



Fig.1.

Locations of enzymes in soil: (i) enzymes functioning within the cytoplasm of proliferating microbial, animal and plant cells, (ii) enzymes restricted to the periplasmic space of proliferating Gram-negative bacteria, (iii) enzymes attached to the outer surface of viable cells which active sites extend into the soil environment, (iv) enzymes within non-proliferating cells such as fungal spores, protozoa cysts, plant seeds and bacteria endospores, (v) enzymes attached to an entire dead cell and cell debris, (vi) enzymes leaking from intact cells or released from lysed cells, originally located on the cell membrane or within the cell, which may survive for a short period in the soil solution, (vii) free extracellular enzymes in soil pore water, (viii) enzymes associated temporarily in soluble or insoluble enzyme-substrate complexes, and (ix) enzymes complexed with humic colloids by absorption, entrapment, or co-polymerization during humification, (x) enzymes absorbed to the external or internal (i.e., within the lattices of 2:1 layer silicates) surfaces of clay minerals, (xi) enzymes bound to condensed tannins leached from plant leaves or roots. Extracellular enzymes can be degraded abiotically or through the activity of proteolytic enzymes into (xii) peptides and then degraded by peptidases into their constituent amino acids (xiii), which are assimilated by microbes and plants.