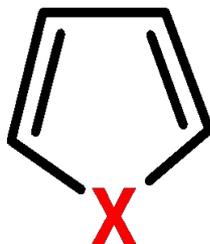
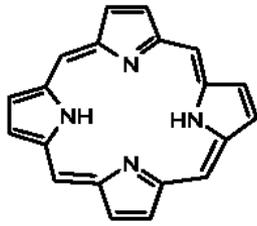


Пятичленные гетероциклы с одним гетероатомом

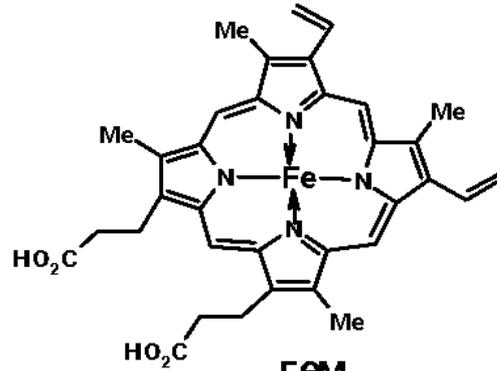


X = NH - ПИРРОЛ, X=S - ТИОФЕН, X=O - ФУРАН

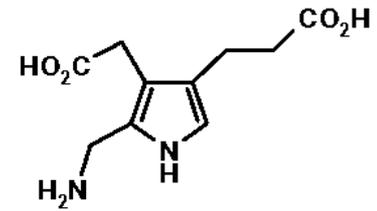


порфирин

I

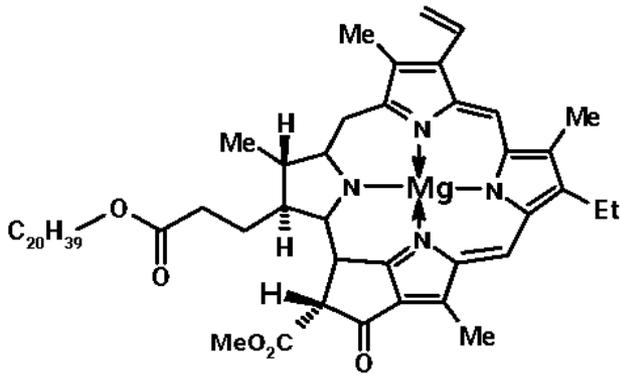


ГЕМ
II



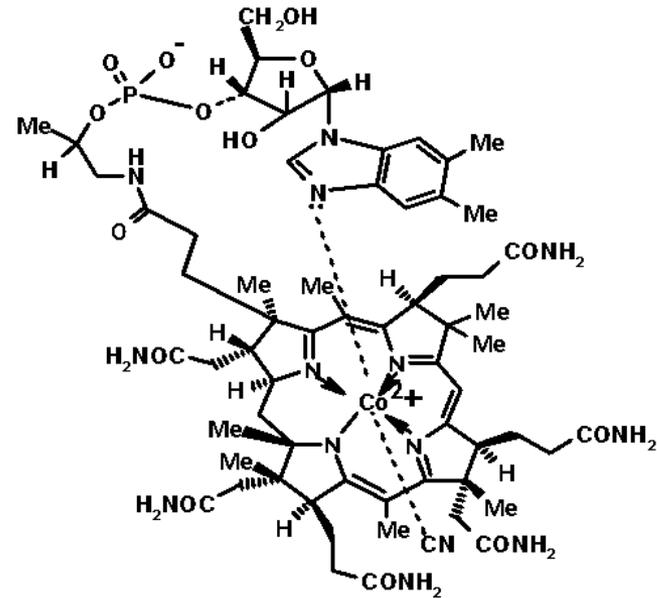
порфобилиноген

V



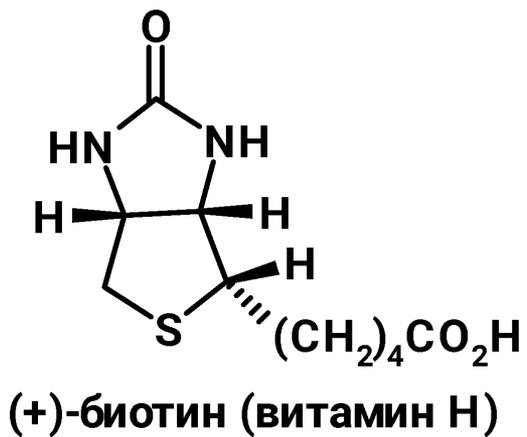
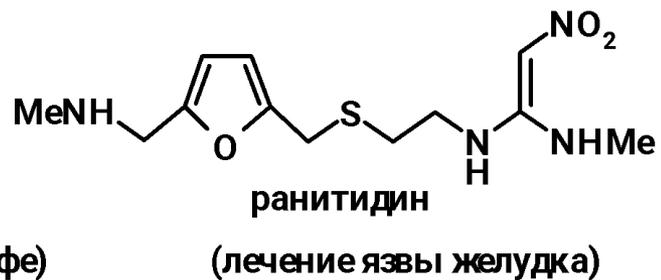
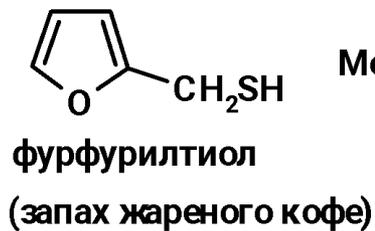
хлорофилл-а

III

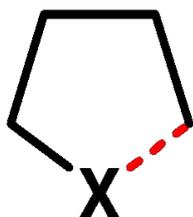


ВТИМИН В₁₂

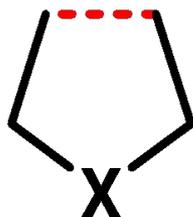
IV



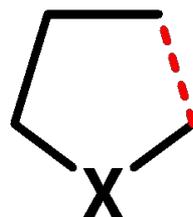
Типы образования связей



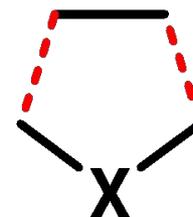
C-X



C₍₃₎-C₍₄₎



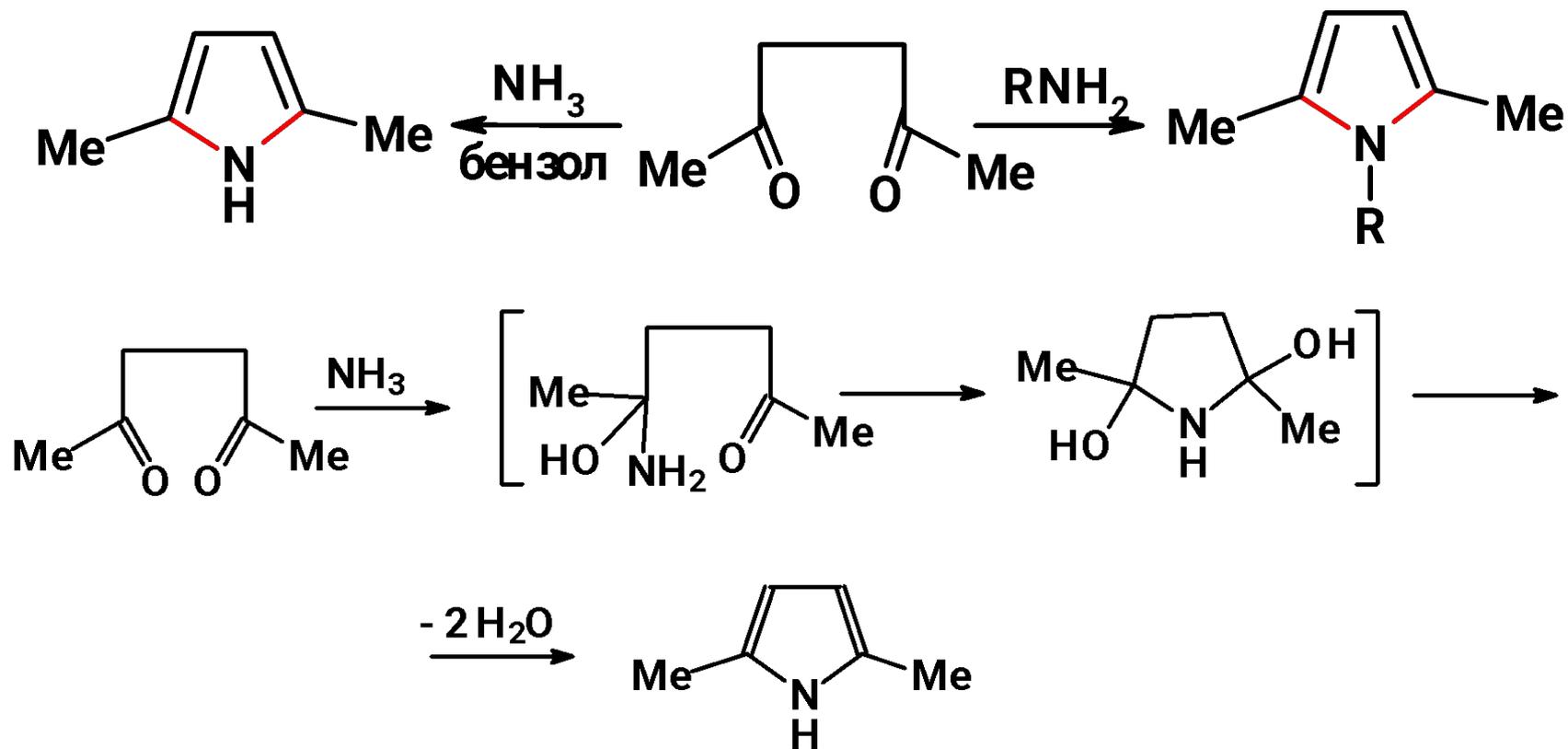
C₍₂₎-C₍₃₎

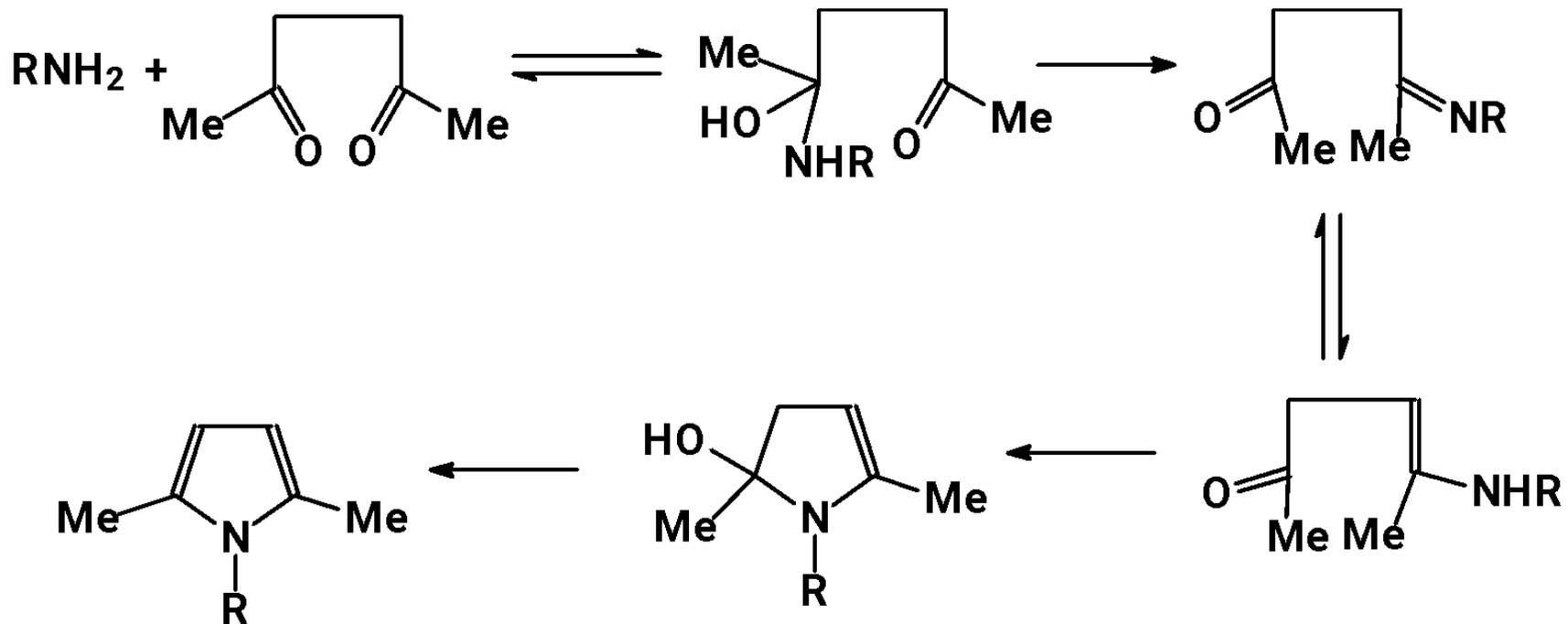


C₍₂₎-C₍₃₎ + C₍₄₎-C₍₅₎

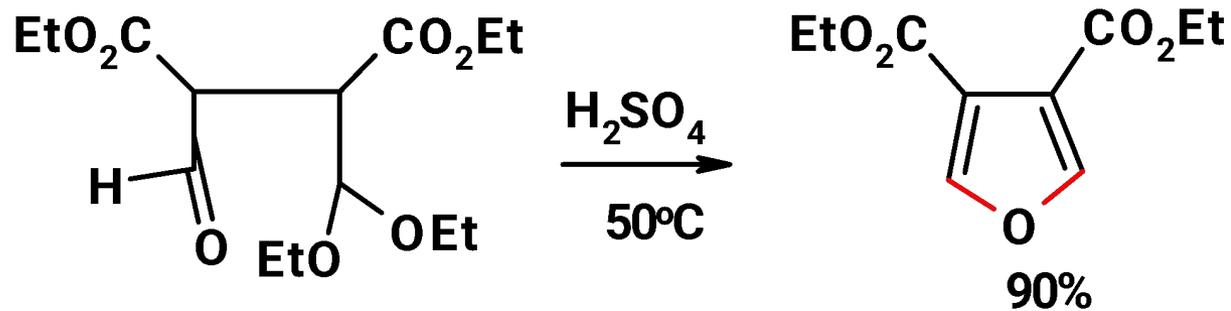
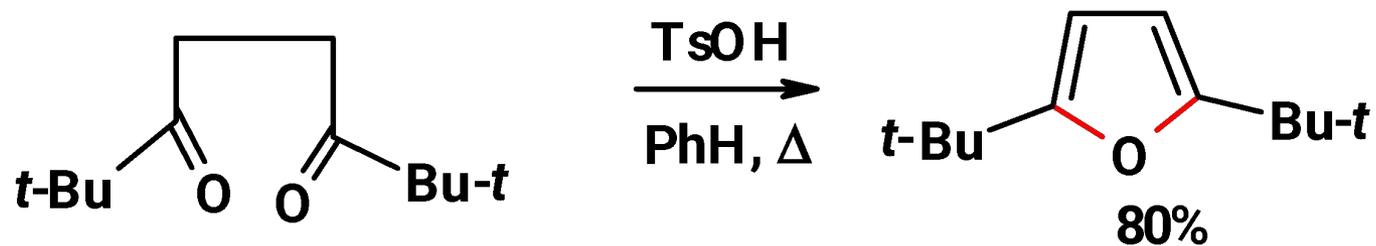
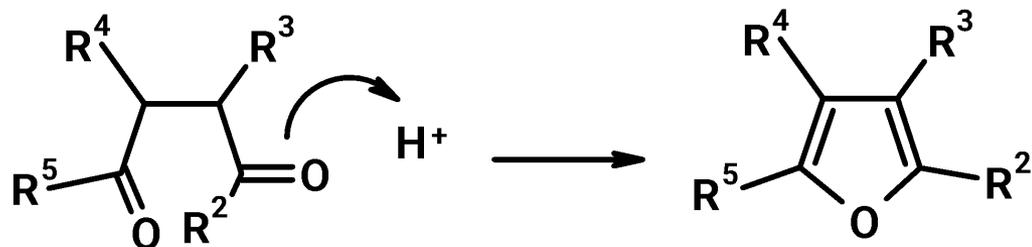
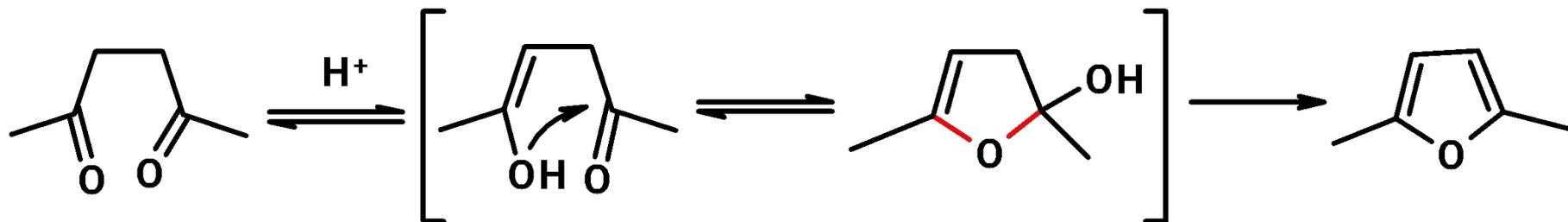
Образование связи С-Х

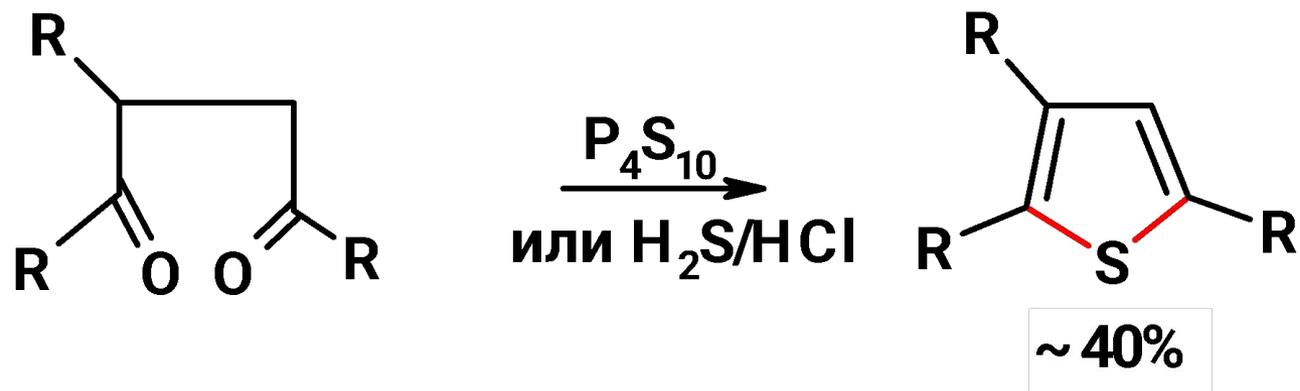
Из 1,4-дикарбонильных соединений (метод Паалы-Кнорра)



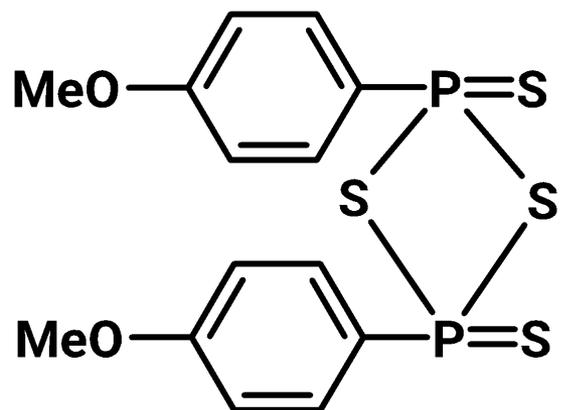


A.R.Katrizki, *Tetrahedron*, 43, 5171 (1987)

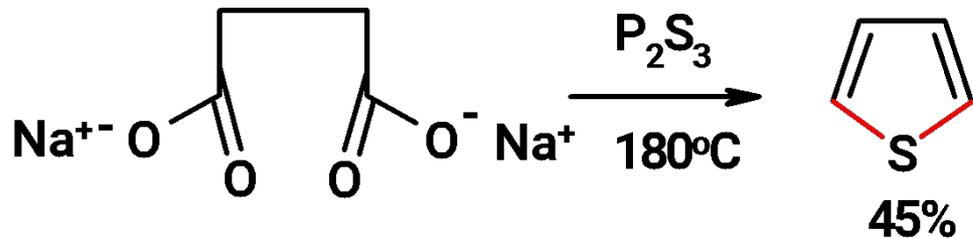
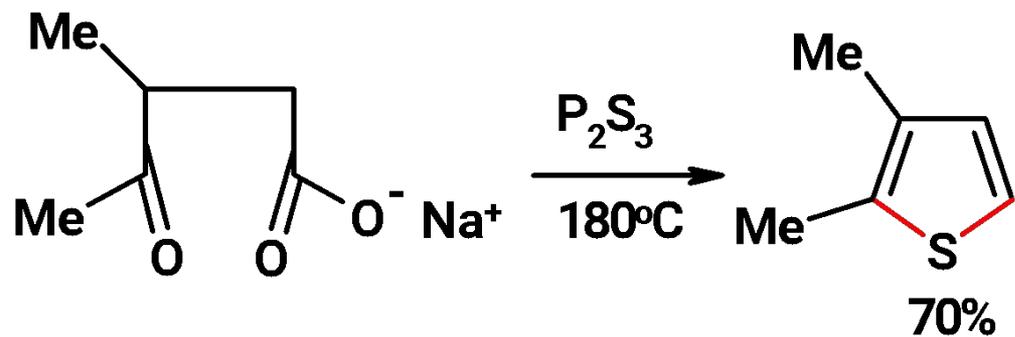
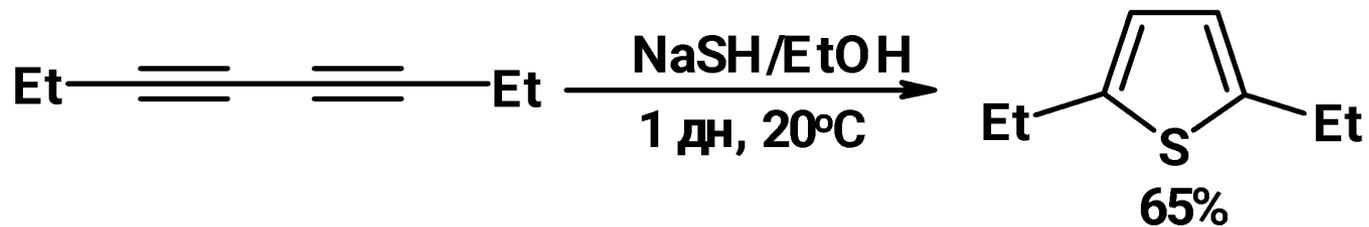




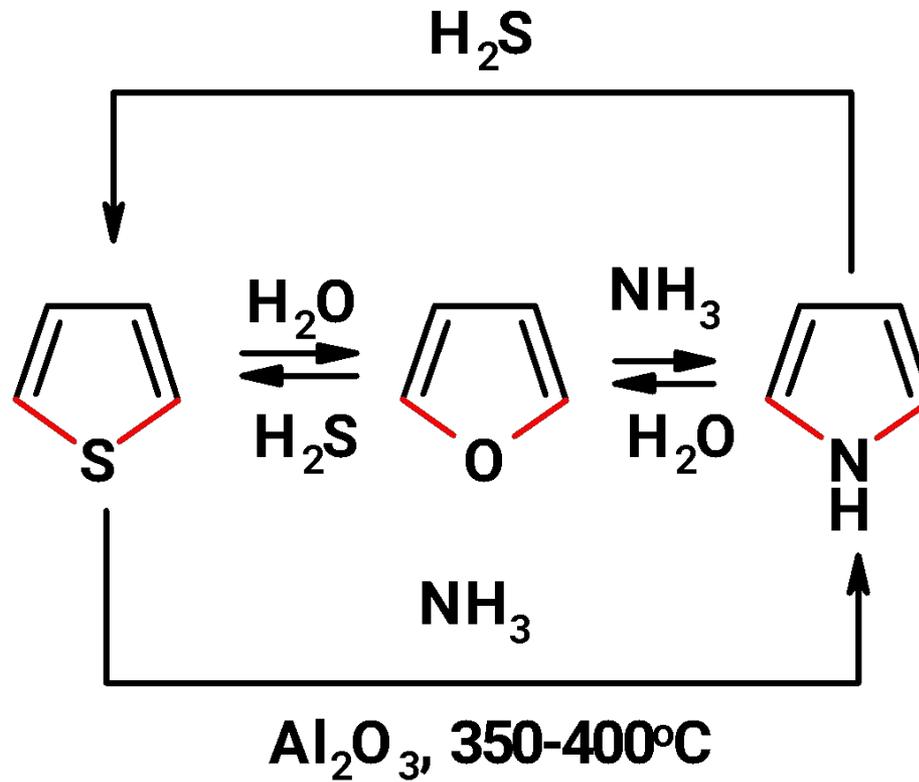
Реактив Лоуссона



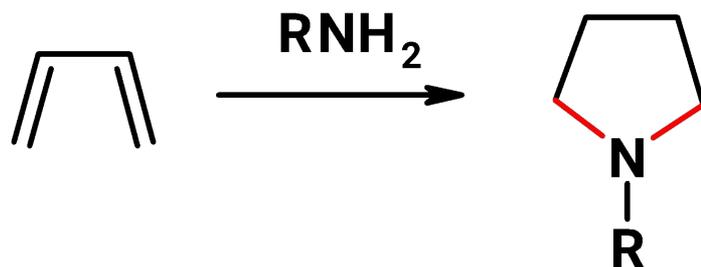
Tetrahedron Lett., 41 (22), 5061 (1985)



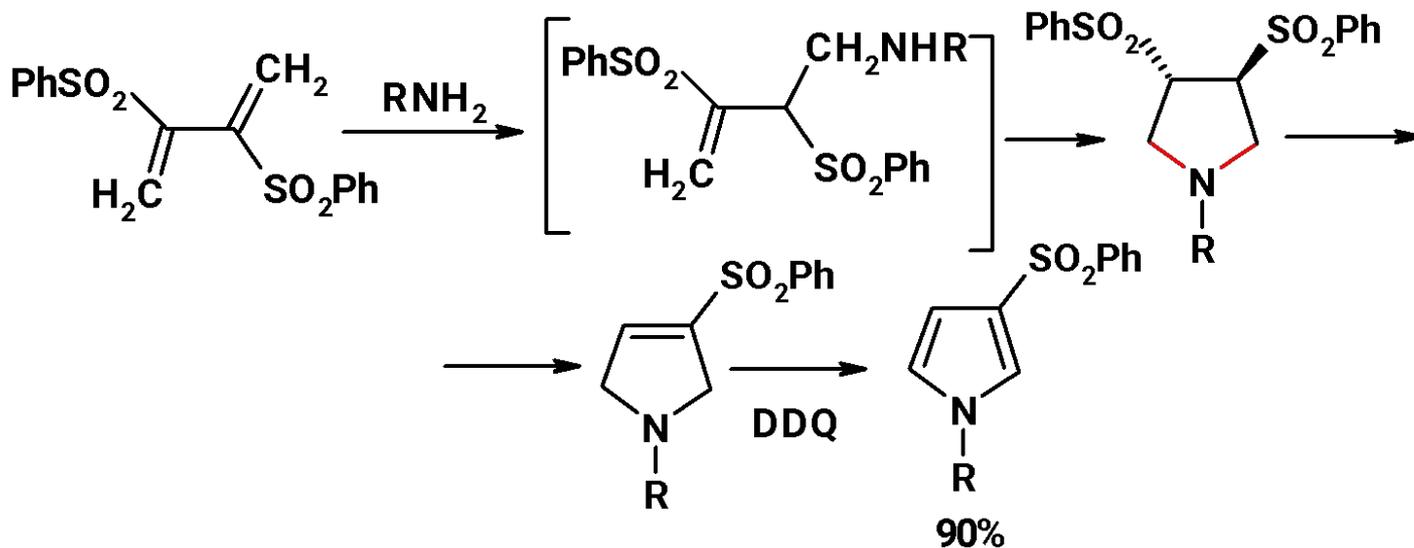
Реакция Юрьева



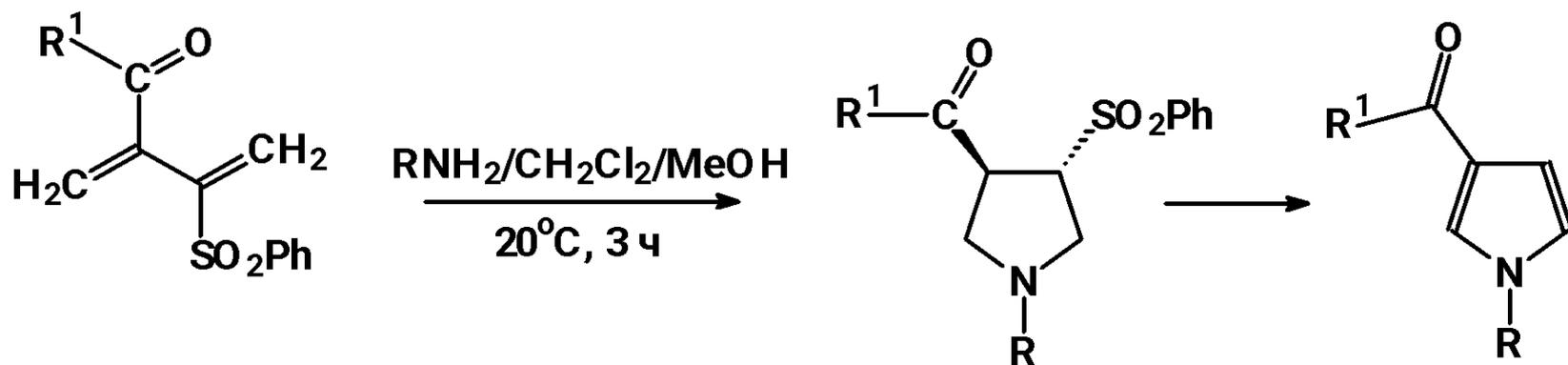
[4+2]-Циклоприсоединение аминов к активированным бутадиенам



A. Padwa, B. H. Norman, *Tetrah. Lett.*, 29, 3041 (1988)

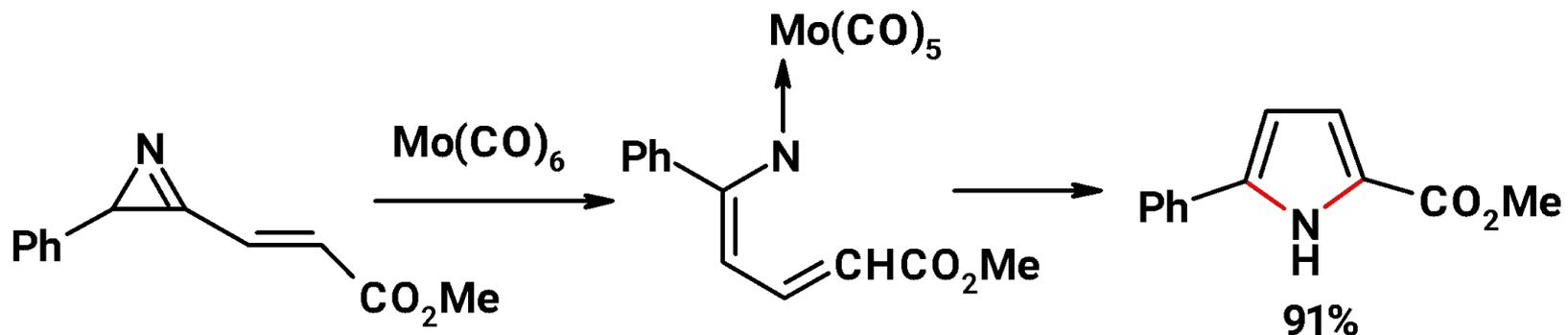


$\text{R} = \text{Bu}, \text{Bn}, \text{CH}_2\text{-o-C}_6\text{H}_3\text{Me}, \text{CH}_2(\text{CH}_2)_n\text{OH}, n=1-3$



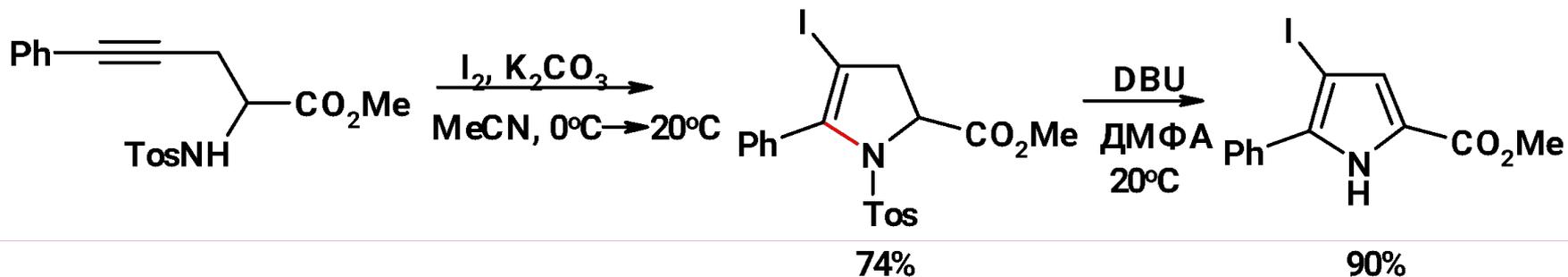
R = Me, Ph; R¹ = *i*-Bu, *s*-Bu, *t*-Bu, Bz, CH₂(CH₂)₂OH

Расширение азиридинового цикла

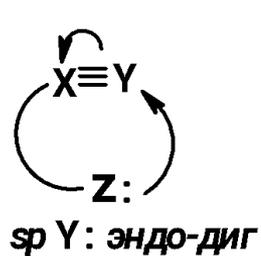
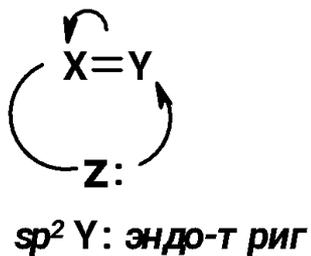
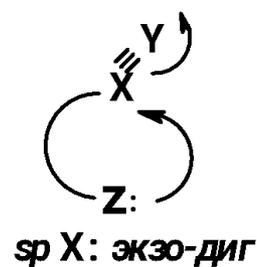
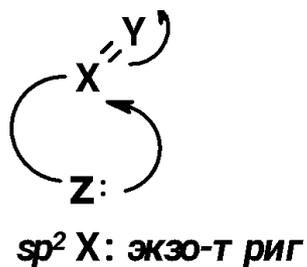
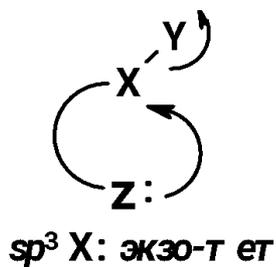
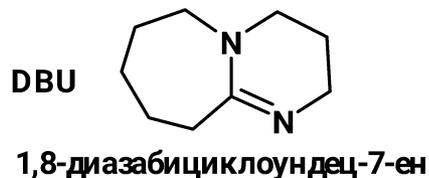


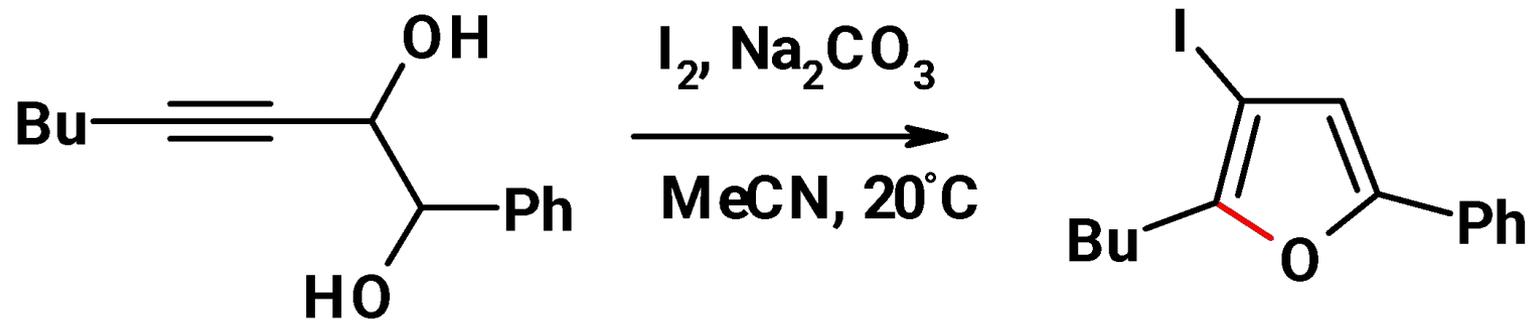
Heterocycles, 22, 859 (1984)

Синтез пирролов из 4-аминоацетиленов и фуранов из алк-3-ин-1,2-диолюв (5 *эндо-диг*-циклизация)



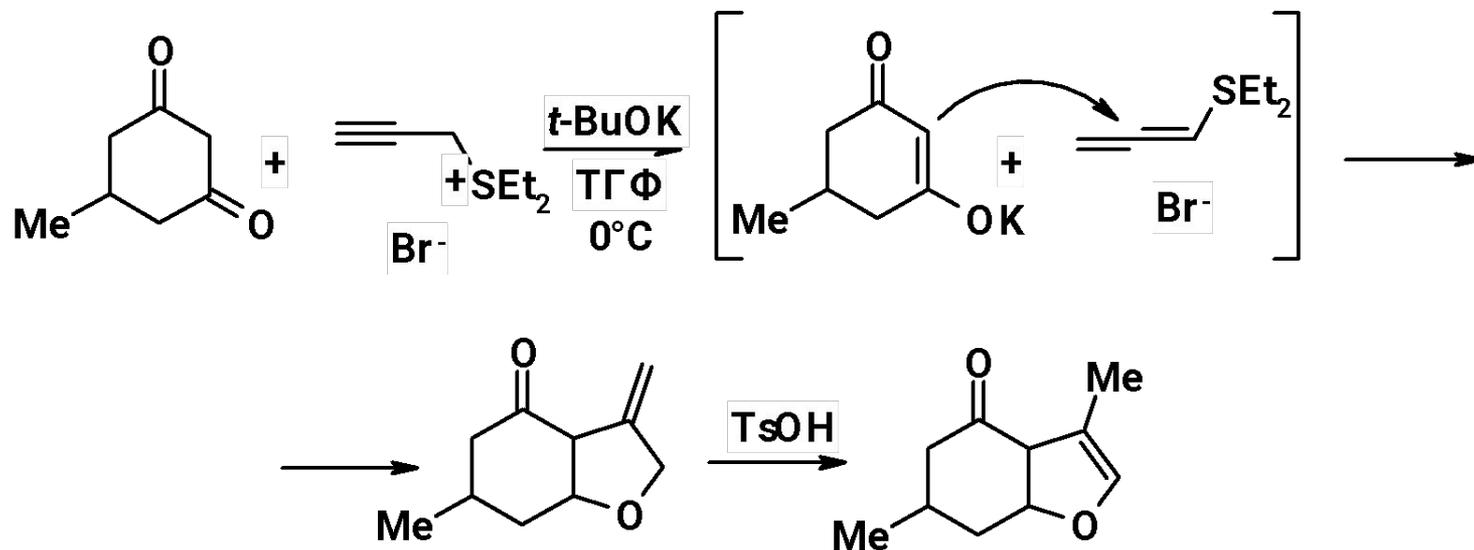
Chem. Commun., 2207 (1998)





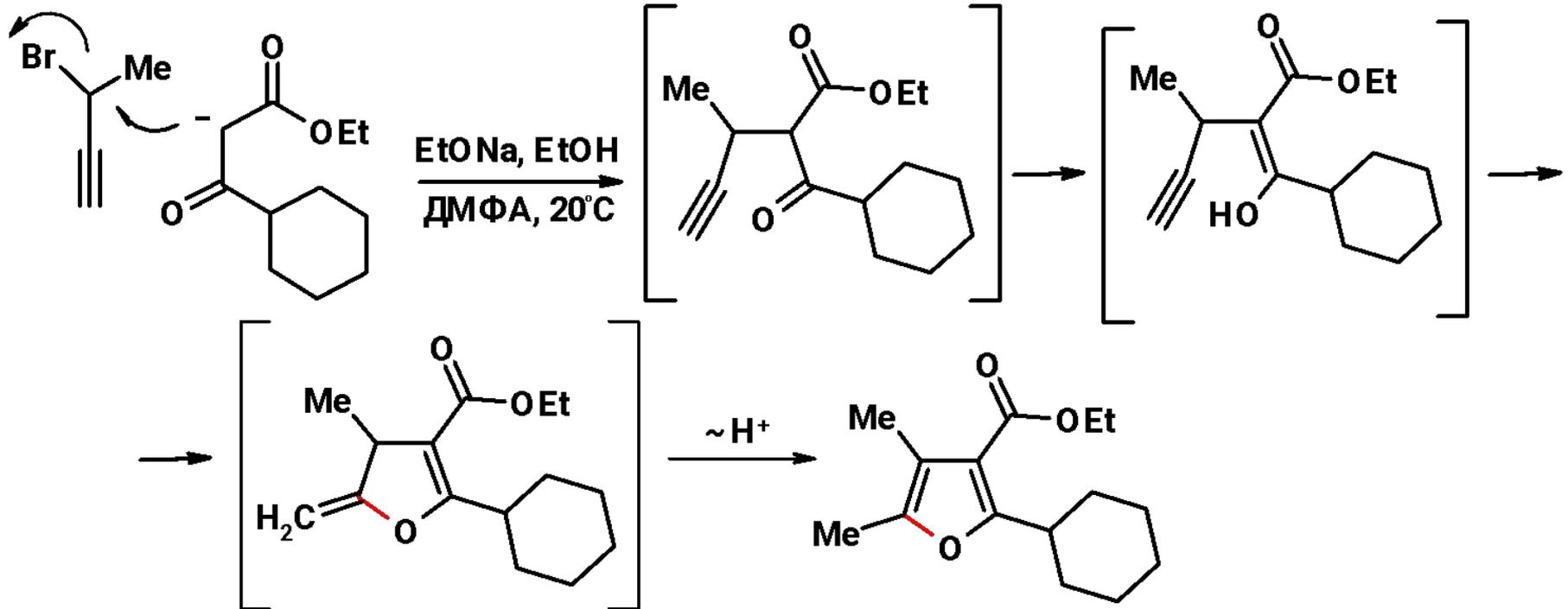
J. Org. Chem., 62, 5327 (1997)

Синтез фуранов из алкенилсульфониевых солей и 1,3-дикарбонильных соединений

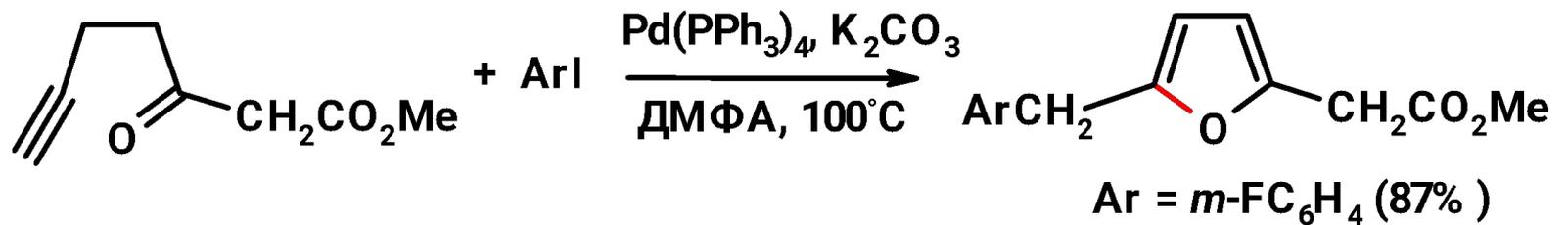


J. Org. Chem., 59, 5970 (1994)

Синтез фуранов из пентинонов

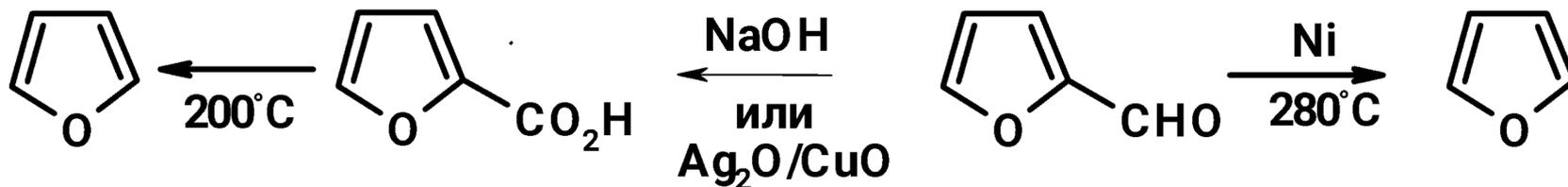
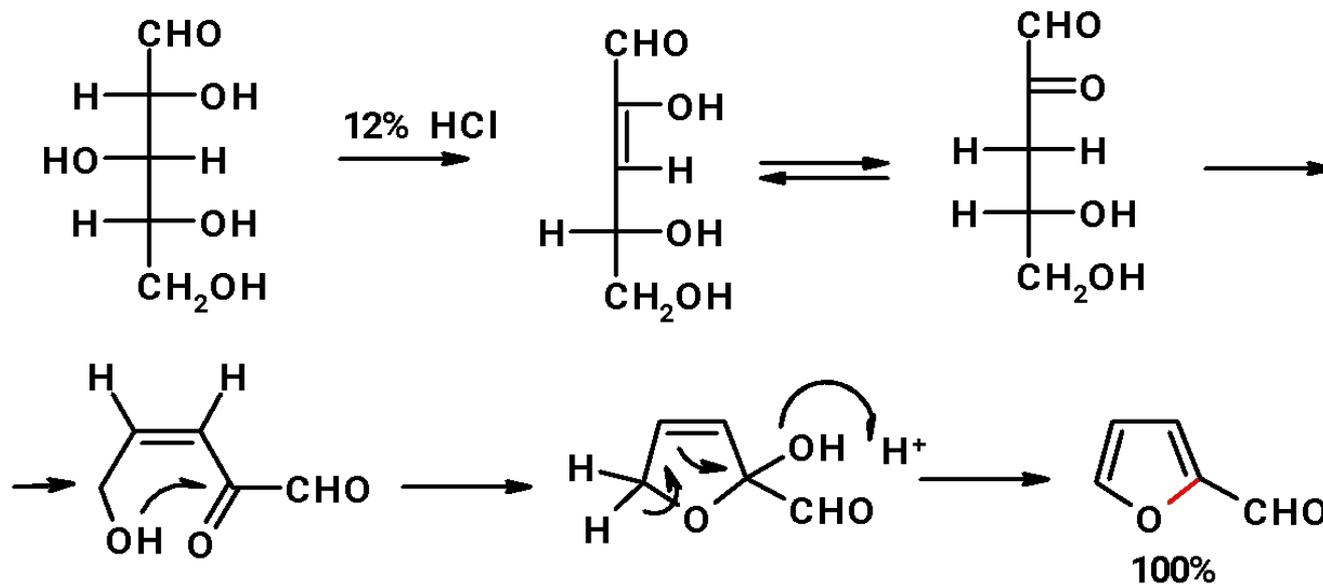


Synthesis, 581 (1974)

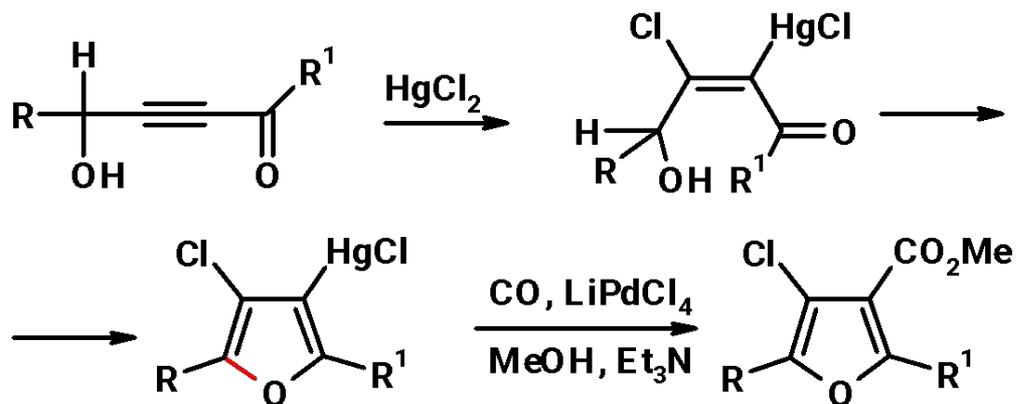


J.Org.Chem., 62, 5327 (1997)

Синтез фурана из фурфурола



Синтез фуранов из меркурипроизводных ацилпропаргиловых спиртов



Промышленные методы синтеза тиафена Heterocycles 18, 397 (1982)

