AHA-P-TMS a good candidate for antimicrobial coating through dielectric barrier discharge cold atmospheric plasma deposition ?

10 Millions death/year

Bacteria with their ability to quickly becoming resistant to antibiotic became a threat. Some need just a week to acquire a new resistance.[1]

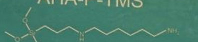
Associated with multi antibiotic resistant bacteria (superbug) contamination in 2050. Urging the need to find alternative solutions.[1]

Surface chemistry turns out to be a great alternative to antibiotics by making antifouling or bactericidal surface.[2]

Among deposition technique could atmospheric plasma has a lot of interesting features.[3]

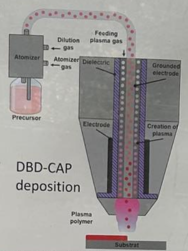
Method

AHA-P-TMS



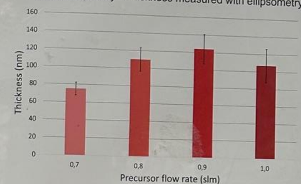
N-(6-aminohexyl)aminopropyltrimethoxysilane

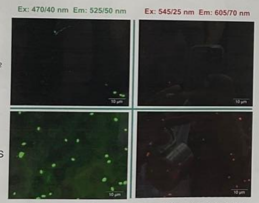
- Polymerize easily
- $-NH_2$ available
- Antibacterial[3]



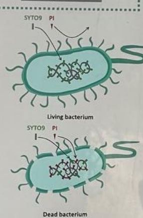
DBD-CAP deposition

Results

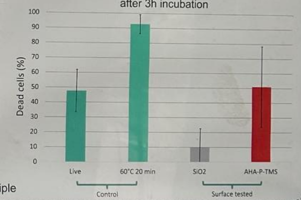




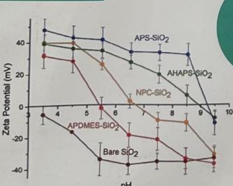
Fluorescence microscopy image x100 of *E. Coli* (10^8 *CFU/mL*) on a SiO2 or AHA-P-TMS plasma polymer



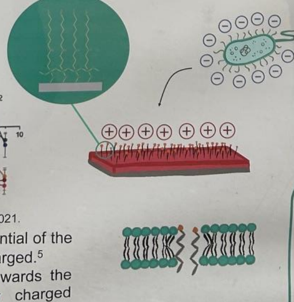
Live/Dead dual staining working principle



Hypothesis



Barak et al. Colloids and Surfaces, 2021.



Hypothesis on the bactericidal activity of AHA-P-TMS thin film

- Literature indicate that zeta potential of the surface at pH 7 is **positively** charged.[5]
- Bacteria should be attracted towards the surface with their **negatively** charged membrane.[6]
- Alkyl chains penetrate their hydrophobic membrane and weaken them.[6]

Conclusion & outlooks

- AHA-P-TMS is easily deposited via DBD-CAP and exhibits good stability across different substrates.
- Initial results suggests a decrease in bacterial viability after 3h.

Further characterization is required to gain deeper insights into the antibacterial properties and to better understand the surface-bacteria interactions. Additionally, the potential to enhance those properties through the incorporation of antimicrobial molecules will be explored.

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