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RESEARCH ARTICLE

PHYSICAL AND CHEMICAL PROPERTIES OF WOODY BIOMASS SPECIES

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ABSTRACT

Biomass is the most potential considering their quantitative availability. Prosopis juliflora a Mesquite is a shrub or small tree in the Fabaceae family. It is also one of the biomass which is available hundred hectares in our area. Casuarina equisetifolia is an evergreen shrubs trees growing to 35m tall. In order to characterize the physical and chemical properties of P.juliflora and C.equisetifolia as feed stocks for energy conversion process, we developed protocol. The particle size of both samples was found to be 8nm from X-ray diffraction (XRD) technique. Surface morphology of the samples was studied by scanning electron microscopy. Proximate, structural and elemental analyses showed that P.juliflora has lower moisture content and high fixed carbon indicates that it is appropriate to meet requirements of thermochemical process. Also, considered as one of the strengths of biomass utilization for energy purposes in terms of contribution to environmental protection, P.juliflora contains very low level of Mg and Ca (0.39% & 2.32% respectively). Higher proportion of carbon and lower proportion of oxygen content in P.juliflora leads to high calorific value 3891Kcal/kg.

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INTRODUCTION

Biomass constitutes the first energy source human has tamed. Biomass fuels continue to representing the primary source of energy for more than 50% of the world population and amount to about 14% of the total energy global consumption (Kendry, 2002). Amongst different sources of renewable energy, biomass residues hold special promise due to their inherent capability to store solar energy and amenability to subsequent conversion to convenient solid, liquid and gaseous fuels. *Prosopis juliflora* is one of the biomass residue which is used to generate electricity. *P. juliflora* has a negative impact on plant diversity (Singh *et al.*, 2008). The leaves of *P.juliflora* contain various chemicals including tannins, flavonoids, steroids, hydrocarbons, waxes and alkaloids (Pasiecznik *et al*., 2001). The Mesquite tree grows to a height of up to 12 meters (39 ft.) and has a trunk with a diameter of up to 1.2 meters (3.9 ft.). However to use biomass efficiently for energy production a detailed knowledge of its physical and chemical properties are required. These properties more specifically average and variation in elemental compositions is also essential for modeling and analysis of energy conversion process (Nordin, 1994). Ash forming elements such as Si, Ca, Fe, K, Mg, Na, and P in biomass are important to be documented for any thermochemical conversion process (Cuping *et al.,* 2004). Actually, high contents of alkali are well-known to conduct to critical technical problems when biomass is used as feedstock for thermal power production, since they contribute to slagging, fouling and sintering formation. Actually, information on concentration and speciation of some elements is useful both for energy and environmental issues. Therefore the investigation of physico-chemical properties of biomass fuels would help finding for them suitable and appropriate energy conversion technologies (Obemberger *et al*., 2004). In the present work the physical chemical properties of *P.juliflora and C.equisetifolia* have been investigated.

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MATERIALS AND METHODS

One to two kilograms of *P.juliflora* and *C.equisetifolia* was collected from the plantation. They were oven dried at 70°C during 24h. The samples were then grounded into powder.

Material characterization

The particle size of the sample was determined using X-ray diffraction (XRD) in a wide range of Bragg angles 2θ ($10^{\circ}<2\theta<90^{\circ}$) with Co radiation (1.54054 Å). The surface morphology was recorded using field emission scanning electron microscope. The proximate analysis to measure moisture, volatile, fixed carbon and ash content was performed by ordinary oven and muffle furnace. The calorific value of the samples was measured using bomb calorimeter. Elements presented in the sample were identified using EDAX analysis.

RESULTS AND DISCUSSION

Structural

The XRD pattern of the samples was shown in Fig.1. The size of the samples was determined using the broadening of a few XRD peaks using Scherr's equation (Vincent, 2000) $D=.89\lambda/(\beta_{1/2}\cos\theta)$, where λ= 1.54054Å and $\beta_{1/2}$ is the peak width of the reflection at half intensity. The average particle size was found to be 8nm for both *P.juliflora and C.equisetifolia*.Fig.1 (inset) shows the scanning electron micrograph of the samples at room temperature. Aggromolahar and cluster of needle shaped texture was observed.

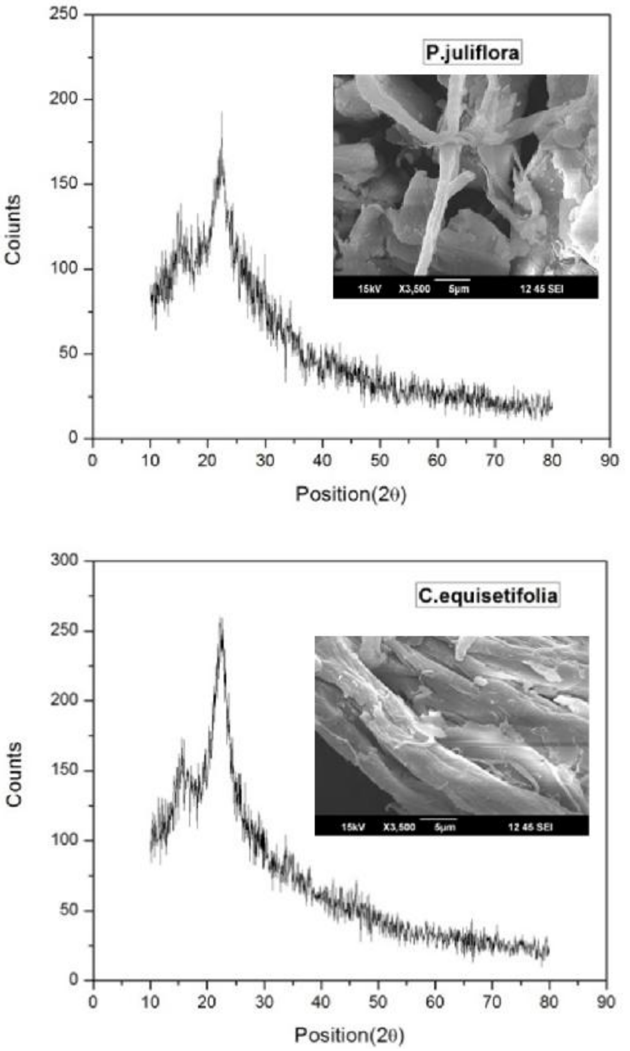

Fig. 1. Room temperature XRD pattern and SEM micrograph of *P.juliflora* and *C.equisetifolia*

EDAX Results

From the EDAX analysis *P.juliflora* has low concentration 0.39% of Mg 2.32% of Ca. The good heat of combustion of *P. juliflora* is due to its higher proportion of carbon and lower proportion of oxygen (Goel *et al*., 1996). Higher proportion of oxygen leads to calorific value reduction. Therefore *C.equisetifolia* has lower calorific value compare to *P.juliflora.* Obtained results of minor elements of *P.juliflora* and *C.equisetifolia* by EDAX analysis is reported in Table 1.

Table 1. Elemental analysis of *P.juliflora and C.equisetifolia*

Element	P.juliflora Mass%	*C.equisetifolia* Mass%
CK	75.3	77.78
OK	17.92	22.22
MgK	0.39	----
CaK	2.32	----
CuK	4.05	----

Table 2. Proximate analysis of *P.juliflora and C.equisetifolia*

Species	Moisture (%)	Ash (%)	Volatile matter (%)	Fixed Carbon (%)	Calorific value Kcal/kg
P.juliflora	5.35	1.01	79.23	15.69	3891
C.equisetifolia	6.02	1.39	86.75	8.17	3502

Proximate analysis results

Proximate analysis is reported in Table 2. Moisture content is of important interest since it corresponds to one of the main criteria for the selection of energy conversion process technology. Thermal conversion technology requires biomass fuels with low moisture content, while those with high moisture content are more appropriate for biological-based process such as fermentation or anaerobic digestion. From Table 2, it is noted that *P.juliflora* and *C.equisetifolia* has moisture content of lesser than 10% and hence more suitable to serve as feedstock for thermal conversion technologies. The ash content of biomass influences the expenses related to handling and processing to be included in the overall conversion cost. On the other hand, the chemical composition of the ash is a determinant parameter to consider for the operation of a thermal conversion unit, since it gives rise to problems of slagging, fouling, sintering and corrosion. Higher proportion of carbon content leads to high calorific value 4200Kcal/kg (Khan *et al.* 1986). Even though both are having low ash content and high volatile matter, compare with *P.juliflora*, *C.equisetifolia* has low fixed carbon (8.17%) therefore *P.juliflora* is the best candidate for thermal conversion technologies.

Conclusion

In order to characterize the physical and chemical properties of *P.juliflora* and *C.equisetifolia* to be used as feedstock for energy conversion process, we developed an analytical protocol. Proximate and EDAX analysis showed that *P.juliflora* is of low moisture content; low proportion of oxygen indicates it is appropriate to meet requirements of thermochemical process. Environmental benefits of using *P.juliflora* as fuel for thermal power generation units also more. This study could serve to establish a database of biomass fuels or feedstock that would support decision making in terms of energy conversion technology selection and operating conditions setting.

REFERENCES

Cuping L., Changzhi, W., Yanyongijie and Haitao, H. 2004. *Biomass and Bioenergy,* 27pp 119-130

Kendry, P. 2002. *Energy production from biomass (part1): Overview of biomass. Bioresource Technology,* 83 pp. 37-46

Khan, D., Ahmad, R. and Ismail, S. 1986. *Pakistan Journal of Botany,* 19, pp.131–138

Nimisha, V., Joshi, M. J., Shah, B. S. and Joshi, D. R. 1997. *Bull. Mater.Sci.,* 20 333

Nordin, A. 1994. *Biomass and Bioenergy* 6(5) pp.339-347

Obemberger, I. and Thek, G. 2004. *Biomass and Bioenergy,* 27 pp. 653-669

Singh, G., Rathod, T. R., Mutha, S., Upadhyaya, S. and Bala, N. 2008. *Tropical Ecology,* 49(1) pp.13–23

Goel, V. L., Behl, H. M. 1996. *Biomass and Bioenergy,* 10 (1) pp. 57-61

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