



Case study

Environmental impacts of bamboo as a substitute constructional material in Nigeria



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ABSTRACT

The environment in Nigeria is exceptionally exposed to diverse natural hazards. Due to this factor, this paper investigates a material which can be substituted for wood or steel in construction. Bamboo, a natural raw material, is one of the fastest growing plants on earth. Bamboo use in construction is not new; it has been regularly utilized for building mud houses and small huts in villages for centuries. Bamboo is a durable and exceptionally flexible building material. It has been utilized for flooring, walls, roofing, concrete reinforcement, and scaffolding, is light in weight and easily transported. This paper will examine bamboo and its environmental benefits, its properties and qualities. In Nigeria, the rate of bamboo use is low; therefore, this paper will investigate bamboo and its uses in Nigeria, conceivable uses that can be embraced demonstrating its accessibility and impacts on the environment in Nigeria.

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1. Environmental impacts of bamboo as a substitute constructional material in Nigeria

Bamboo as a natural raw material existed together in the world since the days of man on earth. In the construction sector of Nigeria, wood and steel have been the major materials used in the production. With the forest been reaped down year in year out for logs of timber for construction, experimental researches (Andam, 1995; Youssef, 1976; Liese, 1986) are being discovered to state the fact that bamboo has a natural raw material and a strong capability to that of wood, bricks, also as strong as steel, and it is environmental friendly, cheap, locally accessible, which can be readily used as a substitute material for flooring, roofing, and reinforcement in place of steel in buildings.

Bamboo a composite material is readily accessible in Nigeria and has not been properly utilized. From researches conducted by scholars (Cleaver, 1993; American Bamboo Society, 2002; Anon., 1987), bamboo possesses a vast advantageous usage scheme which is environmental friendly, in respect to trees (wood) which are gathered within 10–30 years, bamboo can be collected within 3–5 years, likewise a 10–30% of biomass contrasted with 2–5% of bamboo (American Bamboo Society, 2014). With the high rate of wood exploitation in Nigeria forest, it will be necessary to provide an alternative means/sources of raw materials for construction. The aim of this paper is to investigate the information about bamboo as a raw material, which can be utilized in the constructional sector in Nigeria, revealing its potential and ecological profits and disservices. With findings gathered this paper will provide a formidable platform, to be considered if bamboo can reduce the environmental defects in the construction sector in Nigeria. The objectives of this paper are: to identify the strength and capability of bamboo for constructional purpose, to identify its present use in

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Nigeria and explore further possible usage, to examine the effects depends upon the environment in Nigeria. The article is based on bamboo use, characteristics and properties, data will be collected from literature sources: journals, books, magazines, etc. In this paper, a qualitative research approach will be adopted. Data collected will be examined with references related to previous researches done by scholars and scientist in regards to bamboo. The study will cover bamboo, its characteristics, properties and use in Nigeria. The investigation of bamboo in this paper will be restricted to the ones found in the Nigeria. This paper will only cover the use of bamboo in construction, other aspects like medicinal attribute, industrial use; will not be discussed.

2. Bamboo: characteristics, properties, usage

Bamboo is the fastest developing plant on the plane (Alfonso, 1987); there are more than 70 genera and in excess of 1000 species which have been proposed in botanical literature, (Anon., 1988). They grow in sub-tropical and calm zones, primarily on sandy topsoil to loamy mud soils. It is an adaptable plant with a short development life cycle. The growth of bamboo culms is exceptionally quick, around 70 mm everyday and can be as much as 350–450 mm everyday. The development of its culms is completed within 4–6 months, stated by Wong (1995) their culms take 2–6 years to mature depending on the species. Bamboo culms are generally cylindrical and smooth, with a diameter ranging from 29 to 300 mm, 60–70% of bamboo wood comprises of fiber, and the fiber substance is more prominent in the outskirts than inside. The average height of bamboo is around 100 times its diameter.

Bamboo development pattern is a particular blend of grass, leaf-bearing tree, and palm. They are like leaf bearing tree; they also have tubular blades, lanced shaped cover leaves and peculiar flowers like grasses. They build their crown consistently furthermore shed their leaf yearly, bamboo has a strong rootstock.

3. Properties

Properties of bamboo change because of an extensive variety of genera families and species. Besides, imperative species of bamboo properties will be mentioned as: 1. Tensile and compressive strength, 2. Shrinkage, 3. Resistibility and 4. Elasticity. Fibers in bamboo run axial; hence the tensile strength of bamboo is in their outer zones which are profoundly versatile vascular bundle, their strength varies along with culm height, the compressive strength increases with height while bending strength has opposite pattern. Bamboo shrinks more than wood when it loses water. It shrinks in the cross sections ca. 10–16%, in the wall thickness, ca. 15–17%. Bamboo has an abnormal state of flame resistibility due to its high substance of silicate acid. Bamboo has an enormous elasticity which makes it a good building material which is environmental friendly for areas with earthquake. Lastly bamboo has a relatively low weight and can be transported easily and utilized (Klaus, 2002).

4. Usage

The utilization of bamboo can be grouped into six major aspects as follows: 1. Construction, 2. Furniture production, 3. Paper making, 4. Textile, 5. Pharmaceutical usage and 6. Household-items. In the constructional aspect, bamboo is used as a building material for decoration and as a structural member of a house. Bamboo has been utilized by the local populace for housings years back, being used as poles, purlins, trusses, rafter, mats, flooring (Fig. 1), ceiling, roof, wall (Fig. 2), window and door frames, foot bridges and fence posts. They are additionally used in modern-day as scaffolds to support slabs while constructing. Bamboo production is now common to the world and has been developed in China, India, Vietnam and Thailand where bamboo mat boards are manufactured. With studies observed, in Asian countries bamboo can be a valuable sustainable natural resource (Naxium, 2001a).

Bamboo has been utilized in furniture production and pulp and paper making, as a fuel (charcoal, oil, gas produced through pyrolysis), and the fibers are used for textile making, and other ranges of products like chopsticks and table wears, also to medicinal health care products (Xaing, 2010). Bamboo has been chosen to be used as a raw material in construction due to its environmental friendly attributes and readily availability (Yu et al., 2011). Nutritional active minerals such as vitamins, amino acids, steroids are also extracted from bamboo culm, shoot and leaves. Bamboo can also be processed into beverages, medicines, pesticides and household items e.g., toothpaste, soap, etc. (Naxium, 2001b).

5. Bamboo in Nigeria: source and availability

According to RMRDC, (2004a), bamboo is widely distributed in Nigeria. Fig. 3 demonstrates the level of bamboo occurrence in Nigeria. However, RMRDC, (2004a) indicates that bamboo is widely distributed in the south and middle belt regions of Nigeria. In reference to this report the states in which the bamboo is not less than 10% of their natural vegetation are: Ogun, Oyo, Osun, Ondo, Edo, Delta, Rivers, Akwa-Ibom, Cross-River, Abia, Ebonyi, Enugu, Anambra and Imo states. While states like, Ekiti, Bayelsa, Lagos, Kogi, Kwara, Benue, and Nassarawa have not less than 6.0–9.0% of their natural vegetation occupied by bamboo. Pocket of bamboo clumps is found in Niger, Taraba, Plateau and Abuja, in these states however the availability of bamboo is short of what 3.0–5.9% of natural vegetation. In Adamawa, Bauchi, Borno, Gombe,

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