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WOOD CHARCOAL PRODUCTION PERFORMANCE - A BIRDS EYE VIEW STUDY

Dr. C. PARAMASIVAN, Ph.D.

Assistant Professor

J. PREMADAS

Full Time Ph.D. Research Scholar

PG & Research Department of Commerce

Periyar E.V.R. College (Autonomous), Tiruchirappalli-23

Abstract

Wood charcoal is one of the important natural fuel materials which is largely used for cooking, heating and other fire work activities. Charcoal may seem a mundane material, but its exceptional properties have been appreciated by people throughout history. It was first used more than 30,000 years ago to make some of the earliest cave paintings. Much later, charcoal played a significant role as a technologically material. Now charcoal is also of great interest since we are beginning to accomplish a detailed picture of its atomic structure for the first time. This article made an attempt to understand the charcoal production with respected to overall countries in the world.

Keywords: Wood charcoal, Mundane material, Atomic structure, Metallurgical fuel.

Introduction

Fire is the one of the natural components which helps to heat the substance. It can be generated from various sources such as sunlight, fire and heating of materials. The production of wood charcoal in areas with an abundance of wood dates back to ancient times. It generally consisted of piling billets of wood on their ends so as to form a conical pile, openings being left at the bottom to admit air, with a central shaft to serve as a flue. Even how, charcoal production is one of the continuous processes in the developing countries which used as substitute for fire energy. Its use as a fuel was crucial in the development of metallurgy. This paper discuss meaning of wood charcoal, types of charcoal,

environmental impacts, social and economic impacts, production quantity and conclusion.

Meaning of Wood Charcoal

Wood charcoal is one of the popular materials in domestic and industrial power generation material which made from woods. Charcoal is a black substance obtained by burning wood without much air. It can be burned as a fuel, and small sticks of it are used for drawing with. Charcoal has been used since the initial times for a large range of purposes including art and medicine, but by far its most important use has been as a metallurgical fuel. Wood charcoal is also important to chemists, gardeners, households etc. As can be seen the science of charcoal has been studied for over 200 years, but there is still much to learn.

The massive production of charcoal was a major cause of deforestation, especially in Central Europe. In England, many woods were managed as coppices, which were cut and redrew episodically, so that a steady supply of charcoal would be available forever. Complaints about shortages may relate to the results of temporary over-exploitation or the impossibility of increasing production to match growing demand. The increasing scarcity of easily harvested wood was a major factor for the switch to the fossil fuel equivalents, mainly coal and brown coal for industrial use. Therefore, wood charcoals become unavoidable part in domestic and industrial uses.

Types of Charcoal

Charcoal is the material which converted from the wood for the purpose of fire making in industries. Charcoal is the lightweight black carbon and ash residue hydrocarbon produced by removing water and other volatile constituents from animal and vegetation substances. Charcoal is usually produced by slow pyrolysis — the heating of wood or other substances in the absence of oxygen. This process is called charcoal burning. The finished charcoal consists largely of carbon. Commercial charcoal is found in either lump, briquette, or extruded forms. The characteristics of these forms vary widely from product to product.

- Lump charcoal is made directly from hardwood material and usually produces far less ash than briquettes.
- Briquettes are made by compressing charcoal, typically made from sawdust and other wood by-products, with a binder and other additives.
- Extruded charcoal is made by extruding either raw ground wood or carbonized wood into logs without the use of a binder.

Environmental Impacts

There is a need of understanding environmental and social impacts of wood charcoal uses in the world with respects to other alternatives. Six to 15 tons of wood are necessary to make one ton of charcoal, consequently much of African forests have already been lost due to its charcoal export to Europe. Paraguay loses nearly 40,000 hectares of forest every year due to illegal export of charcoal, and another 12,000 ha for producing barbecue coal for Europe. Moreover the

Paraguayan charcoal producers who mostly run small-scale rural units earn little from this trade. On the other hand, compared to the production of kerosene, coal, Liquid Petroleum Gas, fuel wood, and electricity, the production of a Terajoule of energy by charcoal provides employment to 200 to 350 persons. In India, Pakistan, Philippines, Nepal, and Myanmar, the industry provides employment for up to 6 per cent to 10 per cent of their rural populations.

Social and Economic Impacts

Social and economic impacts of wood charcoal uses are also one of the considerable factors which decide many variables. Charcoal consumption is a very controversial issue, as the transformation process from wood to charcoal results in considerable energy loss, requiring significantly more forest resources to produce the same amount of energy. This has led to many countries such as Kenya, Tanzania, Gambia etc, to impose bans on charcoal. However these bans have had little success and charcoal use continues to increase with the pressures of growing urbanization. Charcoal burns more cleanly than wood or dried biomass, producing higher temperatures and it is cheaper to transport and store. For these reasons, interest in charcoal as a fuel is reviving, and steps need to be taken to promote improved charcoal-making technologies and thus reduce the amount of raw biomass required. Thus, it is considered as a regular and continuous demand oriented materials.

Charcoal production is a labour-intensive process, employing a large number of people at different phases of the process and distribution. It is estimated that charcoal production generates between 200-350 person days of employment per Terajoule of energy, compared to 10 person days per Terajoule for kerosene. Sustainable production of wood-based fuels can support rural development through decentralized processing & production, short transport distances with low risks, locally available and renewable resources, and potential for short-term efficiency improvements. It can yield a health-dividend, due to reduced levels of smoke, cleaner combustion, and easy handling. To be environmentally beneficial, highly efficient kilns and renewably-sourced fuels are required.

Review of literature

Many studies have been undertaken relating to wood charcoal process, production,

uses, importance, issues, and economic aspects. The following are the major reviews which held to understand the issues relating to the wood charcoal in general.

Afrane, G., & Ntiamoah, A. (2011). concluded that Charcoal is by far the most dominant cooking fuel in urban Ghana, and due to the expected increase in demand with urbanization, improvements are needed in its production methods. Consumers of charcoal must also be encouraged to switch to high-efficiency charcoal cook stoves to reduce the cooking-phase emissions.

Ijagbemi Christiana. O, et al. (2014) concluded that the combustion characteristics of charcoal used in this study was influenced by the properties of wood that was used. The quality of the charcoal that was produced using wood off cuts of Afara wood was higher than those of other species. It has the lowest percentage moisture content, ash content and highest heating value and it is followed by charcoal produced from obeche wood off cut. There was little variation in the qualities of charcoal from other wood species used in this study. However, all species of wood off cut used possess good combustion properties and had a high range of heating values.

Kayhan Menemencioglu (2013). has observed this study was 11087 kg/per adult and average wholesale price was 0.70 US\$/kg and average income was 7761 US\$/adult in a season. A total of annual income of the producers in Turkey is calculated as 140 million US\$. Current status of labour intensive traditional wood charcoal production process from supply of woods to production, transport and marketing of charcoal in Turkey is reviewed in this paper.

Kolade Victoria Olufunmilayo, et al. (2018). This study examined poverty status among charcoal producers in Ogun and Oyo States, Nigeria. Multistage Random Sampling technique was used to select three hundred (300) respondents comprising 120 and 180 charcoal producers in Ogun and Oyo States respectively. Structured questionnaire was used to elicit information. Descriptive statistics summarized the socio-economic characteristics of the respondents. Poverty line was determined with Foster, Greer and Thornback method. Poverty incidence (P0) and poverty depth (P1) were also evaluated. Log it regression was used to examine factors influencing poverty among

the respondents in the study areas.

Neema Msuya et al. (2011). The observed high level of methane produced calls for appropriate technology to capture and re-use it as a natural gas. Some of these gases might lead into acid rain. There is therefore, an urgent need to reduce pressure on forests through advocacy of affordable and more environmental friendly alternative sources of energy for cooking in Tanzania.

Nike Daggart and Charles Meshack (2017). observed that the analysis also highlights the need for change throughout the policy cycle, including generating a stronger knowledge base, and valuing the needs and interests of more marginalized stakeholders, including woodland-owning communities and charcoal producers. The lessons learned from Tanzania have implications for other countries dependent on charcoal from natural woodlands including the leading charcoal producers in Africa, the Democratic Republic of Congo, Ethiopia, and Nigeria.

Njenga.M. et al. (2014) has argued that it also has potential in reducing GHG as it produces low emissions from the additional fuel produced. In the life cycle of charcoal p charcoal briquettes and charcoal, the highest GHG emissions were from wood carbonization and cooking. Although kerosene had lower GWP than charcoal, most of its GHG emissions are inevitable as it is a fossil fuel, whereas the GWP of charcoal can be reduced by adopting better practices in wood supply, wood carbonization and household use.

Olugbire, O.O and Aremu, F.J (2014). suggested that Yoruba is the dominating tribe in charcoal business in the study area. Wholesalers (42.1%), retailers (29.8%) and those that act as both wholesalers and retailers altogether, that is, wholesaler/retailers (26.3%) are mostly found actively engaged in charcoal business in the study area with only 1.8% of the producer/processors. Charcoal market association is very strong in the study area as 98.2% of the marketers are aware of the association and fully participate as members. Sex, marital status and amount of capital set up owned by the marketers have significant impacts on the gross margin realized in the business.

Rob Bailis (2009). This paper analyzes the climate change mitigation potential of charcoal production in East Africa by

examining the impact of changing both land management and technology. Current production in a major charcoal producing region of Kenya where charcoal is made as a by-product of land clearance for commercial grain production is modeled as the “businesses-usual” scenario. Alternative production systems are proposed based on coppice management of native or exotic trees. Improved kilns are also considered.

Salau, S. A. and Keshinro, O. O. (2015) revealed that quantities of woods, labour in man-days and producers’ experience are the important determinants of charcoal production in the study area. Three main policy issues emerge from the results of this study. First, there is need to promote cheap and effective fuel source like the briquette through the use extension agents. The cost of electricity, kerosene and cooking gases should be lower than charcoal and firewood. Thirdly, there is need to provide other alternative ways of life such as provision of off-season employment so as to dissuade both rural and urban dwellers from energy driven deforestation.

Production Quantity

Stacked wood, logs, or even waste from old furniture in underground pits are covered with mud or metal, and burnt slowly without oxygen for around five days. Modern manufacturers undertake this process in cement constructions and kilns as well. This process burns volatile substances, water and sap in the wood, leaving behind pure carbon, which ignites quickly and produces 30 per cent more heat or energy than wood, and performs better than anthracite coal. However, the conversion of wood to charcoal leads to approximately 60 per cent energy loss. Wood charcoal is used in its natural lump form or as briquettes, where the coal is crushed, compressed and shaped into regular forms using natural binding starches. Charcoal is a high volume and low value product, so briquettes can reduce transportation costs

Top Ten Countries Wood Charcoal Production Quantity

Top Ten countries	Production Qty (tonnes)	
	Sum	Average
Brazil	42754000	6107714.29
Nigeria	29864965	4266423.57
Ethiopia	28736898	4105271.14
India	20160000	2880000.00

Democratic of Congo	16175662	2310808.86
Ghana	12743900	1820557.40
United Republic Tanzania	12667080	1809582.86
China, mainland	11739686	1677098.00
Madagascar	10181896	1454556.57
Thailand	9994603	1427800.43

Source: FAOSTAT (November 28, 2018)

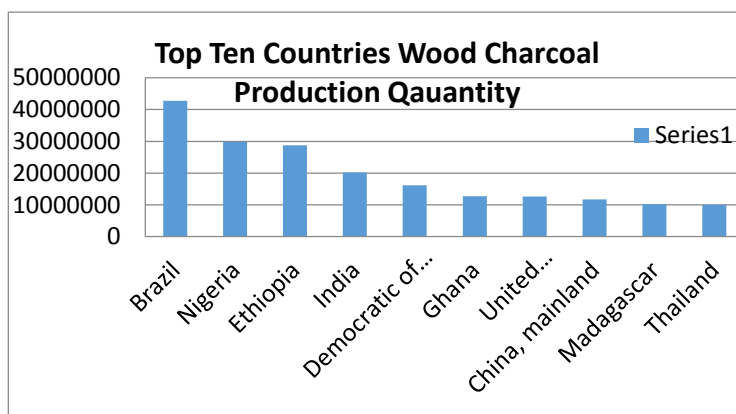


Table No. 1 explains that Wood Charcoal Production Quantity in top ten countries. Sum of Production Quantity of Brazil amounted to 42754000 tonnes with the average of 6107714.29 tonnes, Sum of production Quantity of Nigeria amounted to 29864965 tonnes with the average of 4266423.57 tones, Sum of production Quantity of Ethiopia amounted to 28736898 tonnes hhwith the average of 4105271.14 tonnes, Sum of production Quantity of India amounted to 20160000 tonnes with the average of 2880000.00 tonnes, Sum of production Quantity of Democratic of Congo amounted to 16175662 tonnes with the average of 2310808.86 tonnes, Sum of production Quantity of Ghana amounted to 12743900 tonnes with the average of 1820557.40 tonnes, Sum of production Quantity of United Republic Tanzania amounted to 12667080 tonnes with the average of 1809582.86 tonnes, Sum of production Quantity of China, mainland amounted to 11739686 tonnes with the average of 1677098.00 tonnes, Sum of production Quantity of Madagascar amounted to 10181896 tonnes with the average of 1454556.57 tonnes, Sum of production Quantity of Thailand amounted to 9994603 tonnes with the average of 1427800.43 tonnes. Largest Producers and Importers of Charcoal-

type Fuels

Production of charcoal has been increasing worldwide from 18 million tons in 1965 to 47 million tons in 2009, by which time Africa produced 63% of the charcoal in the world. The largest contributors to global export in coal, Paraguay (12%), India (11%), Indonesia (11%), Argentina (11%), and Somalia (5%) account for half of the coal exports.

Countries which have the highest share in global coal import are Germany (9%), China (8%), Malaysia (8%), Japan (7%) and Republic of Korea (6%). Germany imports coal worth 111 million US dollars, coming mainly from Poland (40%), Paraguay (12%), Nigeria (6.7%), France (6.3%), Bosnia and Herzegovina (5.3%), Ukraine.3%) and Indonesia (4.5%). The charcoal is mainly used in the leisure industry for barbecues and restaurants, as well as industrial purposes such as smelting. China imports 75 million dollars of coal mainly from India, Myanmar, Colombia, Indonesia, Thailand and Ivory Coast. China's growing demand for charcoal is driven by its silicon production which accounts for 50% of the world production.

Wood Charcoal Production Quantity Share by Region

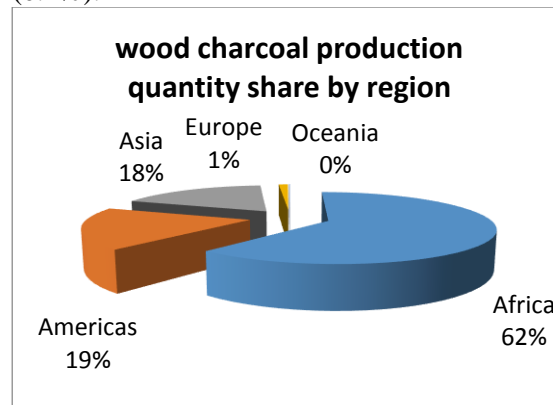
Region	Production Qty (Tonnes)		%
	Sum	Average	
Africa	215271335	30745333.57	61.6
Americas	66966358	9566622.57	19.2
Asia	62918975	8988425.00	18.0
Europe	3929907	561415.29	1.1
Oceania	259741	37105.86	0.1

Source: FAOSTAT (November 28, 2018)

Table No.2 shows that wood charcoal Production Quantity share by region (sum and average Quantity in 2011-2017) As regards Africa Region, sum of Production Quantity amounted to 215271335 tonnes with the average of 30745333.57 tonnes, As regards Americas Region; sum of Production Quantity amounted to 66966358 tonnes with the average of 9566622.57 tonnes, As regards Asia Region, sum of Production Quantity amounted to 62918975 tonnes with the average of 8988425 tonnes, As regards Europe Region, sum of Production Quantity amounted to 3929907 tonnes with the average of 561415.29 tonnes, As regards Oceania Region, sum of Production Quantity amounted to 259741

tonnes with the average of 37105.86 tonnes.

As regards percentage of share of wood charcoal production Quantity by region Africa with 61.6 per cent followed by Americas (19.2%), Asia (18%), Europe (1.1%), Oceania (0.1%).



Paraguay's coal industry is one of the main drivers of the deforestation of the already scarce tropical dry forests. Biomass and charcoal are the main fuels for cooking and industrial use. Export of coal is one of its main revenue, and exceeds domestic consumption. Its main importer is Brazil itself a large producer, with truckloads of charcoal illegally crossing the borders. In addition high quality barbecue charcoal is exported to Spain, Germany, Belgium, Brazil, Israel and Chile. Similarly charcoal making is an illegal activity in Indonesia. India produces activated charcoal, hardwood charcoal, coconut charcoal, charcoal dust on a large scale using modern technology and machinery. India exported 18 per cent of the wood charcoal it produced in 2014. The USA is its major importers.

Wood Charcoal Production Quantity in India

Years	Production Quantity (tonnes)
2011	2880000
2012	2880000
2013	2880000
2014	2880000
2015	2880000
2016	2880000
2017	2880000

Source: FAOSTAT (November 28, 2018)

Table No.3 reveals that wood charcoal production quantity in India 2011-2017

Production of wood charcoal amounted to 2880000 tonnes during the year 2011-2017. There are 637 charcoal productions in India suppliers, mainly located in Asia. The top supplying countries are India, China

(Mainland), and Vietnam, which supply 37 per cent 31 per cent, and 30 per cent of charcoal production in India respectively. Charcoal productions in India products are most popular in Domestic Market, South Asia, and Southern Europe.

Conclusion

Wood charcoal production is one of the continuous processes in various countries which produce and exports not only to contribute foreign exchange but also for the employment generation and utilization of local resources. When talking about wood charcoal most people think about it as a cooking fuel. It is known that wood charcoal is much better than wood due to the following reasons: its calorific value is higher than that of wood, its ignition temperature is less than wood, it causes less air pollution and it smells better. So, it is widely used for outdoor grilling and barbecues in backyards and on camping trips. But at the same time, there is a need to consider the environmental issues relating to the wood charcoal production process. It creates more smoke emission and spread dust through air.

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