A new microbial DNA analysis-based approach to improve environmental biotechnologies

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Abstract

Environmental biotechnologies such as composting and biogas fermentation utilize complex microbial ecosystems in which many microorganisms co-exist and interact with each other. Recently developed molecular techniques enable us to understand dynamic changes in the behavior of characteristic microorganisms, and the roles of these microorganisms in the microbial consortia by microbial DNA analyses. The information obtained from DNA analysis can assist in controlling the composting process by defining microbial succession, which regulates compost maturity. It can also enhance efficiency of biogas production (i.e., stable biogas production) by monitoring indicator species for deterioration of biogas fermentation. New innovations in composting and biogas fermentation will help to popularize these old but important environmental biotechnologies, and promote a recycling-oriented society.

Keywords--- **environmental biotechnology, DNA analysis, composting, biogas fermentation**

PLENARY (Renewable Energy and Biological Waste Treatment)

Production of biohydrogen from oil palm empty fruit bunch fiber using a newly identified photosynthetic bacterium, *Rhodobacter sphaeroids* S10

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Abstract

Thermal and acid hydrolysates of oil palm empty fruit bunch fiber contain glucose, xylose and acetic acid as the main carbon components. In using the hydrolysates for photofermentative production of biohydrogen by *Rhodobacter sphaeroides* S10, a suitable nutrient component required for maximum hydrogen production was evaluated through a Plackette Burman design, in a flat bottle reactor. In the optimal medium component, the cumulative hydrogen produce was 2,018 mL H_2 L^{-1} medium, biomass was 2.5 g DCW L^{-1}, and the maximum hydrogen production rate was 22.4 mL H_2 L^{-1} medium h^{-1} during a 90 h batch culture of the bacterium. In repeated-batch fermentations which were carried out in various ways. A 90% replacement of the broth volume with the fresh medium at an exchange interval of 84 h proved to be the best. After 324 h operation the cumulative hydrogen production of the five cycles was 7,152 mL H_2 L^{-1} medium, the average maximum hydrogen production rate was 32 mL H_2 L^{-1} medium h^{-1} and biomass was 1.8 g DCW L^{-1}. Further experiments were conducted in continuous operation, in a tubular loop reactor. In the outdoor, under the best production conditions, the daytime feeding rate of the mixed carbon substrate was 48 mL h^{-1} and the average pseudo-steady state hydrogen production rate was 36 mL H_2 L^{-1} medium h^{-1}. For the indoor photobioreactor fed at the same rate as the outdoor system, the steady state average hydrogen production rate was 43 mL H_2 L^{-1} medium h^{-1}. The sunlight-based cumulative hydrogen production was only about 17% less compared to the artificially lit system, but required only 22% of the electrical energy.

Seagrass Ecosystems and Resources in Malaysia: Issues and Challenges Ahead

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Abstract

Healthy seagrasses may grow dense and form an extensive beds or meadows. Seagrasses provide conditions for the growth and abundance of invertebrates and fish that many local coastal communities collect and catch for their livelihood. Their characteristics and interactive community within and from outside account for the high diversity and enable survival of diverse invertebrates (shrimps, sea cucumbers, starfishes, bivalves, gastropods), vertebrates (dugongs, green sea turtles, fishes) and macroalgae. In Malaysia, these plants thrive in relatively shallow waters and are increasingly subject to pressures caused by human for variety of diversified activities. It is not surprising to see seagrass beds being filled, dredged or mined for conversion to other coastal uses. Malaysian seagrass ecosystems are continually facing serious threats from external human sources and coastal development activities, causing their fast degradation and possible habitat loss. The optimal and sustainable use of coastal habitats is a high priority due to their important ecological functions and socioeconomic benefits to coastal human population. However, the protection and conservation of seagrass ecosystems is only afforded to those within protected areas, e.g., marine parks under Fisheries Act 1985 and not for those outside their boundaries. This paper presents the status and importance of seagrass ecosystems in Malaysia, reviews the issues and challenges associated with their conservation and protection and emphasizes their susceptibility and vulnerability to the rapidly deteriorating marine environment. In addition, this paper introduces the assisted recovery of seagrass in rehabilitation of degraded seagrass habitats for sustaining seagrass ecosystems and their resources.

Keywords: Coastal habitats, biodiversity, seagrass ecosystem, resources, Malaysia