Thermo-resistance acquisition of a mesophilic bacterium with the aid of vector particles originating from thermophiles

Hiroshi, X. Chiura[1]; Toshihiro Sugitate[1]

[1] ICU, NS, Biol

Particles abundantly found in every aquatic environment with morphological similarities with virus are called virus-like particles (VLPs). We have demonstrated the existence of 'the particles' among the VLPs population that showed certain lethal effects and gene transfer capability towards microbes those were phylogenically distant from their original hosts (e.g., Chiura, 2002). It has been observed that such 'particles' were produced by a budding-like scheme without accompanying cell lysis. Such types of particles are arbitrary referred to Vector Particles (VPs). Previous studies have examined the gene transfer capability of 'VP' towards recipient cells by using the restoration of auxotrophy, hence it is worthwhile to examine the possibility of gene transfer other than nutrients requirements.

The present study was aimed to examine whether VPs would be able to transfer and express the thermo-resistance gene of thermophilic microbes towards mesophilic auxotrophic Escherichia coli AB1157 mutant as recipient.

The particles (KD-VLPs) used in the present study were derived from Thermococcus kodakaraenesis B41, that was isolated from the Suiyo Seamount APSK06 boring core. Transduction towards recipient mesophilic E. coli AB1157 was carried out using KD-VLP as the gene transfer mediator in order to examine the lethal effect and thermo-resistant gene transfer capability of the particle. The colony forming ability of the cells was examined in 7% gerlite supplemented-LB plates (LB-gerlite plates) [1 % polypeptone, 0.5 % yeast extract, 0.5 % NaCl, pH 7.0] at 50, 56 and 70C. Regardless of UV irradiation, KD-VLP showed the reduced efficiency of plating (EOP) of recipient viable cell population to ca 60~70%. Four colonies were formed in LB-gerlite plates at 50C, which were named as KD-E-Trans, and the gene transfer frequency was estimated to be 5.12 X 10^-8 cfu/particle. Obtained KD-E-Trans was cultured in LB liquid medium employing the same high temperature conditions. The cells grew to ca 1.6~6 fold of the inocula in 13days at all the examined temperatures, and the generation time of the transductants were as follows: ca 28 hours at 50C, ca 73 hours at 56C, ca 266 hours at 70C.

Thus, the gene transfer of thermo-resistance towards mesophilic E. coli across the Domain with the aid of KD-VLPs was demonstrated. Current findings suggest that VPs existing in thermal environments may have capability of transferring genes with thermo-resistant traits towards broad phylogenetic range of recipients, which are distantly related to the original host of the particles.