Risk analysis and development of algae biofuel from aquatic and terrestrial systems

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Abstract

Production of algae biofuel from aquatic and terrestrial systems are global emerging strategies for the reduction of the overreliance on fossil fuel based on its potentials to promote the green environment, which can be a panacea to the global warming, climate change and other earthly challenges affecting global evolution. Algae as bioenergetic resource has the capacity to solve the uneven energy supply of developing countries. This study adopts an exploratory research approach and uses a contextual SWOT model to assess what needs to be done on the premise of the prevailing situation in Nigeria and strategically analyzes the risk and potential benefits of biodiesel production from algae. The model helps to examine the strength, weaknesses, opportunities, and threats of the algae biofuel production and utilization peculiar to Nigeria. The result showed that there are prospects for the algae biofuel implementation in Nigeria, though with various limitations. Some of the challenges anticipated could be resolved with adequate government and private stakeholders support in terms of policies, funding and sustainable management. The main focus of this paper is on micro-algae, known for their rapid growth rate and suitability as feedstock for biodiesel (third generation of bio energy). With Nigeria’s total economic dependence on petroleum oils, algae derived biofuel could provide options as well as aid environmental sustainability.

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1. Introduction

Conventional energy sources such as oil, coal, and natural gas are very important for economic development [1]. However, the negative impacts of these energy sources on the environment as well as human health results in continuous search for alternative cleaner, greener and more sustainable energy sources, which is the main feature of the third generation of bioenergy.

Energy sources in most developing countries are still very crude and coal remains one of the most widely used in these nations. With the decision of the Kyoto Protocol on greenhouse gas (GHG) reduction, phasing out of coal may be inevitable [1] implying the acceptance of newer sources. Algal derived biofuels are global emerging energy sources poised to help reduce the overreliance on fossil fuels due to their potential to promote green environment, a panacea to global warming, climate change and other earthly challenges affecting the globe. Being signatory to the Kyoto Protocol, Nigeria’s shift away from coal and natural gas can be fast-tracked giving room for more sustainable energy development. Algae present such opportunity to help develop biofuels, thus reducing the monopoly of petroleum as the main energy source in Nigeria [2]. Hence, this study evaluates critically the potentials of optimizing the development of biofuels (biodiesel, bioethanol etc.), from algae in the Nigerian context using an analytical-based strength, weaknesses, opportunities, and threats (SWOT) approach.

2. Methodology

This research is an exploratory type of research because there are paucity of information on algae biofuel production in Nigeria (Fig. 1). However, secondary information were considered. This article adopts SWOT analysis as the main approach and also present strategies for development, production, and harvest of algae biofuel which is applicable for Nigeria. It is a well-known acronym that refers to the strengths, weaknesses, opportunities, and threats of an ongoing developmental process or organizational service. It is a strategic analytical tool that can be used to evaluate the rate at which development of an initiated process is taking place with respect to factors (internal and external) which may either aid or retard such a process, thus enhancing decision making. In the context of this paper, the process refers to the development of a platform for algal biofuel production and usage in Nigeria, internal and external factors include; cost of production, population, economics of dependence on petroleum and environmental sustainability amongst others.
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