(Abstract Presentation Only)

THERMODYNAMICS OF THERMOPHILIC ARCHEABACTERIA

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Thermophilic archeabacteria living close to terrestrial or submarine vulcanic vents in extreme thermodynamic conditions are attracting increasing interest as chemosynthetic microganisms possibly descendent from primordial unicellular microrganisms.

A thermodynamic study was therefore undertaken based on equilibrium and non equilibrium methods.

An equilibrium thermodynamic equation of state was used in order to compare the thermal stability of thermophilic proteins and that of mesophilic proteins.

As a result it became clear that, just as the meeting temperature of synthetic polymers, the unfolding temperature of thermophilic proteins is determined by enthalpic and/or entropic effects.

On this basis a simple relation between unfolding temperature and aminoacid composition was derived by adopting the resonable assumption that the aminoacid substitutions observed in going from a mesophilic to a thermophilic protein leave the tertiary structure virtually unchanged as in the case of homologous proteins.

A growth equaton previously derived on the basis of concepts typical of non equilibrium thermodynamics was used in conjunction with the above temperature dependence of the average equilibrium fraction of native (undenatured) proteins to explain why the abrupt decrease of growth rate is markedly shifted on going from mesophilic to thermophilic microrganisms.

It is suggested that neutral mutations transforming "hard" thermophilic proteins into "soft" mesophilic proteins took place during early evolution which were tolerated by progressively milder thermodynamic conditions.