

COATINGS

► New route to lead-free porcelain designs discovered

Akai is a traditional Japanese enameling technique used to decorate porcelain. Historically, it involved combining leaded glass powder with iron(III) oxide in a water-based solution to yield a red paint. As porcelain makers have tried to switch to lead-free glass, however, they have had trouble producing high-quality akai samples. Experiments combining various particle sizes of glass and iron(III) oxide now seem to provide an optimal recipe that yields a glass particle core coated with an iron(III) oxide shell, reports a team led by Hideki Hashimoto of Kogakuin University. In contrast, the researchers find that preparing akai paint such that the iron oxide is isolated in spaces between glass particles results in a lower quality enamel (ACS

Appl. Mater. Interfaces 2016, DOI: 10.1021/acsami.6b01549).



Japanese researchers have figured out how to make high-quality, lead-free red akai enamel designs, such as the one on this dish.

The group succeeded in preparing the core-shell material by combining 2- μm glass particles with 100-nm iron(III) oxide particles, but the details of the preparation method were key: They blended the particles with green tea solution in a mortar and let the mixture dry, repeating the process a total of three times. Because mortars and pestles are commonly used by porcelain artisans, the authors believe that the method should be easy to implement.—JYLLIAN KEMSLEY

ANTIBIOTICS

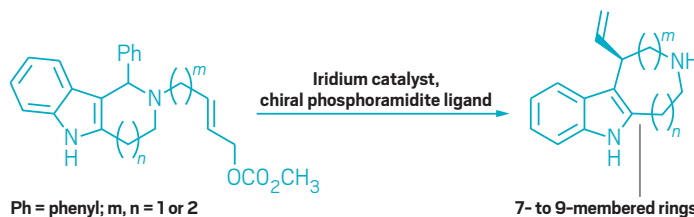
► Agent uses quorum sensing to kill bacteria

The superbug methicillin-resistant *Staphylococcus aureus* (MRSA) is a leading cause of hospital infections. Serge Van Calenbergh of Ghent University and co-

SYNTHESIS

Extended third ring is a charm for indole-annulated compounds

Fused-ring systems are special structural features of many natural product and synthetic compounds, contributing to the bioactivity that makes them useful as pharmaceuticals and agrochemicals. Chemists have numerous methods for generating small rings with six or fewer members, such as Diels-Alder and other cycloaddition reactions. They also have ways of constructing large rings with

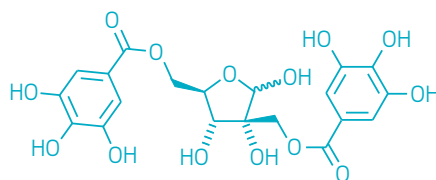


Ph = phenyl; m, n = 1 or 2

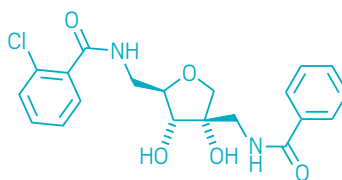
7- to 9-membered rings

10 or more members, including macrolactonization and ring-closing metathesis. However, the direct synthesis of medium-sized rings, especially enantioselectively, has remained a challenge because of steric constraints. Lin Huang, Li-Xin Dai, and Shu-Li You of Shanghai Institute of Organic Chemistry have now discovered a pathway around this roadblock by developing an intramolecular cascade reaction for building asymmetric seven- to nine-membered rings onto indole frameworks (*J. Am. Chem. Soc.* 2016, DOI: 10.1021/jacs.6b02678). As an example, the team found that a chiral iridium catalyst can drive dearomatization of an allylic carboline to form a bridged intermediate. A subsequent ring-opening retro-Mannich step followed by hydrolysis results in expanding the size of the piperidine ring (shown). The researchers anticipate that their method will facilitate synthesis of new indole-annulated compounds to join those already among the ranks of commercial products.—STEVE RITTER

workers have now developed a potentiator that helps overcome MRSA resistance to antibiotics by disrupting quorum sensing (*Angew. Chem. Int. Ed.* 2016, DOI: 10.1002/anie.201601973). Potentiators are agents



Hamamelitannin



Most potent hamamelitannin analog

that boost the sensitivity of microbes to existing drugs, and quorum sensing is a communication system bacteria use to regulate virulence. To find a potentiator for anti-MRSA drugs, Van Calenbergh and coworkers started with hamamelitannin, a natural product from witch hazel. Hamamelitannin potentiates anti-MRSA agents by modulating quorum sensing but is weakly active and metabolically unstable. The researchers synthesized 58 analogs designed to have better drug properties. When the best of these analogs was administered with the antibiotic cephalexin to infected mice, it killed MRSA about five times as potently as hamamelitannin combined with cephalexin and about 100 times as well as cephalexin alone. The group is currently collaborating with Elanco Animal Health to examine the use of an optimized compound to treat mastitis, a MRSA infection of breast tissue, in cattle.—STU BORMAN