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Production of Hydrochar a Promising Fuel From Aquatic Weed *Potamogeton crispus*

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ABSTRACT

In this study, the biofuel hydrochar was produced from aquatic weed Potamogeton crispus by subjecting same to hydrothermal carbonization (HTC) .P.crispusbelongs to kingdom Plantae, order Alismatales and family Potamogetonaceae .The hydrochar produced had high calorific value and energy density and its fuel quality was similar to that of lignite. The research paves a way to utilize aquatic weeds as energy resource, which otherwise are being simply dumped upon the shores of rivers and other water bodies thus leading to pollution problems while they decompose.

I. INTRODUCTION

Fossilfuels are fast declining, after serving as primary sources of energy for centuries. To offset the fuel crisis in futurewe are prompted to look for alternate sources ofenergy . Biofuel generation from non-food crops is highly desirable as no compromise is made with food security. Aquatic weeds (microalgae, macroalgaeand macrophytes) are non-food crops, can serve as potential sources of biofuel generation without risking the food security[1]

Directcombustion of fuels is not a satisfying option owing to inherent properties of biomass feedstocks such as high moisture and oxygen contents and pollution roblems[2]. To overcome these problems, it is necessary to pre-treat or modify the biomass feedstock prior to combustion to homogenize different biomass feedstocks into a form similar to coal. Hydrothermal carbonization (HTC) offers significant advantages for biomass conversion including the lack of an energy-extensive drying process, high conversion efficiency and relatively low operation temperature among thermal methods.Merit of HTC process lies in that it obviates the need for drying of the feed stocks and is thus highly suitable for aquatic biomass like Potamogeton lucens. HTC as renewable energy process is less damaging to the environment when compared to some other competitive nonrenewable conversion processes [1].

HTC converts wet biomass into a coal like material commonly called ‘hydrochar’along with aqueous products and gases [1]. HTC process takes place at subcritical water conditions (below the water critical point temperature of 374 ^{0}C and pressure of 22 MPa).

In our study, the hydrochar was produced from aquatic weed *Potamogeton crispus* by subjecting this to HTC .The hydrochar produced had high calorific value and energy density and its fuel quality was similar to that of lignite.

II. METHODOLOGY

HTC was carried out in a cylindrical autoclave reactor of 700 mlcapacity, made of alloy steel (SS 316L). Controlled heating by PIDtemperature controller was carried out by means of an externalceramic band heater of 2000 W power rating. In a typical run30 g of feed (stored in desiccator and priorly dried at 60 C for1 h) was taken from container for processing. Feed was added withdemineralized water of specified quantity and fed to reactor tomake a homogeneous mixture. Reactor was properly sealed andhead tightened by traditional wrenches for leak proof operation.Heating was started and autogenic pressure build up allowedunder inert atmosphere. When required temperature reached, carbonization reaction was kept going on for holding time of 10–40 min. At this stage heating was stopped and reactor cooled to room temperature and gas-phase vented. The carbonized solids were separated from the liquid phase by means of vacuum filtration using 0.45 µm nylon filters. During filtration about 50 ml of organic solvent dichloromethane (DCM) were added to dissolve organic sorbatesfrom carbonized solids. The solid product referred to as hydrochar was dried in an oven at temperature of 50 ^{0}C for 24 h to remove any residual moisture. Dried hydrochar was weighed and processed for further characterization.

III. RESULTS AND DISCUSSION

HTC was carried out at the temperature of 285 ^{0}C with variations of holding time as 10, 15 and 60 minutes. Caloric value of hydrochar produced varied from 25.2,27.27 and 26.35 Mj/kg at 10,15 and 60 minutes of holding timerespectively .Thus hydrochar produced for holding time of 15 minutes at temperature of 285 ^{0}C had the highest calorific value which matched to that of lignite coal. The above process has thus huge potential to meet part of global energy demand.

References

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