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Singapore scientists develop safer and sustainable antimicrobials to prevent infection of cow udders

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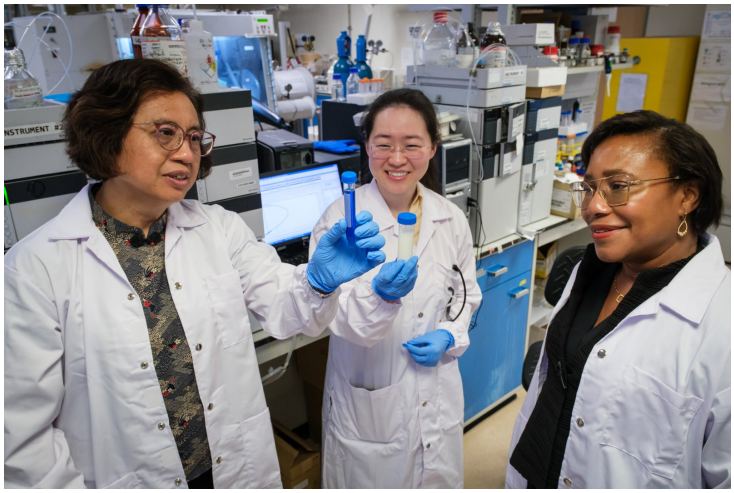

NTU Singapore and SMART scientists develop new antimicrobial compounds

A team of international researchers in Singapore has developed a groundbreaking alternative to antibiotics, offering a novel approach to preventing bacterial infections. In a preliminary farm trial, these innovative antimicrobial compounds were applied to cow teats, successfully preventing udder infections after exposure to bacteria.

The study, conducted by researchers from Nanyang Technological University, Singapore (NTU Singapore), in collaboration with the Antimicrobial Resistance (AMR) Interdisciplinary Research Group at the Singapore-MIT Alliance for Research and Technology (SMART), highlights a promising step forward in combating antimicrobial resistance.

When cattle udders get infected, the antibiotics used to treat them often end up in their milk in high concentrations for some time, so the milk cannot be consumed or sold under existing rules. Bacteria resistant to such antibiotic treatments have surfaced too. The NTU-led scientists realised that these challenges in the dairy business could be addressed with novel compounds called â??**oligoimidazolium carbon acidsâ?• (OIMs)** that they initially developed as alternatives to fight antibiotic-resistant bacteria. They found that OIMs kill bacteria in a new way, unlike traditional â??cationicâ? antimicrobials studied now as antibiotic substitutes. Parts of the OIMs convert into structures called carbenes, which lets them slip past the bacteriaâ??s protective membranes quickly to damage their DNA and kill them. This killing method is more potent than for typical cationic antimicrobials. So, lower doses of OIMs are needed, which reduces the chance of side effects.

â??Our study has unveiled an alternative class of potent antimicrobial compounds that could be used in the agriculture industry to combat multi-drug-resistant bacteria that cause bovine mastitis,â? saidÂ Professor Mary Chan, one of the co-leads of the research fromÂ NTU Singaporeâ??s School of Chemistry, Chemical Engineering and Biotechnology, and the Lee Kong Chian School of Medicine, as well as a Principal Investigator at SMART AMR. â??The compounds are also promising as they did not cause significant adverse effects in cattle in our tests. They didnâ??t spoil the cowsâ?? milk nor make it unsafe for consumption as well.â?•

The new compounds have since attracted interest from several agricultural companies in Australia, Belgium, Malaysia and New Zealand. The businesses are keen as they are seeking substitutes that are safer and more environmentally friendly than existing compounds in preventing the infection of cow teats.

Professor Paula Hammond, Institute Professor and Executive Vice Provost at MIT and Principal Investigator at SMART AMR,Â who is one of the co-authors of the research, said: â??With the success of our initial study in both the laboratory and in the field, we are now planning to work closely with industry partners to scale up and do larger trials in dairy cattle, with the aim of commercialising the novel antimicrobial compounds.â?•

Professor Kevin Pethe, the studyâ??s other co-lead fromÂ NTUâ??s Lee Kong Chian School of Medicine and Principal Investigator at SMART AMR, noted that the new compounds are also very effective in killing multi-drug-resistant bacteria in mice at doses that were not noticeably harmful to the rodents in the teamâ??s study. â??This opens the way for the compounds to be further developed and optimised for other therapeutic applications in the biomedical field in the future,â? he said.

The dairy industry has been plagued by a persistent global problem for decades â?? bacterial infection of cow udders that significantly reduces milk production. The condition, known as bovine mastitis, is estimated to cause annual global losses of US$22 billion (S$28 billion).Â While antibiotics have been used to treat the infection in dairy cattle, there are issues such as rising antibiotic resistance and concerns around milk contamination from antibiotic residues.