Microbial communities in long-term methanogenic n-alkanes-degrading enrichment culture

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Many researches have studied the microbial communities of anaerobic alkanes-degradation under methanogenic conditions, while few of them were focused on the long-term succession of microbial communities. The methanogenic petroleum hydrocarbons degrading microbial communities are complex consortia that contain various fermenting bacteria, syntrophs and methanogens. The large quantities of non-culturable and metabolically inactive organisms interfere the identification of the active members essential to the consortium for degradation. In addition, the various syntrophic associations in methanogenic consortia and the obligate anaerobic conditions make isolation of pure cultures difficult and impossible with the available techniques. Stable consotium obtained through enrichment culturing with long-term stability for methanogenic alkane degradation can eliminate the inactive members to large extent so that the essential ones can be promoted. According to our research, after nearly 6 years of incubation, microorganisms came from oily sludge shifted□*Anaerolineaceae* (within the phylum of *Chloroflexi*) were predominant (45.5%), suggesting syntrophic cooperation with *Methanosaeta* spp. in the process of methanogenic degradation of alkanes. While, in another 5 years of incubation from petroleum reservoir production water sample□*Thermodesulfovibrio* (49.4%) and *Anaerolineaceae* (33.3%) syntrophically cooperated with *Methanoculleus* spp. (100%) as the dominant microorganisms performing the process of alkane degradation and methanogenesis. Interestingly, when comparing *Anaerolineaceae* sequences with isolated strains, the highest identity is only at 91% with *Levilinea saccharolytica* strain KIBI-1^T, indicating that this *Anaerolineaceae* in petroleum hydrocarbon environment may be a new division different from the isolated strains.. These observations are important for predicting long-term microbial communities' changes of methanogenic biodegradation in petroleum-impacted anaerobic environments.