Catalog Number: 100817, 100823, 102189

Lipase

Molecular Weight: 45,000 - 50,000

CAS # : 9001-62-1

Physical Description: Off-white to tan powder

Source: *Porcine pancreas*

Activity: See Desnuell (1972) on "Catalytic Properties" (page 586). Momsen and Brockman (1976a and b) report the effects of taurodeoxycholate and co-lipase. At low concentrations, up to 0.3 mM, the bile salt increases the stability of the lipase to 5 fold. At higher levels (0.3 - 0.8 mM), but below the critical micelle concentration, it interferes with enzyme adsorption on the substrate interface, thus inhibiting lipolysis. Co-lipase counters this inhibitory effect by providing high affinity binding sites at the surface of the lipase-bile salt complex. See also Borgstrom and Elanson (1973), Borgstrom et. al. (1974), and Kaimal and Saroja (1989). Co-lipase without bile-salts only mildly stimulates activity. Brockman et. al. (1973) report on lipase activity toward soluble triglycerides such as tripropionin. It is stimulated in the presence of hydrophobic surfaces. Santhanam and Wagle (1971) indicate that protein kinase, Mg^{2+}, ATP and cAMP stimulate lipase activity.

Unit Definition: One USP unit of lipase activity is contained in the amount of pancreatin that liberates 1.0 uEq of acid per minute at a pH of 9.0 at 37°C under the conditions of the assay for lipase activity.

Activators: Ca^{2+} is required for activity [Sr^{2+} and Mg^{2+} are less effective activators (Sarda, et. al. 1957)].

Inhibitors: Versene, Zn^{2+}, Cu^{2+}, Hg^{2+}, iodine, PCMB (Wills, 1960). DFP does not inhibit.

Stabilizers: DFP may be used to stabilize impure preparations containing proteinases in solutions.

Description: Lipase is effective in splitting dietary fats regardless of source. The relative digestive power on various edible fats is illustrated as follows:

Type of Fat	Grams of fat digested in 1 hour by 1 gram of lipase at pH 9.0
Olive Oil (Triolein)	531.4 grams
Tallow (Tristearin)	534.8 grams
Butter (Tributyrin)	181.4 grams
Coconut Oil (Tripalmitin)	484.4 grams

Lipase catalyzes the hydrolysis of emulsified esters of glycerol and long chain fatty acids. The substrate is not a single molecule but a nonaqueous phase of aggregated lipid (Brockerhoff and Jensen 1974). The operative substrate characteristic is aggregates of ester molecules, micelles or monomolecular film, interfacing an aqueous medium. Enzyme activity is directly related to the concentration of substrate molecules on the interface (Esposito et. al. 1973; Lagocki et. al. 1973). Lipase attacks the primary ester groups most readily. Monoglycerides are poor substrates (it is the 2-monoglycerides that are absorbed through the intestinal wall and reformed into lymph chylomicrons). Pancreatic lipases have been thoroughly reviewed by Brockerhoff and Jensen (1974), and Desnuelle (1972). Lieberman and Ollis (1975) have reported on lipase immobilized on stainless steel and polyacrylamide beads. Using a fluidized bed recycle reactor it is indicated that enzyme-substrate affinity is not altered.

Recommended Storage: 0°C

Composition of Lipase: Two lipases are present. Lipase A is more acidic than Lipase B; otherwise, the two isoenzymes are nearly the same (Verger et. al. 1969). Normally, a cofactor is bound to the enzymes (Maylie et. al. 1971). Two co-lipases were purified by Erlanson et. al. (1973). They were quite similar polypeptide chains with a molecular weight of 11,000. Borstrom and Erlanson (1973) indicated that co-lipase might be classified as a co-enzyme for lipase in that they interact in a stoichiometrical relationship.

The amino acid composition, which is almost identical except for isoleucine, is shown in Brockerhoff and Jensen (1974). Both contain a carbohydrate moiety (Garner and Smith 1972). Histidine is involved in the active site (Semeriva et. al. 1971). See Hultin (1992). Modification of the free carboxyl group by amide formation inactivates the enzyme (Semeriva et. al. 1972). According to Desnuelle (1972) the carboxyl in lipase stabilizes the active enzyme, i.e., the enzyme conformation resulting from adsorption at a hydrophobic interface. Although lipase contains two disulfide groups, they are not involved in enzymatic activity (Verger et. al. 1971). Diisopropylphosphofluoridate (DFP) binds to a tyrosine residue but is not inhibitory (Maylie et. al. 1969).

Extinction coefficient: $E^{1\%}_{280}$ = 13.3 (Desnuelle 1972)

Isoelectric point: Lipase A = 4.9 (Brockerhoff and Jensen 1974) and Lipase B = 5.0

Solubility: Partly soluble in water and insoluble in alcohol.

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