

Discovery of new catalyst promises cheaper, greener drugs

March 27 2012

A chemistry team at the University of Toronto has discovered environmentally-friendly iron-based nanoparticle catalysts that work as well as the expensive, toxic, metal-based catalysts that are currently in wide use by the drug, fragrance and food industry.

"It is always important to strive to make industrial syntheses more green, and using iron catalysts is not only much less toxic, but it is also much more cost effective," said Jessica Sonnenberg, a PhD student and lead author of a paper published this week in the [Journal of the American Chemical Society](#).

The research, which was directed by Robert Morris, chair of the Department of Chemistry, involved several steps. Suspecting the existence of nanoparticles, the team first set out to identify the iron catalysts. They then conducted investigations using an [electron microscope](#) to confirm that the iron nanoparticles were actually being formed during catalysis. The next step was to ensure that the iron nanoparticles were the active catalytic agents. This was done with polymer and poisoning experiments which showed that only the [iron atoms](#) on the surface of a nanoparticle were active.

But a further challenge remained. "Catalysts, even cheap iron ones developed for these types of reaction, still suffer one major downfall," explained Sonnenberg. "They require a one-to-one ratio of very expensive [organic ligands](#) – the molecule that binds to the central metal atom of a chemical compound – to yield catalytic activity. Our discovery

of functional surface nanoparticles opens the door to using much smaller ratios of these expensive compounds relative to the metal centres. This drastically reduces the overall cost of the transformations."

Provided by University of Toronto

Citation: Discovery of new catalyst promises cheaper, greener drugs (2012, March 27) retrieved 19 April 2024 from

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