Campus Briefs

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Two articles written by scientists conducting collaborative research in the University of Utah chemistry department are featured in the Oct. 7 issue of the journal, *Science*.

In the first article, Istvan Horvath, an Exxon scientist and U. adjunct professor, reports the discovery of a new method for chemical reactions, which involves combining fluorinated and non-fluorinated liquids and "ponytails" that anchor molecules in the fluorinated liquid. In the second article, titled "Are Teflon Ponytails the Coming Fashion for Catalysts?" John Gladysz, U. chemistry professor, analyzes Horvath's discovery.

In his article, Gladysz notes that chemists frequently use immiscible liquids (examples would be oil and vinegar used in salad dressing) to separate and purify reaction products. For example, the pH of an aqueous layer (the vinegar in salad dressing) might be adjusted to remove an acidic or basic impurity from a product dissolved in oil, or the organic layer.

A "catalyst" that facilitates the reaction of two other molecules (but is not itself consumed) might only be soluble in one liquid and thus can be considered "immobilized." The reactant molecules might be soluble in both liquids. The actual reaction – bond breaking and forming – would take place in the liquid in which all species dissolve.

"It is sometimes possible to choose the two liquids such that the target product will preferentially dissolve in the second liquid," Galdysz said. "In this situation, it is especially easy to recover and reuse the catalyst. In many cases undesired byproducts will remain in the first liquid." In either scenario, release of chemicals into the environment is minimized.

Horvath heads a team of Exxon researchers in Annandale, N.J., who have developed a new approach to such "liquid biphase" reactions. Their approach involves attaching long fluorocarbon chains, analogous to Teflon, to catalysts or one of the chemical reactions.

These "Teflon ponytails" immobilize the molecules in fluorinated solvents, Gladysz said. Such solvents are commercially available at modest cost and are generally regarded as non-toxic and biologically compatible – consistent with the extensive experience with fluorocarbon coatings in cookware and artificial organ implants over the last several decades.

Horvath has shown that a variety of reactions can be conducted using this process. The molecules with "ponytails" do not leach into the second liquid and are easily recovered and reused. With some liquid combinations, a slight increase in temperature causes mixing, increasing reaction rates. The liquids separate into two layers again upon cooling, with the desired products exclusively in the non-fluorinated layer.

"The protocol developed by Horvath is remarkable in its conceptual simplicity," Gladysz said. "Furthermore, the strategy is even easier than that in 'pin-the-tail-on-the-donkey.' Any point of attachment can in principle be used for the 'ponytail.'"

Horvath and Gladysz are conducting research at the U. based on Horvath's discovery. Paul Bernatis, a post doctoral associate, is assisting them. The National Science Foundation is funding their work.