A new method for microbial cultivation and its application to bacterial community analysis in Buus Nuur, Mongolia*

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With 3 figures and 4 tables

Abstract: We performed a comparative analysis of bacterial diversity in a saline soda lake using a novel cultivation method termed the filter plate microbial trap method (FPMT), and conventional techniques together with DGGE (denaturing gradient gel electrophoresis). The new method allowed for cultivation of representatives of seven bacterial taxonomic groups, including seven novel species. This compares favorably to the results from cultivation of representatives of four taxonomic groups and only one novel species using standard approaches. Neither culture collection matched the community composition revealed by DGGE but the FPMT method produced a more representative collection of strains. We conclude that FPMT is a powerful device for improving bacterial culturability and narrowing the gap between microbial diversity in nature and cultivable microorganisms.

Key words: bacterial diversity, DGGE, improved culturability, soda lake.

Introduction

In the past, bacterial community structure analysis relied mostly on conventional culture methods such as e.g. liquid enrichments, cultivation in Petri dish or membrane filters and for enumeration, the most probable number method. The success of these approaches is limited by “uncultivability” of the majority of microbial species, likely due to suboptimal media composition, allelopathy and other interactions between bacteria and other factors (Amann et al. 1995, Varoutkian et al. 2010).

Rapid development of culture-independent molecular tools such as the rRNA approach, FISH, DGGE (denaturing gradient gel electrophoresis), and others brought a new era in studies of microbial diversity (Christen 2008, Handelsman 2004). Their successes notwithstanding, cultivation and isolation of bacterial species remains essential for studying properties of individual microorganisms, obtaining biomass for whole genome sequencing, etc.

Recently, significant improvements have been achieved in microbial cultivation techniques, opening new opportunities for the study of microbial ecology and diversity. Modifying growth conditions, such as...