



## Fluorination Chemistry at Raybow

Raybow is pleased to announce its efforts in the development and application of fluorination chemistry to address this challenging synthetic issue. In recent years the incorporation of fluorine into NCE's has become widespread as the strategic introduction of fluorine can significantly enhance the desired pharmacological properties of the API/DS.

Raybow has worked with leading academic researchers, including Professors T. Umemoto and J. Hu, in developing solutions for the cost effective, safe, environmentally friendly and scalable introduction of fluorine into the target molecules. These reagents, including the second generation "Umemoto reagent II" and the "Hu reagent SulfoxFluor", as well as others, allow for the synthesis of mono-fluoro, di-fluoromethyl and trifluoromethyl molecules. The transformations include conversion of alcohols to mono-fluoro compounds by deoxyfluorination, mono-fluoromethylation, carbonyls to difluoromethyl compounds, and the introduction of " $CF_3^+$ ".

It is important to note that these fluorination reagents are free and clear of any Intellectual Property issues and their use will not require any royalty payments from Raybow's clients.

Raybow has also considered the implication of the principles of Green Chemistry as typically introduction of fluorine has required either expensive reagents and/or reagents with high reactivity/toxicity. Both the Umemoto and Hu reagents address these concerns as they are thermally and chemically stable with a good safety and environmental profile. Furthermore, they can be easily recycled as required.

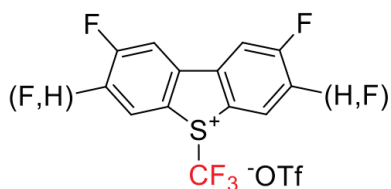
Raybow has applied these reagents to a number of client projects, ranging from laboratory demonstration of proof-of-concept to full scale manufacture of 100s of kilogram quantities of the desired target molecules, including advanced intermediates, RSMs and API/DS. For example, in one case study, replacement of the original SF4 with the Umemoto reagent II resulted in doubling the yield and significantly lowering the costs. Raybow can also provide the fluorination reagents if the customer desires to do the actual chemical transformations themselves. For example, bulk quantities (100s of kgs) of the Umemoto reagent II are available.

Raybow will be happy to discuss the potential applicability of these fluorination reagents for your chemistry needs.

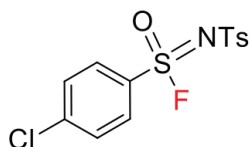
Visit our website contact page to find up to date contact information for our global sales team.

[www.raybow.com](http://www.raybow.com)

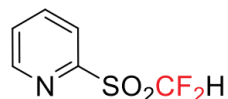
## Fluorination Reagents Offered by Raybow:



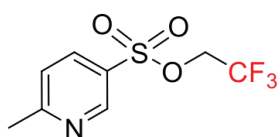
Umemoto's reagent II (A, B)  
(Prof. Umemoto)



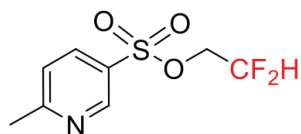
SulfoxFluor  
(Prof. Hu)



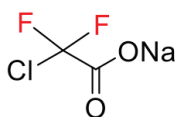
2-[(Difluoromethyl)sulfonyl]pyridine



2,2,2-Trifluoroethyl  
4-methylbenzenesulfonate



2,2-Difluoroethyl  
4-methylbenzenesulfonate



Sodium 2-chloro-  
2,2-difluoroacetate



(Bromodifluoromethyl)-  
trimethylsilane



Methyl 2,2-difluoro-2-  
(fluorosulfonyl)acetate

---

## Fluorination Example by Raybow:

