Influence to colonization on Escherichia coli by applying electric field and plasma to nutrient agar

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Bacteria such as E. coli (Escherichia coli) attach to the surface and form colonies. These colonies then grow up to biofilm by merging each other. Biofilm cause many problems such as MIC (Microbiologically Influenced Corrosion) and bacterial infections. However, biofilm is difficult to sterilize because its self-defense mechanism. Now, we use large quantity of germicide for sterilizing biofilm. But it has high environmental load, and sterilization effect is not enough. So, it is important for us to prevent the surface from sticking bacteria and creating biofilm. In this work, we tried to affect the colonization or the initial process of colony growth of E. coli on nutrient agar by atmospheric pressure plasma and/or electric field.

Firstly, we prepared nutrient agar in a dish 100 mm in diameter. Next, we radiated atmospheric pressure plasma with Ar gas flow. In this process, Ar gas flow rate 2.1 L/min from a quartz tube to the dish located 20 mm below the outlet. Radiation experiences were conducted at applied voltages of 7.5, and 9.0 kV for plasma generation. After that we applied E. coli to the irradiated nutrient agars and a controlled nutrient agar, and incubated them for 2 days at 30°C to count the total number of colony. When we counted the number of colony after 1 day incubation, the plasma radiated dishes at 7.5 and 9.0 kV had colony numbers of 112 - 145 and 78 - 147, respectively, which were smaller than that of 187 - 257 on the controlled dish. However, after 2 days incubation, the numbers of colony on these three dishes reached to almost the same value, 136 - 261. It was considered that nutrient agar was negative charged by high voltage plasma. But negative charge effect maintained in short time. So after enough time, E. coli could grow up and count colony.

Keywords
Escherichia coli
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