Researchers use ketyl radicals for a new multi-component reaction
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"Ketyl radicals are very important species in synthetic chemistry. They are often used in the synthesis of complex natural-occurring products. However, catalytic chemical transformations that use ketyl radicals remain challenging. Their formation often requires 'harsh' reaction conditions with a high temperature. The radicals can also be non-selective in their reaction pathways, which means they are difficult to control," explains Huan-Ming Huang.

The research team used ketyl radicals and palladium catalysis excited by visible light to create an MCR between several coupling partners. When selecting the coupling partners (aldehydes, 1,3-dienes and various nucleophiles), the researchers took various aspects into account: Which substances are necessary for the reaction to take place, which are readily available and which products are useful?

"We succeeded in taming ketyl-type radicals by combining visible light with small amounts of a commercially available palladium catalyst," says co-author Peter Bellotti. "This operationally simple, redox-neutral and thus environmentally friendly approach could become a general platform for the construction of so-called complex homoallylic alcohol motifs, a frequently used structural motif in synthetic chemistry. The one-step synthesis of key intermediates that can be further converted to valuable products is proof of the versatility of this approach."

In addition to the synthetic capabilities of this method, the team investigated the mechanistic intricacies using a combined experimental mechanistic analysis and density functional theory (DFT) calculations. "We anticipate that the combination of visible light with transition metals such as palladium could inspire further unforeseen synthetic transformations beyond the established catalyzed reactions," Frank Glorius says.

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