OXIDATION OF PRIMARY ALIPHATIC AMINES CATALYZED BY AN ELECTROGENERATED QUINONOID SPECIES : A SMALL MOLECULE MIMIC OF AMINE OXIDASES.

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The copper amine oxidases are ubiquitous quinoproteins which catalyze the oxidative deamination of a primary amine to the corresponding aldehyde, with subsequent reduction of dioxygen to hydrogen peroxide. These enzymes contain two cofactors, an organic cofactor topaquinone (TPQ) together with a cupric ion. Whereas the role of TPQ is well understood, there is still debate in the literature as to whether the oxidative half-reaction can proceed at all in the absence of active-site metal. Recent biochemical studies are fairly consistent with a passive role of copper in the catalyzed amine oxidation process.[1,2] Recently, we have evidenced that electrogenerated 3,4-iminoquinone species $\mathbf{1_{ox}}$ (Scheme 1) acts as a potent catalyst for the autorecycling oxidation of benzylamine (3200% turnover yield), following the same pyridoxal-like transamination mechanism than that reported for TPQ cofactor.[3]

We report herein that primary alkyl aliphatic amines can be efficiently oxidized by 3,4-iminoquinone species $\mathbf{1_{ox}}$, with turnover yields up to 2300%. In contrast to other synthetic models previously used, for the first time, no metal ion is required for the catalytic process.[4] Our model cofactor exhibits the same substrate specificity than the copper amine oxidases themselves, i.e. poor reactivity with α-branched amines and no reactivity toward secondary amines. With ring-substituted phenylethylamines, the catalytic process ceases after 5 turnovers due to an untimely conversion of the catalyst into new 1,4-benzoxazine derivatives (Scheme 2).[5]

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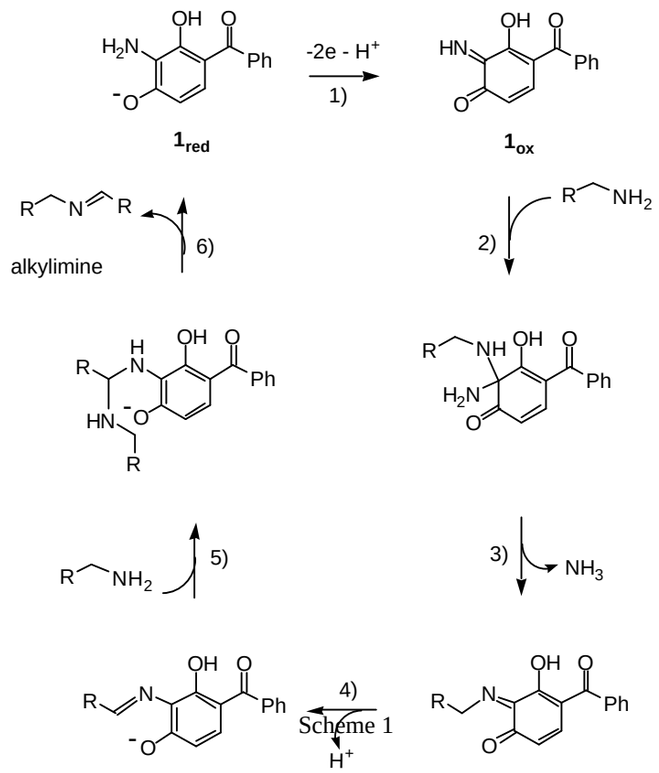
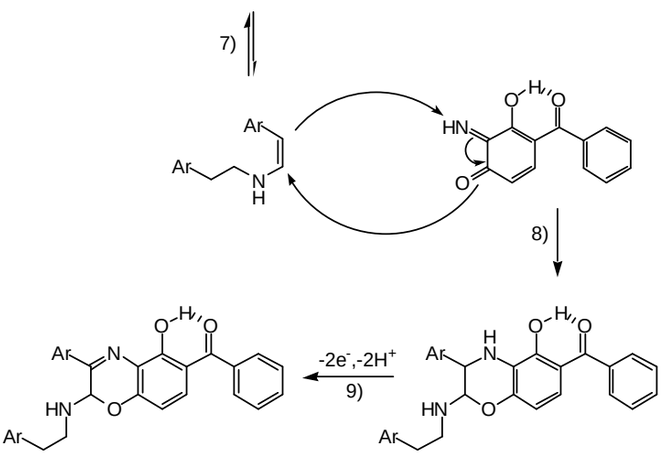


Alkylimine



2: Ar = 4-OMe-C_6H_4

3: Ar = 3,4-OMe-C_6H_3

Scheme 2