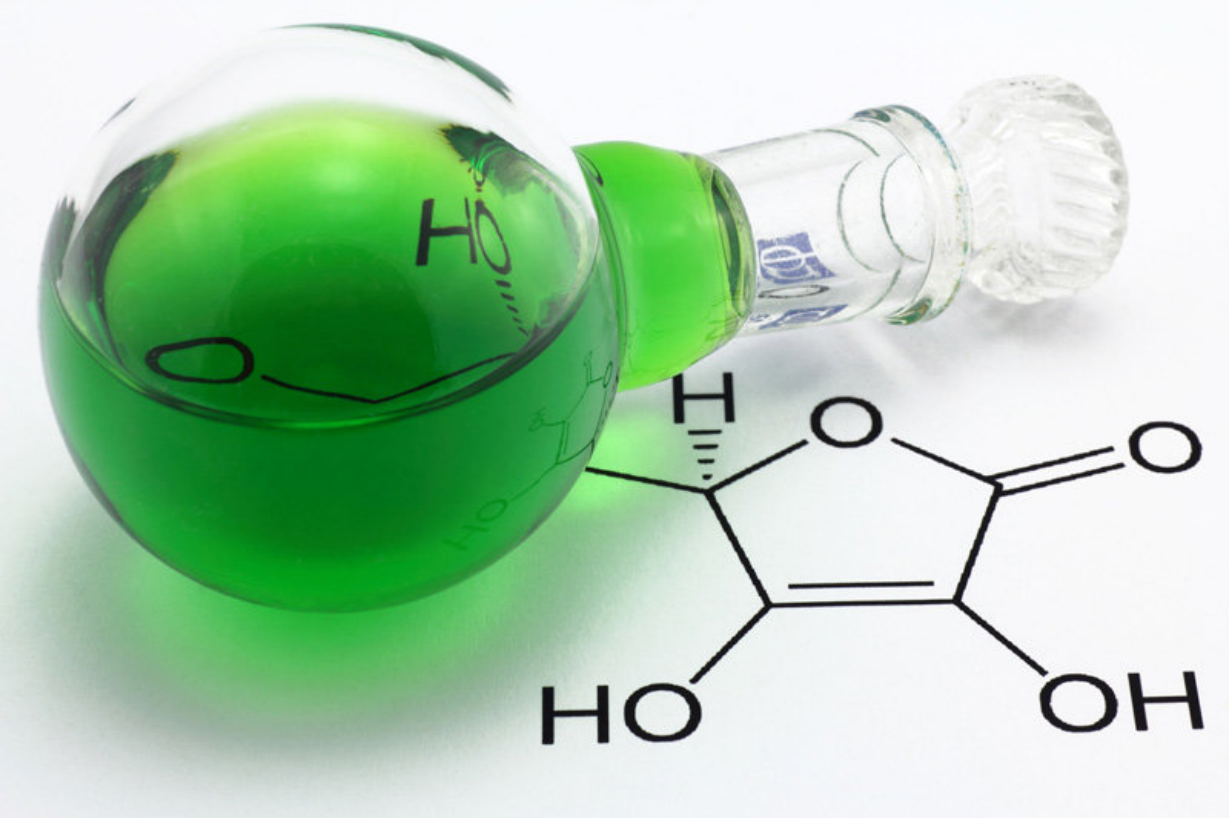
A novel way to synthesize antioxidant substances

December 22 2017



Credit: Tomsk Polytechnic University (TPU)

Scientists from Tomsk Polytechnic University together with their colleagues from USA and Japan have proposed a novel way to address the most important and fundamental challenge of organic chemistry, i.e.

breaking a bond between carbon and hydrogen atoms to form new organic substances. They were the first to carry out "breaking" in water thanks to especially synthesized substances called arylbenziodoxaboroles. As a result, the scientists synthesized a number of novel phenolic substances that possess high biological and antioxidant activity. In the future, they can be used for drug creation.

The outcomes of the study were published in *Chemistry – A European Journal*.

Director of the School of Chemistry & Applied Biomedical Sciences Mekhman Yusubov says, "Our study dates back to 2009 when we synthesized benziodoxaborole with two reaction centers with iodine and boron atoms at a time. By the way, Nobel Prizes were once awarded for the research of each of the reaction centers and we managed to combine them in one substance. Benziodoxaborole is a precursor that presents a chemical building block that is used to create other substances. Recently, we have found conditions in which benziodoxaborole exhibits amazing properties.

We carried out the reaction in water at room temperature and obtained a highly reactive intermediate aryne (an aromatic ring with a triple bond), resulting in novel phenolic substances to be further obtained. They possess a high biological and antioxidant activity."

According to the scientists, ordinary water as a 'green' solvent is a highly interesting medium for conducting chemical reactions, that allows substances to manifest new properties. In addition, it is available and easily regenerated. It is noteworthy, that such aryne intermediates are usually obtained either with hard irradiation or using organic solvents.

"These two elements, namely, the precursor of aryne intermediate and ordinary water enabled a new way to solve a fundamental problem which

challenges organic chemists around the world. These elements helped to carry out CH-activation, i.e. to break the bond between carbon and hydrogen in molecules and to create a new carbon-carbon bond and thereby obtain new promising substances. For this purpose, expensive metal-containing catalysts are usually used. After all, why are there more organic compounds than inorganic? Just due to the formation of carbon-carbon bond when carbon molecules stand side by side. In this case, most of the organic compounds have carbon-carbon bonds that are the most inactive. In order to obtain new compounds, it is necessary to break the bond of carbon and hydrogen to form carbon-carbon bond," explains the researcher.

The study aligns with the concept of green chemistry focused on the reduction of the negative impact of chemical industry on the environment.

Mekhman Yusubov says, "At present, chemists around the world are trying to find ways to use substances more efficiently, to minimize losses of active substances during reactions, to find less toxic ways for obtaining compounds. All this requires the improvement of reactivity of compounds. In this field, Tomsk Polytechnic University takes a significant place in the world scientific community. We have accumulated large amounts of knowledge and technologies. Thus, in this publication, we reveal three important outcomes: the synthesis of new precursors enabling extremely interesting novel compounds, a new way of CH-activation and the reaction conducted in water."

More information: Akira Yoshimura et al. Pseudocyclic Arylbenziodoxaboroles: Efficient Benzyne Precursors Triggered by Water at Room Temperature, *Chemistry - A European Journal* (2017). DOI: 10.1002/chem.201704393

Provided by Tomsk Polytechnic University