SUSTAINABILITY AND OXIDASE BIOCATALYSIS – AN OVERVIEW

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The principles for developing and applying processes based on biocatalytic reactions are closely aligned with the concepts of green chemistry and sustainability, as has been recognised for some decades. Concepts which were originally mooted under the banner of 'green chemistry', promoting environmentally benign approaches, are now applied routinely, and at scale, in 'sustainable' bioprocesses. These include aspects such as prevention of waste, use of safer chemicals and solvents, energy efficiency and use of renewable feedstocks, as well as the overarching principle of using efficient and 'environmentally-friendly' catalysts. All of these factors directly underpin the development and application of biocatalysis in chemical processes. Added to this, major progress has been made through fast-evolving molecular techniques, including the rapidly advancing use of genome and metagenome sequence data to identify potentially useful industrial enzymes, and application of protein engineering strategies to improve them. Process engineering to optimise efficiency has allowed systems to be designed which are well-suited to the demands of practical applications in industrial processes.

Using multicopper oxidases (e.g., laccases), copper oxidases (e.g., tyrosinases), and peroxidases as examples, this presentation will review the progress made in oxidative biocatalysis over 3 decades, covering gene discovery and enzyme engineering, manipulation of reaction conditions, bioprocess development, improvements in production, and applications in sustainable production of relevant products such as antioxidants.