OXYGEN SUPPLY TO BIOCATALYTIC OXIDATIONS

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Oxygen-dependent enzymes are becoming increasingly relevant in the synthesis of fine chemicals, flavours and fragrances as well as pharmaceutical intermediates. Oxidases are a notable subclass of oxidizing enzymes, which use molecular oxygen either as an oxidant or as an electron acceptor. This property makes them highly attractive for industrial manufacturing processes, avoiding the use of harmful metal oxidants However, supplying molecular oxygen with high transfer rates is still a major challenge when high reaction productivities need to be achieved to develop an economic feasible process. Commonly, bioreactors supply oxygen by sparging air into the reaction medium and the resultant mass transfer of oxygen from the gas to the liquid phase has proved to be a limiting factor due to the poor solubility of oxygen in water and since high oxygen demand is needed to achieve adequate reaction productivities (1). Furthermore, enzyme stability might become an issue since oxidases may deactivate at a gas-liquid interface (2). Therefore, in order to develop robust processes using oxygen-dependent enzymes, there is a necessity to quantify the oxygen affinity of the enzyme, explore the enzyme stability and quantify how fast the oxygen needs to be supplied to achieve high productivities. This can be done by characterizing the enzyme under relevant conditions for an industrial process. This contribution is focused on the characterization of enzyme and reaction kinetics of oxygen-dependent biocatalysts, with emphasis on the oxygen requirements, in order to provide guidance for the design and development of oxidative biocatalytic processes. The influence of KMO (kinetic Michaelis constant for oxygen) on enzyme efficiency will be discussed (3) as well as process limitations of oxygen transfer.

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