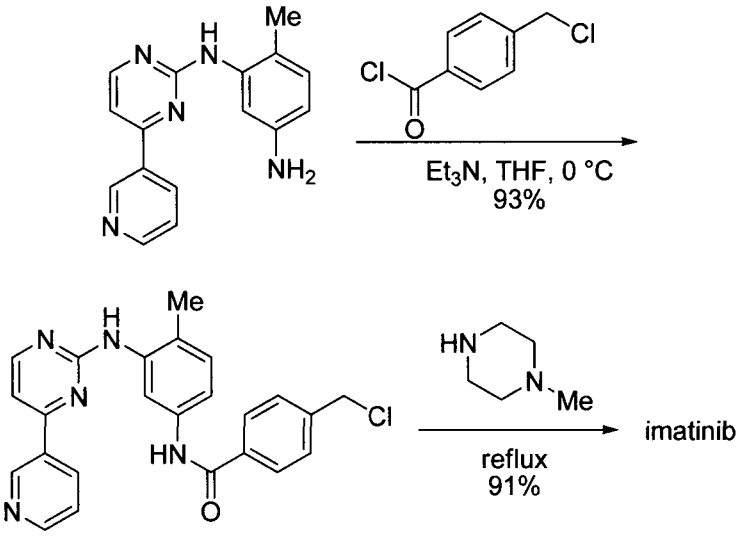

An alternative imatinib synthesis was presented with an aim to improve industrial production of imatinib.[44] 2-Acetylpyridine was alkylated with the acetal of *N*,*N*-dimethylformamide (DMFDMA) to enamine. A pyrimidine ring was formed with base and reagent guanidine nitrate and nitrotoluene fragment was added in an Ullmann-type reaction with CuI generating secondary amine. The nitro group was reduced by hydrazine/$FeCl_3$ to the amine, which was then converted to amide with acid chloride. The final step is the addition of piperazine to form imatinib. This route has eradicated the use of toxic cyanamide, sodium metal, and relatively expensive palladium, but has also introduced toxic hydrazine and the harmful and explosive guanidine nitrate. The final step was only demonstrated on a 0.5 gram-scale.