New step towards future production of solar fuels

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In one hour, the earth receives as much energy from the sun as humankind uses in one year. Uppsala researchers have found a new way of tranforming solar energy into fuel.

One way of storing solar energy is to transform the energy directly into a fuel. Researchers at Uppsala University have shown a reaction which makes the process of creating fuel from solar energy more efficient and less energy demanding.

Solar energy is abundant. In one hour, the earth receives as much energy from the sun as humankind uses in a whole year. To meet our energy

needs when the sun doesn't shine, at night or during the winter, solar energy needs to be stored. One way to do this is to transform the solar energy directly into a fuel, such as for instance hydrogen gas or an alcohol, from basic raw materials such as water and carbon dioxide.

A good chemical catalyst which facilitates the process is needed to allow efficient production of the fuel. Exactly which chemical steps a catalyst causes is not always known and must first be studied closely. That knowledge allows us to understand how to design even better catalysts.

Now, researchers at Uppsala University have shown a reaction where the catalyst molechule goes through two reaction steps at once, thereby avoiding more energy demanding and slow reaction paths. The study has found that it is possible to design the process, allowing more efficient production of fuel from water and carbon dioxide. This is one step towards future production of solar fuels.

The researchers used a metal complex as a model for the catalyst, a tungsten hybrid complex. This was allowed to react with different oxidants and bases which take electrons and protons from the complex, and the researchers measured how quickly the reactions progressed. Through physical–chemical analysis, the results showed that when using the weakest oxidants and bases – which represent an energy efficient process – the electron and proton were transferred simultaneously to the oxidant and the base – a so-called concerted reaction. The researchers now want to continue by designing catalytic complexes that produce hydrogen through concerted and energy efficient reactions, and fine-tune the molecular structures so that the reactions happen as quickly as possible.

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