Water oxidation catalysts and a turned hydrogenase for solar hydrogen production.

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In the Swedish Consortium for Artificial Photosynthesis[1,2] we develop both manmade, artificial photosynthetic systems and photosynthetic microorganisms for solar fuel production.

We design and synthesize catalysts for light driven oxidation of water, an essential part of all solar fuel production methods. The lecture will describe a water-oxidizing cobalt nano-particle[3]. This nano-particle has been linked to a photosensitizer to form a water-splitting photosensitizer-catalyst complex[4]. Using MIMS (membrane inlet mass spectrometry) we have resolved the detailed catalytic mechanism in this nanoparticle[4]. Recently we have applied EPR spectroscopy to study the catalytic mechanism in a series of extremely efficient, molecular Ru-catalysts for water oxidation[5]. An unexpected outcome of this research is that water is bound in what seems to be an unusual seventh ligand position, already in the Ru(III) oxidation state.

The lecture will also describe a spectroscopic study on the uptake hydrogenase from *Nostoc punctiforme* electron transfer relay[6]. Normally this enzyme oxidizes hydrogen (H_2) but by exchange of one amino acid in the electron transfer relay with three FeS clusters, the electron transfer is turned towards H_2 formation[6]. This work is taken further and EPR studies indicate that the proximal FeS cluster involves Fe-ligation with an asparagine which is a quite uncommon ligand.

References

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