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Immobilised Bulk Enzymes for Chiral Intermediate and Chiral API Production

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Enzymes meet the increasing demand by manufacturers of chemicals and pharmaceuticals for enantiomerically pure compounds, because of their greater selectivity and specificity and because of their mild reaction conditions and lower energy consumption. Immobilisation of enzymes offers easier separation and reuse of enzymes thereby making production processes more cost effective. Additionally process conditions can be chosen with increased flexibility. Despite the impressive progress in asymmetric synthesis, the dominant production method to obtain a single enantiomer in industrial synthesis consists of the resolution of racemates. For kinetic resolutions enzymes are found to be most versatile. Besides lipases the group of proteases are used since in many cases opposite chiral selectivity is found. Since the list of most attractive commercially available (bulk) hydrolytic enzymes is about 100, one can ask what chance there is for a successful process. The answer is simple: the enzyme is but one of the variables in the equation. The combination with clever substrate derivatisation (yielding the same end product) and medium optimisation (including solvent system, temperature, pH, buffer salts, etc.) yields a choice of at least 10,000 - 100,000 distinctively different process conditions with varying yield and enantioselectivity.

As a result of these developments, industrial biocatalysis is steadily growing and the ongoing progress will ensure continued success in meeting new industrial challenges. Clearly, enzymatic resolution and enzyme immobilisation has become an indispensable tool in the chemist's chiral toolbox.