Biocatalytic Hydrolysis of Nitriles

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Abstract—Two pathways of enzymatic hydrolysis of nitriles to carboxylic acids are known today. Under the action of nitrilases, nitriles turn into carboxylic acids in a single step via the addition of two water molecules. Under the action of nitrile hydratases, nitriles turn into amides, which are then hydrolyzed by amidase to carboxylic acids. This review deals with the structure, substrate specificity, mechanisms of action, and industrial potential of these three enzymes. Examples of successful use of the nitrile-hydrolyzing enzymes in the large-scale manufacture of acrylamide and nicotinamide in Russia and abroad and in the industrial synthesis of α-hydroxy acids (glycolic and *R*-mandelic acids) are presented. The stereoselectivity and regioselectivity of the enzymes make them usable in the synthesis of chiral synthons for the production of important pharmaceuticals (statins, antimitotic agents, and enzyme inhibitors).

Keywords: enzymatic hydrolysis of nitriles, nitrile hydratases, amidases, nitrilases, use in organic synthesis.

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