The Antimicrobial Efficacy of Nitric Oxide based on Release Rate from Mesoporous Silica Nanoparticles on A. actinomycetemcomitans and S. mutans

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Steptococcus mutans and Aggregatibacter actinomycetemcomitans (AA) are bacterial strains commonly found in the dental plaque biofilm and which cause conditions such as dental caries, gingivitis, and periodontal disease. Current treatments (other than surgery) for these diseases have not been shown to have long-term applicability. Due to its various reaction pathways, nitric oxide (NO) is an effective antimicrobial agent as it is difficult for bacterial strains to form a resistance against it, and therefore is applicable in eliminating these strains. This study focuses on varying the identity of the NO storage molecule in mesoporous silica nanoparticles (MSNs) to change NO release rates and determine the differences in particle concentration required for bacterial eradication. MSNs (diameters of ± 700nm) were synthesized and grafted with three different aminosilanes, MAP3, AEAP3, and BAP3, and were analyzed using a dynamic light scattering system, SEM, and NO analyzer (NOA). AA was exposed to different concentrations of BAP3 and AEAP3 particles, and the number of visible bacteria after exposure was determined using microbial culturing methods. Slower NO release rates showed to require a lower particle concentration for AA elimination. It was noted that higher particle dosages may be needed to effectively reduce the bacterial viability of S.mutans.