Domestic wastewater treatment and remediation is an expensive process due to significant time and planning needed for successful treatment. Modern wastewater treatment plants are highly mechanized and expensive to build and maintain. In less economically developed parts of the world alternative methods of wastewater treatment are required. Waste stabilization ponds, or lagoons, provide an ideal solution for wastewater treatment in developing countries and rural areas. These ponds facilitate the oxidation of organic matter through complex symbiotic relationships between bacterial consortia and assimilation of wastewater nutrients by photoautotrophic microalgae [1]. In the United States more than 7,000 lagoon systems are used to treat domestic wastewater (U.S. EPA, 2002, Report No. EPA 832-F02-014) [2]. Most domestic wastewater is considered weak or medium in strength with nitrogen levels between 20–40 mg/L and phosphorus levels between 4–8 mg/L [3]. These concentrations of nitrogen and phosphorus are undesirable as they can lead to considerable pollution and eutrophication of downstream waterways [1].

Open pond lagoon systems have many advantages over mechanicalized methods and are able to remove nitrogen and phosphorus to required EPA levels. Interestingly, nitrogen and phosphorus found in weak domestic wastewater are at an ideal level for microalgae cultivation and growth. Microalgae can grow to high densities by assimilating nitrogen and phosphorus, thus removing these inorganic nutrients from the wastewater. In addition, open pond lagoon systems also allow ideal mixing and adequate light exposure for microalgae growth. Microalgae play a vital role in recycling carbon in lagoon systems also allow ideal mixing and adequate light exposure for microalgae growth. Microalgae as feedstocks provide high densities of biomass that can be used as feedstock for the production of high value compounds [5,6].

Algal biomass can be processed chemically and biologically to produce high value products such as bioacetone, biobutanol, biodiesel, and biomethane. Microalgae as feedstocks provide high densities of carbohydrates (typically comprising glucose units), triacylglycerides and free fatty acids that can be used to produce biofuels and biodiesel. It has been demonstrated that microalgae can be a promising feedstock and will play a vital role in the future production of clean and renewable energy [1,5].

The disadvantages to an open pond lagoon system are that the microalgae nutrient requirement may not match the stoichiometric ratio of the microalgae biomass, where the optimum nitrogen to phosphorus ratio for microalgae growth is 16:1. Thus, photoautotrophic bioremediation of inorganic compounds might not be carried out to adequate levels. To meet nutrient requirements for microalgae growth, additional chemicals (usually nitrogen rich sources) may need to be supplemented to the wastewater, which is undesirable.

Bioremediation of Domestic Wastewater and Production of Bioproducts from Microalgae Using Waste Stabilization Ponds

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