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Detoxification and Recycling of the Harvested Microalgae using Eco-friendly Food Waste Recycling Technology with Salt-tolerant Mushroom Strains

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Abstract : Cyanobacterial blooms in lakes, reservoirs, and rivers have been environmental and social issues due to its toxicity, odor, etc. Among the cyanotoxins, microcystins exist mostly within the cyanobacterial cells, and they are released from the cells. Therefore, an innovative technology is needed to detoxify the harvested microalgae for environment-friendly utilization of the harvested microalgae. This study develops detoxification method of microcystins in the harvested microalgae and recycling harvested microalgae with food waste using salt-tolerant mushroom strains and natural ecosystem decomposer. During this eco-friendly organic waste recycling process, diverse bacteria or various enzymes of the salt-tolerant mushroom strains decompose the microystins and cyclic peptides. Using PHLC/Mass analysis, it was verified that 99.8% of the microcystins of the harvested microalgae was detoxified in the harvested mushroom as well as in the recycled organic biomass. Further study is planned to verify the decomposition mechanisms of the microcystins by the bacteria or enzymes. In this study, the harvested microalgae is mixed with the food waste, and then the mixed toxic organic waste is used as mushroom compost by adjusting the water content of about 70% using cellulose such as sawdust cocopeats and cottonseeds. The mushroom compost is bottled, sterilized, and salt-tolerant mushroom spawn is inoculated. The mushroom is then cultured and growing in the temperature, humidity, and CO2 controlled environment. During the cultivation and growing process of the mushroom, microcystins are decomposed into non-toxic organic or inorganic compounds by diverse bacteria or various enzymes of the mushroom strains. Various enzymes of the mushroom strains decompose organics of the mixed organic waste and produce nutritious and antibiotic mushrooms. Cultured biomass compost after mushroom harvest can be used for organic fertilizer, functional bio-feed, and RE-100 biomass renewable energy source. In this eco-friendly organic waste recycling process, no toxic material, wastewater, nor sludge is generated; thus, sustainable with the circular economy.

Keywords : microalgae, microcystin, food waste, salt-tolerant mushroom strains, sustainability, circular economy
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