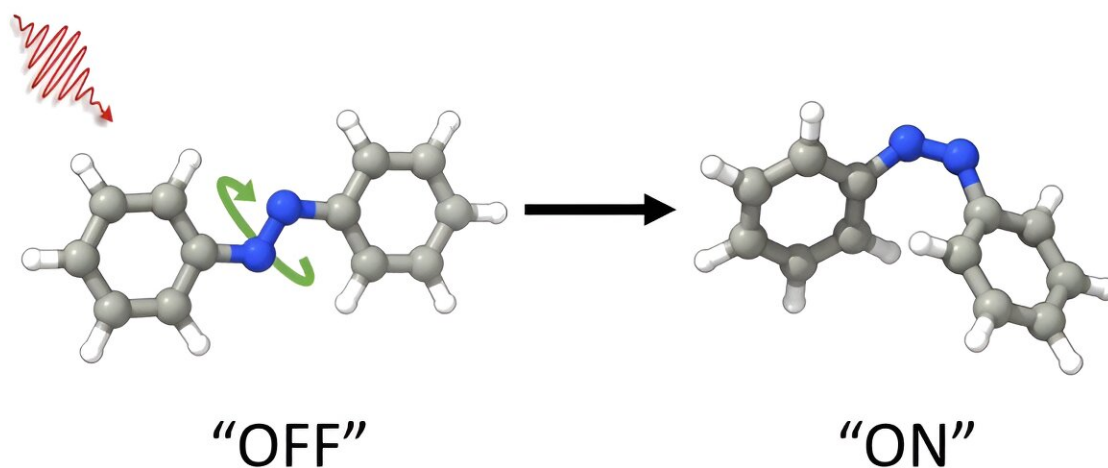


Using harmless light to change azobenzene molecules with new supramolecular complex

September 21 2023



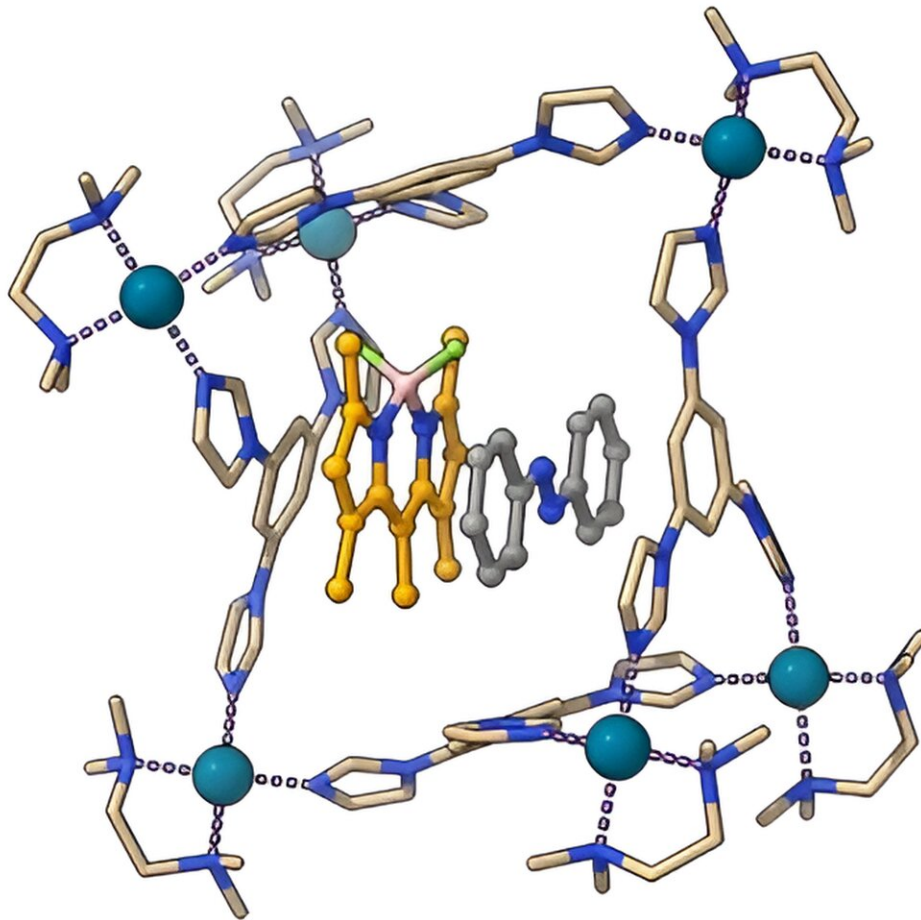
Azobenzene molecules changes between two forms by light. Credit: Jonathan R. Church

Azobenzenes are incredibly versatile and have many potential uses, such as in making tiny machines and improving technology as well as making light controllable drugs. This molecule can switch between two different forms by light. However, the two forms are in equilibrium, which means that a mixture present that prevents optimal use for applications.

Being able to control them with visible light and enrich only one form opens up new possibilities for these applications, making them more efficient and accessible.

Azobenzenes have traditionally required ultraviolet light for photoisomerization. However, a new approach promises to change the game. Profs. Igor Schapiro from Hebrew University of Jerusalem, Rafal Klajn from the Weizmann Institute of Science and Institute of Science and Technology Austria, and Arri Primagi from Tampere University along with a team of researchers, have introduced a novel concept termed "disequilibrium by sensitization under confinement" or DESC.

This innovative approach offers for the first time the possibility of prompting a specific molecular transformation, specifically the conversion from an "E" to a "Z" state. They can be thought of as an "on" and "off" form in applications. This change can be triggered by visible light, including wavelengths in the red part of the visible spectrum.



The new mechanism is based on the supramolecular approach where a molecular switch (azobenzene) and a photosensitizer are confined in a molecular cage. The confined space of the cage fits only an E-form of azobenzene but not the Z-form of azobenzene, which is expelled from the cage. Credit: Jonathan R. Church

The study, titled "Disequilibrating azobenzenes by visible-light sensitization under confinement," was published in the journal, *Science*.

What makes azobenzene molecules particularly interesting is their ability to undergo changes in their shape in response to specific types of light,

including ultraviolet and visible light. This phenomenon, known as photoisomerization, enables azobenzenes to transition between two distinct shapes or isomers, the "E" and "Z" isomers. This unique attribute holds immense significance, as it unlocks a diverse spectrum of applications spanning nanotechnology, [data storage](#), [drug delivery](#), [materials science](#), and [biological research](#).

In essence, azobenzenes serve as pivotal elements in numerous scientific and technological advancements.

"Through our computational studies and quantum chemical calculations, we've illuminated the path to an innovative approach, which not only advances the fundamental field of azobenzene but also paves the way for practical applications. These applications harness the power of [visible light](#), including red wavelength of light," said Prof. Igor Schapiro, Hebrew University of Jerusalem

Azobenzenes are pivotal components in a wide range of technologies, from molecular switches and actuators to data storage and drug delivery systems. Until now, their photoisomerization necessitated [ultraviolet light](#), limiting their applicability. However, DESC represents a significant breakthrough, offering a supramolecular approach that enables controlled E-to-Z isomerization with harmless light.

This pioneering research opens up exciting new avenues for the utilization of azobenzenes across various fields. By broadening the range of light wavelengths that can induce isomerization, DESC promises to enhance the efficiency and applicability of azobenzene-based technologies.

More information: Julius Gemen et al, Disequilibrating azobenzenes by visible-light sensitization under confinement, *Science* (2023). [DOI: 10.1126/science.adh9059](https://doi.org/10.1126/science.adh9059).

www.science.org/doi/10.1126/science.adh9059

Provided by Hebrew University of Jerusalem

Citation: Using harmless light to change azobenzene molecules with new supramolecular complex (2023, September 21) retrieved 27 April 2024 from <https://phys.org/news/2023-09-harmless-azobenzene-molecules-supramolecular-complex.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.