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Bioseparation during downstream processing occupy an important and complex position in biotechnology and biochemical engineering. Improved bioseparation/downstream processing techniques are increasingly in demand for biotechnology because separation is often the limiting factor for the commercial success of biological processes. Aqueous two-phase extraction (ATPE) is increasingly gaining prominence in the area biotechnology due to its advantages. ATPE has the potential to produce a concentrated and purified product in a single step when compared to the number of steps involved in conventional downstream processing. Further, productivity of a given bioprocess can be considerably improved by relatively new strategy of process integration such as integration of extraction with membrane processes for achieving desired selectivity and purity of the biomolecule.

In order to evaluate the efficacy of the proposed process integration, the research work was undertaken employing real systems (enzymes such as alcohol dehydrogenase (ADH) and invertase from baker's yeast (Saccharomyces cerevisiae)). Initial extraction and purification of selected enzymes was carried out using ATPE. Standardization of process was carried out by considering phase forming salt, polymer molecular weight, concentrations of polymer and salt, TLL and volume ratio as process parameters and/or variables to achieve higher purity and enzyme activity recovery. Incorporation of nanoparticles (such as gold, silver, copper, aluminium nitride, aluminium oxide and silicon oxide) to ATPSs as affinity ligands was attempted for enhancing the partitioning and selectivity in the extractions. Further, during process integration, ATPE followed by membrane process (including
nanofibrous membranes) was employed for the selective separation and purification of target biomolecules (ADH and Invertase). Electroextraction was carried out for the first time employing polymer/salt two-phase systems for enhancing the selectivity and recovery of the target enzyme.