MONASH University

MONASH INNOVATION

NEW ANTIMICROBIAL ADDITIVE

Metal-organic bismuth complexes

Thermally stable, safe, non-toxic additives for the development of a large range of antimicrobial products - including synthetic and natural (cellulose) polymer based materials - such as medical devices, packaging and surface coatings. Primary results demonstrate efficacy comparable to commercial products, including against resistant bacterial strains.

- **Antibacterial efficacy comparable to silver**
- **Potential low toxicity in humans**
- **Suitable for incorporation into a broad range of products due to thermal stability features**

THE CHALLENGE

Antimicrobial resistance (AMR) is rising alarmingly and is expected to be responsible for an annual 10 million deaths worldwide by 2050.

Current antimicrobial product development focuses on creating 'clean' surfaces. For medical devices and packaging, the focus is on inhibiting bacteria and formation of biofilms.

These developments rely on:

- cleaning with liquid disinfectants
- physical surface alteration, and/or
- permanent incorporation

and include organic compounds, metals and metal-based antimicrobials.

Metal compounds demonstrate greater efficacy and resilience to bacterial resistance than organic compounds and silver-based compounds account for the highest share of the antimicrobial additives market.

The predominance of silver in broad-spectrum antimicrobials is a source of concern due to:

- toxicity
- environmental accumulation, and most importantly
- emergence of antimicrobial resistance.

Clearly, new and safer alternatives to silver-based antimicrobials are needed.

THE TECHNOLOGY

Monash researchers have developed metal-organic bismuth based complexes that demonstrate antibacterial activity against Gram negative and Gram positive bacteria, including multidrug-resistant strains (MRSA and VRE).

Bismuth compounds (Pepto-Bismol) are already widely used for the treatment of gastrointestinal disorders and are safe to use.

Independent tests on our bismuth compounds show activity comparable with commercial (silver) antibacterials. Proof-of-concept studies encompass inclusion in agar, polymer and cellulose based materials.

Benefits of these bismuth-based antimicrobials include:

- synthesis is simple and reproducible
- they have low solubility (reducing the risk of leaching from the final material)
- their thermal stability makes them suitable for incorporation into melt / extrusion technology.

These features make the compounds viable candidates for the development of new antibacterial products such as medical devices, packaging and surface coatings.

Intellectual property: National filings in Australia, Europe and the USA on PCT/AU2016/050406, covering the novel bismuth compounds (composition of matter) and their use as antimicrobial agents. The ISR has 90% of the claims considered novel, inventive and with industrial applicability.

THE OPPORTUNITY

Monash seeks a partner to further develop this technology. The team, led by Prof Phil Andrews and Dr Melissa Werrett, has extensive experience in organometallic and medicinal chemistry with a particular focus on synthesis, structure development and bismuth complexes for targeted applications.

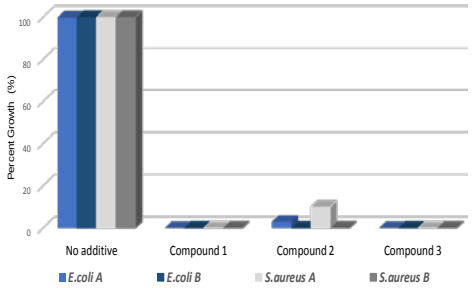

Figure 1: Percent growth of *E.coli* and *S.aureus*. Bacteria were incubated with the novel bismuth complexes at two concentrations (A, B) for 2hr under the Shake-flask method.

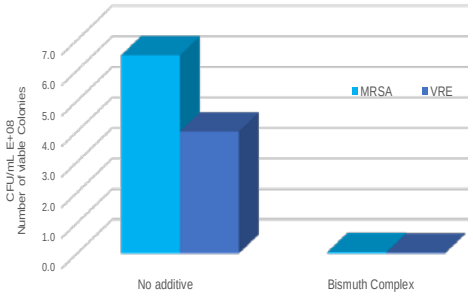

Figure 2: Testing of bismuth complex against multidrug-resistant MRSA and VRE in agar matrix.

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