S205 Microalgae – key bioresources for green technology –

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In addition to the large amount of CO_2, the fossil fuel combustion generates air pollutants such as SO_2 and NOx, which cause acid rain and urban smog. We proposed the use of microalgae for the recycling of air pollutants such as CO_2 and NOx.

Using a marine green alga, *Dunaliella tertiolecta*, NOx in a flue gas was removed simultaneously with CO_2 in a long tubular photobioreactor. Our NOx removal system was stably operated for 15 days under "continuous light" or "light-and weak light cycle" conditions.

Although microalgal biomass is regarded as a low-grade energy source owing to its high moisture content, it could be converted, through biotechnological processes, to modern gaseous and liquid fuels such as H_2, methane, ethanol, and oils. Biomass of *D. tertiolecta* was converted to a substrate suitable for bacterial H_2 production by a starch-hydrolyzing lactic acid bacterium, *Lactobacillus amylovorus*. A photosynthetic bacterium, *Rhodobium marinum*, produced H_2 from lactic acid fermentation products of microalgal biomass. A mixed culture of these two bacteria decomposed raw algal biomass and produced H_2.

Algal mass culture systems for the photosynthetic recovery of CO_2 and NOx can be combined with any bacterial conversion system in which microalgal biomass is used as a raw material for the bacterial production of energy or commodity chemicals. Thus, microalgae could be key bioresources for green technology.

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Key words microalgae, bio-resources, energy source, green technology, hydrogen, bio-reactor

S206 Enzymatic synthesis of phosphatidylserine from lecithin – An advanced utilization of lipid bioresources

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1. Lipids as Bioresorce: Lipids are important, inexpensive, renewable, biodegradable, and energy-rich natural resources. Lipid resource is one of major bioresources and hence is included in green chemistry strategy. Lipid resource includes plant seed oils, animal fats and oils , single cell oils, and phospho- lipids. Major natural resources of phospholipids are soybean lecithin, and egg yolk lecithin.
2. Enzymatic synthesis of phosphatidylserine from lecithin: Phosphatidylserine (PS) has been claimed as a nutritional supplement effective to retard Age-Associated Memory Impairment (AAMI). To utilize PS as a material for nutritional or functional food, it is required to develop not only economical but also safe manufacturing process on industrial scale. PS can be prepared enzymatically from cheap lecithin such as soy lecithin and excessive L-serine by tranphosphatidylation action of phospholipase D (PLD). We have found that lecithin with high PS content can be produced by *Streptomyces antibioticus* PLD from soy lecithin and excess L-serine in aqueous buffer in the absence of any solvent when fine powder of proper solid material is added in the reaction mixture.

Enzymatic synthesis of phosphatidylserine from lecithin – An advanced utilization of lipid bioresources

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Key words enzymatic synthesis, phosphatidylserine, lecithin, lipid, bioresources

S207 New trends of bioprocess systems engineering

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In this report, the recent research activity of BioProcess Systems Engineering (BPSE) is summarized focusing on our research projects. One is application of synergy effect of two microbial populations to effective bioproduction in fermentation processes such as bacteriocin or kefiran productions. In these systems, lactic acid bacteria and yeasts are co-cultured and utilized to control the pH decrease and to eliminate the lactate inhibition or to enhance the productivity due to the synergy effect. The techniques of co-culture system can be easily transferred to the South-Asian countries and polished up by their own traditional fermentation resources and techniques. Another topic is a trend of the BPSE based on the genome information such as transcriptome, proteome and so on, which are recent key issues after post-genome projects. It will be one of ways how to construct a superior strain (super cell) which produce a desired product most effectively based on metabolic engineering with genome information.

New trends of bioprocess systems engineering

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Key words bioprocess system engineering, synergy effect, co-culture, bacteriocin, lactic acid bacteria, metabolic engineering

S208 Biological recycling system of energy and elements for zero emission (BREEZE)

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Unfortunately in Japan, we have limited amount of organic resources. The most abundant organic resource in our country is organic wastes such as urban or agricultural waste. The total amount of those wastes reaches to more than 300 milion tons/year. At this present in Japan, most of the organic waste are treated by combustion (75%) or dumping(15%) without the recovery of useful organic materials or energy.I believe that microbial treatment of organic waste to produce energetic or organic materials is the most environmentally friendly method, because, on this plannet, the decomposition of organic materials by various kinds of microorganisms has been occured since before the appearance of mankind.

From this year, the Ministry of Economy, Trade and Industry (METI) and New Energy and Industrial Technology Development Organization (NEDO) started two new National Projects on the treatment of Organic waste to recover biogas energy or biodegradation of contaminants to recover the healthful environment.The breakthrough technology to achieve these projects is "analyses and understandings of the structure of microbial comminities". In this presentation, I wuold like to explain on our aproaches to understand the structures of the microbial comminities(societies) which can degrade urban, agricultural or industrial organic wastes.

Biological recycling system of energy and elements for zero emission (BREEZE)

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Key words recycling, energy, elements, zero emission, kitchen refuges, complex microbe system