Bioresource Technology 120 (2012) 1–5

Contents lists available at SciVerse ScienceDirect

Bioresource Technology

journal homepage: www.elsevier.com/locate/biortech

Effect of dissolved oxygen concentration (microaerobic and aerobic) on selective enrichment culture for bioaugmentation of acidic industrial wastewater

Ying Quan, Hui Han, Shaokui Zheng *

MOE Key Laboratory of Water and Sediment Sciences/State Key Lab of Water Environment Simulation, School of Environment, Beijing Normal University, Beijing 100875, PR China

HIGHLIGHTS

- DO level (aerobic/microaerobic) is a secondary bioaugmentation selective pressure.
- DO concentration influenced the enrichment of dominant microorganisms.
- No difference in pollutant removal performance occurred at two DO levels.

ARTICLE INFO

Article history:
Received 6 April 2012
Received in revised form 9 June 2012
Accepted 11 June 2012
Available online 16 June 2012

Keywords:
Bioaugmentation
Enrichment
Dissolved oxygen
Community structure
Acidic industrial wastewater

ABSTRACT

The successful application of bioaugmentation is largely dependent on the selective enrichment of culture with regards to pH, temperature, salt, or specific toxic organic pollutants. In this study, we investigated the effect of dissolved oxygen (DO) concentrations (aerobic, >2 mg L^{-1}; microaerobic, <1 mg L^{-1}) on yeast enrichment culture for bioaugmentation of acidic industrial wastewater (pH 3.9–4.7). Clone library analyses revealed that the yeast community shifted in response to different DO levels, and that *Candida humilis* and *Candida pseudolambica* were individually dominant in the aerobic and microaerobic enrichment cultures. This would significantly influence the isolation results, and further hinder bioaugmentation due to differences in DO environments during the enrichment and application periods. However, differences in the selective enrichment culture cannot be predicted based on differences in pollutant removal performance. Thus, DO concentrations (aerobic/microaerobic) should be considered a secondary selective pressure to achieve successful bioaugmentation.

1. Introduction

Bioaugmentation is the introduction of microorganisms with specific catabolic abilities into contaminated environments to accelerate or enable the degradation of targeted pollutants (Perelo, 2010). It is considered a relatively cost-effective and environmentally friendly technology for pollutant elimination from stressed environments. Successful application of bioaugmentation techniques is largely dependent on selective enrichment culture and the subsequent isolation of 'superior strains' (Singer et al., 2005). As an efficient strategy that favors growth of the selected microorganism but inhibits the growth of others, the selective pressure in enrichment cultures generally involves pH (for acidophiles, Dopson et al., 2007), temperature (for thermophiles, Koskinen et al., 2008), and salt (for halophiles, Yang et al., 2010). The most common selective pressures are specific organic pollutants (as a sole carbon source), *e.g.*, antibiotics (Dantas et al., 2008), and polycyclic aromatic hydrocarbons (Teng et al., 2010).

One major concern regarding the use of bioaugmentation is the survival and activity of the introduced organisms in the environment. Not all bioaugmentation experiments have been successful (Bouchez et al., 2000). Therefore, the relationship of the inoculated microorganism with its new biotic and abiotic environments is a critical determinant of the outcome of any bioaugmentation strategy (El Fantroussi and Agathos, 2005). In other words, besides a competent microbe able to degrade the contaminant carbon source, other ecological considerations concerning adaptation to the habitat, such as oxygen, must be taken into account (Rosenberg et al., 1992). However, there have been no previous investigations on the influence of dissolved oxygen (DO) concentration (*e.g.*, aerobic, >2 mg L^{-1}; microaerobic or oxygen-limited, <1 mg L^{-1}) on selective enrichment culture, although differences in DO concentrations frequently occur in natural environments (Götz et al., 2002; Geelhoed et al., 2009; Pringsheim, 1951). These differences, which also occur in the activated sludge process (ASP) (Ma et al., 2009; Zheng and Cui, 2012; Zheng et al., 2011), may lead to an inefficiency

* Corresponding author. Tel.: +86 10 58809266; fax: +86 10 622 00 397.
E-mail address: zshaokui@yahoo.com.cn (S. Zheng).

0960-8524/$ - see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.biortech.2012.06.019