



Who said catalysis in organic chemistry has to be done in petroleum-derived organic solvents, while bio-catalysis is commonly done, separately, in water? That makes no sense; such an individual approach is wasteful, costly, and far more dangerous than need be. It is time to do organic chemistry as Nature has been doing it for millions of years: to merge both types into the same medium, water. This work illustrates not only how both "chemo-catalysis" and "bio-catalysis" can be done safely in water, but also done sequentially in the same reaction vessel, eliminating organic solvents, and minimizing individual processing of reaction mixtures and hence, organic waste.

Pharmaceuticals are made using sequences of reactions involving either non-natural chemicals in organic solvents, and/or enzymatic processes in water. Use of organic solvents leads to depletion of our petroleum reserves, generation of huge stores of buried toxic waste, pollution of the worlds' waterways, and the potential for massive fires and explosions from its required stockpiling. This new technology documents how chemistry in water, in tandem with enzymatic processes, provides a convenient, far more economically attractive, and safe alternative for the preparation of valued drugs.

Although this is a report on "chemo-catalysis" together with "bio-catalysis" used sequentially in water, a huge bonus appears to have been uncovered along the way. That is, the nanoreactors present in the water that enable chemo-catalysis to take place, also serve as reservoirs for the substrates that will eventually enter the enzymatic cavity. Hence, the enzyme can do bio-catalysis without "inhibition" due to buildup of either the substrate or the newly formed product around the enzymatic pocket, thereby allowing such reactions to occur to a greater extent.