

Bioenergy; Bio Briquettes as an Alternative Fuel in Nepal

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Abstract

Although fossil fuel sources are limited and likely to be depleted soon, current energy consumption is entirely dependent on them. Excessive use of fossil fuels not only depletes natural resources but also raises carbon dioxide levels and global temperatures. A significant amount of herbal waste biomass is generated during agricultural crop processing, as well as during 'post-harvest lines' operations. Because such waste biomass exists in bulk, it is unsuitable for direct combustion. The global energy crisis has accelerated the global demand for alternative, advanced renewable, sustainable energy supplies such as biofuels, which have never been more required than now. There is a push in poor nations to utilize waste biomass for energy generation in the form of bio-briquettes. With the goal of studying and investigating bioenergy and bio-briquettes, a thorough evaluation of past papers on bioenergy and bio-briquettes was done. There were a total of 12 articles compiled. Using reputable databases such as Google Scholar and Research Gate. The advantage of using bio-briquettes as a fuel is that they have a higher heating value, a longer burning time, improved chemical characteristics (less smoke), and are easier to handle and transport than bulk biomass. So bio briquettes have a strong potential to develop themselves as an alternative biomass energy source in Nepal through fostering sustainable markets. Bioenergy should be investigated further as a viable alternative to fossil fuels.

Keywords: Bioenergy • Alternative energy • Bio briquettes • Briquetting methods

Introduction

Energy is all around us, and the seven billion people that live on the planet rely on it for their daily activities. Our global environment provides this energy in the form of energy extracted from fossil fuels, natural gas, hydroelectricity, nuclear energy, and other renewable sources, with fossil fuels providing 67% of global energy, natural gas providing 22%, hydroelectricity providing 6%, nuclear energy providing 4.4%, and renewable sources such as wind, geothermal, biomass, and solar energy providing only 0.6% [1]. Global energy based on fossil fuels is not only depleting natural resources, but is also causing a steady increase in carbon dioxide emissions, which is increasing average global temperatures, causing unprecedented climate change, threatening resources, and exposing some people around the world to extreme natural hazards [2]. Excessive energy demand combined with diminishing global fossil fuel energy reserves may result in an energy crisis in many countries so the transition to renewable energy has been widely discussed among policymakers, and investors are willing to invest in Renewables which can sustainably contribute to energy security [3].

For replacing fossil fuels in the current circumstances due to the increasing demand for clean energy Bioenergy is one of the appealing choices. Biomass represents an alternative but appropriate solution to rising energy demands, as well as the possibility of lowering net carbon emissions, greenhouse gas emissions (GHG), and detrimental environmental pollution caused by fossil fuels. Biomass is the third most abundant source of energy in the world, accounting for around 14% of the global yearly energy supply, and its importance will grow as most national energy policies and strategies place a greater emphasis on renewable sources and conservation. Bioenergy is energy derived from biological and renewable sources (biomass) [4]. Biomass is organic matter produced in nature by photosynthesis, which is accomplished by solar energy conversion. It is a renewable energy source not only because the energy originates from the sun, but also because biomass may re-grow in a relatively short amount of time. Biofuels can be solid (fuel wood, charcoal, wood pellets, briquettes, and so on) or liquid (bioethanol, biodiesel)

Methodology

A thorough evaluation of the literature on existing reports on bioenergy and bio briquettes was conducted utilizing various credible databases such as Google Scholar and Research Gate [5]. Relevant information was sought using various keywords such as Bioenergy. A total of 12 articles were collected and evaluated, and the information obtained is summarized here.

Literature Review

Briquettes are a solid fuel made of organic carbon-containing matter that has a high calorific value and may be ignited for a longer duration. Bio-briquettes are a simple but sustainable technology that can be utilized as an alternative energy source [3]. Briquettes are manufactured from the newspaper, charcoal dust rice husk partially decomposed plant waste, or sawdust and can be used as a home and industrial energy source instead of charcoal, firewood, gas coal, or electricity. Briquettes may burn cleaner than charcoal or firewood depending on the ingredients used to produce them. The world generates a large amount of waste biomass from wood wastes, agricultural crops and their waste by-products, municipal solid trash, animal waste, fruit waste, food processing waste, and aquatic plants [6]. Such waste biomass exists in the bulk form; direct burning of loose biomass is inefficient and pollutes the environment significantly. Aside from transportation, storage, and handling issues, direct burning of loose biomass is linked with very low thermal efficiency and widespread air pollution [7]. The briquette technique is frequently used to overcome the disadvantages of loose biomass raw materials.

The process of turning low bulk density biomass into high density and energy concentrated fuel briquettes is known as briquetting. Briquetting is primarily used to produce high-density fuel by compacting combustible raw materials such as charcoal, agricultural residue, forest waste, and industrial and municipal waste to increase the net calorific value per unit volume, improve combustion efficiency, reduce pollution, and ease handling, transportation, and storage, among other things. In this process, loose biomass or charcoal powder is densified or converted into a solid form of a specific shape and size by compaction in a die or mould using pressure, heat, and binding material [8-9]. Typically, the availability of trash is taken into account when selecting raw materials for biomass briquettes. Coconut husks, rice husks, coffee husks, and sawdust are examples of these wastes. Raw material preparation Except for sawdust, all selected raw materials are sun-dried to reduce moisture content. All raw materials are crushed into smaller parts to be readily inserted and placed into the pyrolysis furnace till it produces charcoal. After becoming charcoal, it is allowed to cool at normal temperature before being crushed into a fine powder, which is then treated and mixed with a binder. After that, the dough is printed on a cylindrical moulding block. Ideally, bio-briquettes are subsequently sun-dried for 1 week to 2 weeks [10].

Once dried, it may be burned and can burn for around 1 hour-1.5 hour with virtually no smoke produced, making it an efficient source of energy for a 5 member family's household heating and cooking. The most common function of the bio-briquette and the major reason why it is demanded by consumers in both urban and rural areas is for interior heating [3]. Bio-briquettes made from these biomass sources have many advantages over other solid fuels, including a lower price than coal, the fact that they are a renewable source as opposed to oil, coal, or lignite, and they do not contain sulfur, which prevents pollution of the environment, a higher calorific value than other solid fuel sources, the ash content in bio-briquettes is much lower than that in coal, and combustion is more uniform, and they are easier to transport [11].

Status and Scope in Nepal

Nepal continues to rely largely on traditional energy sources such as solid biomass (firewood, cattle dung, and agro-waste) to supply its energy needs. Because it relies on traditional biomass fuels, mainly firewood, Nepal is one of Asia's largest traditional biomass fuel consumers. Because of its availability, practicability, and affordability, Nepalese rural residents have been using traditional animal dung briquettes manufactured by hand. Animal dung, specifically cow and buffalo dung, is mixed with fillers such as straw, jute sticks, and other biomass materials to generate guitha. While these low-pressure briquettes made from locally accessible resources are cheap and popular, they are inefficient and polluting during combustion. Direct combustion of solid biomass is linked with extremely low thermal efficiency and significant air pollution. Indoor air pollution is one of the country's major health dangers, and much of it is related to cooking and indoor heating with solid biomass, primarily firewood. Increased demand for this valuable resource, combined with decreasing supply, results in a grossly unsustainable practice such as deforestation within the country, which will undoubtedly be devastating in the long run as the resource will be completely exhausted, and related negative side effects include increased soil erosion, desertification, loss of biodiversity, climate change, and negative impacts on land and watershed management [3]. Nepal, as an agriculturally based country, has a sufficient supply of agricultural residue and animal waste. Similarly, the country has an abundance of forest resources. As a result, the country has significant bioenergy potential. Given the importance of this source of energy in our country, where the majority of rural populations still rely on wood-based energy, improving fuel efficiency and quality through briquetting is the key technological initiative in this regard, Nepal's bioenergy potential can lead to a sustainable energy supply.

Conclusion

In the current situation, the entire world is reliant on the fossil fuel-dominated energy supply, whereas developing nations rely primarily on traditional sources such as solid biomass. Excessive usage of fossil fuels and solid biomass pollutes the environment severely. The world's population is growing by the day, increasing reliance on scarce fossil fuels for energy generation.

This increase in energy demand has resulted in the global energy crisis. Where the entire world is looking for alternative clean, renewable, and sustainable fuel sources Bio briquettes may be an adequate response to rising energy demands, as well as the prospect of lowering net carbon emissions, which are severe environmental pollution created by fossil fuels. Nepal is an agricultural country with a plentiful supply of agricultural leftovers and animal waste and forest resources; As a result, the country has a lot of potential for bioenergy. Furthermore, briquettes have advantages over fuel wood in terms of higher heat intensity, cleanliness, ease of use, and a significantly reduced storage space required.

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