New uses for diesel by-products

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(PhysOrg.com) -- A new catalytic process discovered by the Cardiff Catalysis Institute could unleash a range of useful new by-products from diesel fuel production.

More sustainable production of sulphur-free diesel from natural gas and biomass is increasing. However the by-products, hydrocarbons like decane and other low value alkanes have little practical use.

Now a discovery by the Institute, part of the School of Chemistry, has found a potential route for upgrading these by-products into more useful chemicals.

In the past, synthetic reactions starting from alkanes like decane have

been fraught with difficulty. They tend either to over-dehydrogenate or to combust, depending on whether oxygen is present in the reaction. Now a Cardiff Catalysis Institute team has reported the use of a mixed-metal catalyst to convert decane to a range of oxygenated aromatics.

The breakthrough, published in *Nature Chemistry*, came when the team fed a gas mixture of decane and air through an iron molybdate catalyst. At higher temperatures, the reaction formed water and decene, which is used in the production of detergents. At lower temperatures, however, the reaction took a different route to create oxygenated aromatic molecules. These included phthalic anhydride, used in the dyeing industry, and coumarin which helps in the production of anti-coagulant drugs.

Professor Stan Golunski, a member of the Institute team behind the discovery said: "This discovery breaks new ground as it implies the involvement of oxygen that has not yet made the full transition from its molecular form to its ionic form. This overturns a widely-held view that this type of oxygen was too reactive to form anything other than carbon monoxide and carbon dioxide in reactions with hydrocarbons."

"While the increased production of sulphur-free diesel has been a positive move, the glut of low value by-products will become a problem. We hope our new process will lead to less waste and the creation of more useful chemicals for a range of industries."

Provided by Cardiff University