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# **pH-Sensitive Compounds for Selective Inhibition of Acid-producing Bacteria**

**ADASRI Case # 16-0001**

## **Background**

According to the World Health Organization (WHO), oral diseases affect nearly 3.5 billion people worldwide. The hard and soft tissue surfaces of the oral cavity provide the ideal environment for abundant microbial growth and biofilm formation (dental plaque), which can lead to caries formation. Furthermore, dental resin composites are prone to failure due to stress and exposure to the oral environment, leading to the formation of secondary caries. Antimicrobial mouthwashes and toothpastes exist for plaque control, and antimicrobial additives may be used in dental resins. However, problems with existing antimicrobial materials include non-selective behavior that may adversely affect the oral microbiome, and questionable long-term effectiveness.

## **Invention Description**

ADA researchers have developed a new series of antimicrobial azo-type quaternary pyridinium salts (Azo-QPS). These can be used as surface treatments or can be polymerized and included into different polymer matrices. The materials are pH-sensitive, exhibiting enhanced antimicrobial activity in acidic conditions. The antimicrobial activity can be triggered locally by acidic metabolic products of nearby bacteria, resulting in subsequent killing of these bacteria. In particular, the azo-QPS compounds have been demonstrated to be effective against *S. mutans*, the primary causative agent in the formation of dental caries. The materials are also redox active, which can make them suitable in sensing applications.

## **Potential Applications**

The antimicrobial materials of the present invention may be used as:

- Mouthwashes and toothpastes
- Additives to dental resin composites and adhesives
- Additives to polymeric dental appliances such as mouth guards & retainers
- Additives/coatings for catheters, medical instruments and trays
- Antimicrobial or anti-fouling coatings for application including biomedical, food packaging, HVAC systems and filters
- Sensors – high sensitivity to physiological pH levels and redox potentials makes it possible to develop pH sensors, and immunosensors to quantify antibody-antigen interaction

## **Benefits and Advantages**

- pH-triggered antimicrobial behavior
- Targets caries-inducing bacteria
- Preserves the oral microbiome: Selectively inhibits acid-producing bacteria such as *S. mutans*