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Modelling the active site properties of dopamine b-hydroxylase

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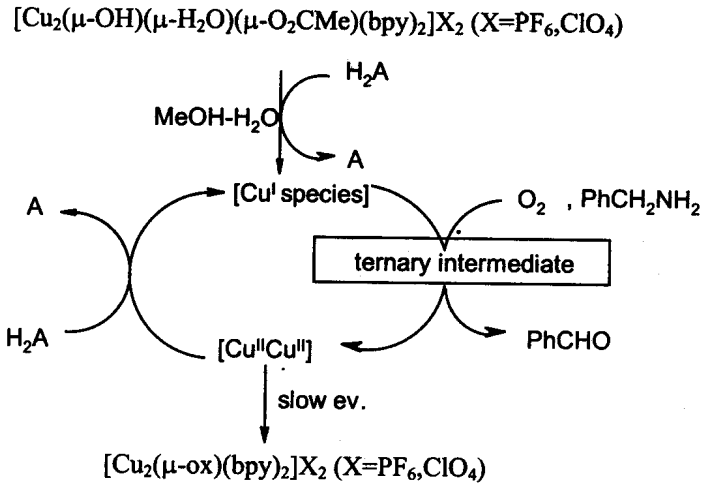
Dopamine b-hydroxylase (DbH) is a copper-containing glycoprotein that hydroxylates dopamine to norepinephrine [1,2]. Based on spectroscopic studies the active site of the metalloenzyme is proposed to have two copper centres. The enzyme in the oxidized dicopper(II) form gets reduced to the dicopper(I) unit by ascorbate and, in the following step, dopamine and dioxygen bind to the enzyme to form a ternary complex resulting in the oxidation of dopamine and the formation of the oxidised form of the enzyme. In this paper, we report a dicopper(II) complex that has been found to be catalytically active in oxidising the ascorbic acid. The reduced complex reacts with dioxygen and benzylamine to form a ternary complex, followed by the oxidation of the amine. The catalytic process models the functional properties of dopamine b-hydroxylase. The reaction of the dicopper(II) complex with ascorbic acid in aqueous–methanol forms an intermediate brown species, which on exposure to air converts to a blue species that has been isolated and structurally characterized. The proposed catalytic cycle for the conversion of the reduced species to the oxidized complex in air is shown below. The oxalate anion in the catalytically active complex is generated from the dehydroascorbic acid by hydrolytic ring rupture followed by oxidation of 2,3-diketo-1-gluconic acid.



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