Chemists synthesize an antimicrobial compound from harmless chitin and selenium

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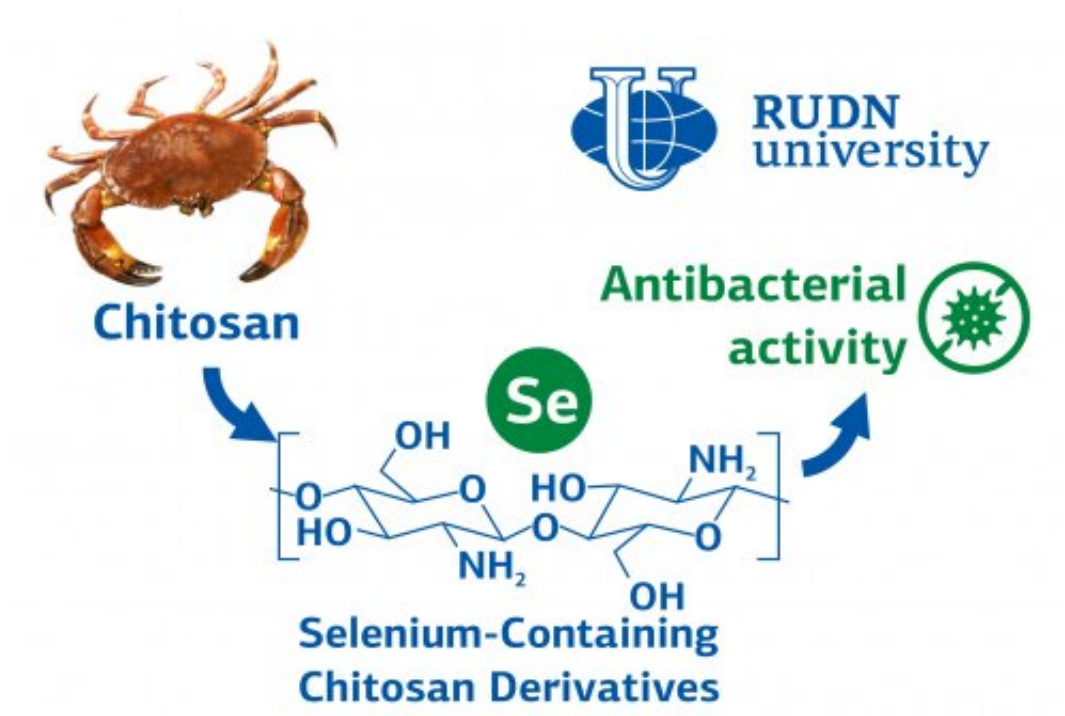

Credit: Russian Foundation for Basic Research

RUDN chemists obtained substances with high antibacterial activity based on chitosan and selenium. One of them even outperformed common antibiotics. The results are published in *Applied Biochemistry and Microbiology*.

Chitosan is a substance from the group of amino sugars, which is obtained from chitin, the main component of arthropod exoskeleton. Due to its biological activity, chitosan is used, for example, to create biodegradable films with antibacterial properties or other coatings where antibiotic action is needed: in food production, medicine and industry. The scope of chitosan is large, but still limited. This is due to the low solubility and the so-called cationic density. To increase it, scientists modify chitosan molecules by adding functional fragments to them. RUDN University chemists have "sewn" a selenium-containing fragment to chitosan and obtained a highly effective anti-viral agent.

"Because of the rise in antimicrobial resistance, the development of new antibacterial agents is needed. This is a priority task of modern pharmacology. Chitosan is one of the preferred compounds with antibacterial activity. Among its advantages are biocompatibility, hypoallergenicity, biodegradability and non-stickiness. At the same time, poor water solubility and low cationic density limit the antibacterial effect of chitosan. To overcome these limitations, chitosan is modified. Our goal was the chemical modification of chitosan with a selenium-containing fragment," says Andrey Kritchenkov, Ph.D., researcher at Department of Inorganic Chemistry, RUDN University.

RUDN chemists obtained a new compound by dissolving chitosan in a selenadiazole derivative in different proportions. The antibacterial effect of the obtained substances was tested on a gram-positive Staphylococcus Aureus and a gram-negative Escherichia Coli, and also compared with commercial antibiotics ampicillin and gentamicin.

All synthesized compounds demonstrated antibacterial activity comparable to that of antibi. The X-Se-65 complex with 65% substitution of the selenediazole derivative turned out to be the most effective. On a Petri dish, it destroyed Staphylococcus aureus within a radius of 34.4 mm (ampicillin did it within a radius of 30.3 mm), and E.

coli was not observed within a radius of 26.3 mm from it (and 22.3 mm from gentamicin).

"The new compounds have shown strong antibacterial activity against both S. aureus and E. coli . Moreover, their antibacterial activity is comparable to the antibiotics ampicillin and gentamicin, and one of the compounds even exceeded them. This fact can be explained by the symbiotic effect of the antibacterial fragment with selenium and chitosan. We have obtained a highly active, antibacterial derivative of chitosan, which is of undoubted interest for further in vivo research," says Anton Egorov, RUDN Research Assistant.

More information: A. R. Egorov et al, Synthesis of Selenium-Containing Chitosan Derivatives and Their Antibacterial Activity, *Applied Biochemistry and Microbiology* (2022). DOI: 10.1134/S0003683822020053

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