carried out on this point. In previous studies, the effect of white LED was low for *S. epidermidis*, so the effect of near-ultraviolet light may be due to a different mechanism. Also, white LED has an integral illuminance of 25.01 mW/cm<sup>2</sup>; therefore, the present findings indicate that near-ultraviolet LED may deliver a more efficient PDI effect.

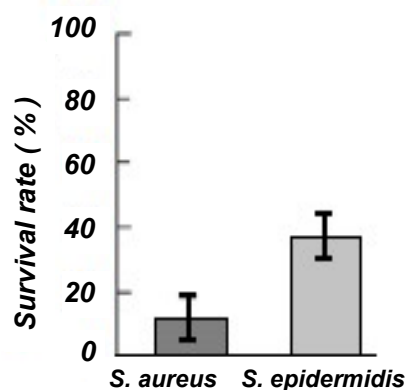


Figure. Effects of photodynamic inactivation using near - ultraviolet light (399 nm) generated by light-emitting diode (LED) for *S. aureus* and *S. epidermidis*.

1) Dailey, H.A., Gerdes, S., Dailey, T.A., Burch, J.S. and Phillips, J.D. *PNAS*, **17**, 2210 (2015).