

Adaptational properties and applications of cold-active lipases from psychrophilic bacteria

ABSTRACT

Psychrophilic microorganisms are cold-adapted with distinct properties from other thermal classes thriving in cold conditions in large areas of the earth's cold environment. Maintenance of functional membranes, evolving cold-adapted enzymes and synthesizing a range of structural features are basic adaptive strategies of psychrophiles. Among the cold-evolved enzymes are the cold-active lipases, a group of microbial lipases with inherent stability-activity-flexibility property that have engaged the interest of researchers over the years. Current knowledge regarding these cold-evolved enzymes in psychrophilic bacteria proves a display of high catalytic efficiency with low thermal stability, which is a differentiating feature with that of their mesophilic and thermophilic counterparts. Improvement strategies of their adaptive structural features have significantly benefited the enzyme industry. Based on their homogeneity and purity, molecular characterizations of these enzymes have been successful and their properties make them unique biocatalysts for various industrial and biotechnological applications. Although, strong association of lipopolysaccharides from Antarctic microorganisms with lipid hydrolases pose a challenge in their purification, heterologous expression of the cold-adapted lipases with affinity tags simplifies purification with higher yield. The review discusses these cold-evolved lipases from bacteria and their peculiar properties, in addition to their potential biotechnological and industrial applications.

Keyword: Psychrophilic bacteria; Extreme adaptation; Cold-active lipase and applications