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# FACTORS INFLUENCING PROSPECTIVE USES OF RATTAN CANES AS FURNISH FOR CEMENT COMPOSITE PRODUCTION

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**Abstract**
This paper discusses the prospective uses of three readily available rattan canes in Southern and Western Nigeria namely: *Laccosperma secundiflorum, Eremospatha macrocarpa,* and *Calamus deerratus* as furnish for Cement Bonded Composites (CBCs) production. Advantages of utilising rattan canes as furnish for CBC production, limiting factors influencing the development of rattan composites and means of curtailment are examined. Rattan canes are potential furniture for CBC production but will require pre treatment before use to ensure formation of strong crystalline bond.

**Keywords:** Rattan Canes, Cement Bonded Composites, Pre-treatments

## Introduction

Rattans are spiny, climbing palms belonging to the *Calamoideae*, a large subfamily of the palm family (*Palmae* or *Arecaceae)* characterised by overlapping reflexed (bent or curved backwards) scales on the fruit. There are around 600 different species of rattan belonging to 13 genera concentrated solely in the old world tropic and subtropics (Table 1). Out of the 13 genera, 4 (*Laccosperma, Eremospatha, Oncocalamus and Calamus*) representing 20 species are endemic to Africa (Sunderland and Dransfield, 2002; Sunderland, 2002). Four rattan species are readily available in the southern and western parts of Nigeria. These are *Laccosperma secundiflorum, Eremospatha macrocarpa, Calamus deerratus* and, *Oncocalamus manni.* Four other i.e. *Eremospatha hookeri, Eremospatha wenlendiana, Laccosperma laeve and Oncocalamus wrigthianus* are located in deep forest inhabited by dangerous animals (Morakinyo, 1993; Dahunsi, 2000). However, three species namely *Calamus deerratus, Eremospatha macrocarpa* and *Laccosperma secundiflorum* are widespread and are commonly used for commercial furniture production (Olorunnisola, 2005; Adefisan and Olorunnisola, 2009).

The indigenous uses of rattan canes are vast that is from bridges to baskets, from fish traps to furniture, from crossbow strings to yam ties. Rattans are also used as ropes for climbing palm trees and as cordage for local drums. The traditional uses of rattan are as dye, medicines against diseases such as syphilis etc., raft making, house construction and poles for

**Table 1: The Rattan Genera, Number of Species and their Distribution**

| Genus | Number of Species | Distribution |
|---|---|---|
| *Calamus* | 370 – 400 | Tropical Africa, India and Sri Lanka, China, South and East to Fiji, Vanuatu and Eastern Australia |
| *Calospatha* | 1 | Endemic to Peninsular Malaysia |
| *Ceratolobus* | 6 | Malay Peninsula, Sumatra, Borneo, Java |
| *Daemonorops* | 115 | India and China to Western-most New Guinea |
| *Eremospatha* | 13 | Humid Tropical Africa |
| *Korthalsia* | 26 | Indo-China and Burma to New Guinea |
| *Laccosperma* | 6 | Humid Tropical Africa |
| *Myrialepis* | 1 | Indo-China, Thailand, Burma, Peninsular Malaysia and Sumatra |
| *Oncocalamus* | 4 | Humid Tropical Africa |
| *Plectocomia* | 16 | Himalayas and South China to Western Malaysia |
| *Ploctocomiopsis* | 5 | Thailand, Peninsular Malaysia, Borneo, Sumatra |
| *Pogonotium* | 3 | Two species endemic to Borneo, one species in both Peninsular Malaysia and Borneo |
| *Retispatha* | 1 | Endemic to Borneo |

(Source: Hunter and Lou, 2002; Sunderland and Dransfield, 2002) carrying goods (Renuka, 2001; Hunter and Lou, 2000). Almost all parts of rattan plants are useful. For example, the skin is good for weaving, as a binding material and as for furniture making. Canes are used for household materials, furniture and sport equipment. The cores of the canes are good for weaving and the leaves are used as curtains, roofing material, weaving etc. Products from rattan plants generate good income for population and country in which they are made (Vongkaluang, 2002).

However, over 30% of rattan canes harvested at any particular time for furniture manufacture is wasted due to discoloration resulting from fungal staining, inflexibility, tendency to breakage and poor mechanical properties (Dransfield and Manokaran 1993) and are often times disposed by on-site incineration (Olorunnisola and Adefisan,2002). In addition, only about 20% of the over 600 known rattan species produce the most sought-after fine quality canes of commercial value. A viable means of enhancing complete material utilisation of rattan canes is in the production of environmentally friendly and fire-resistant cement-based composites for both structural and non-structural applications in building construction. This work examines potentials of rattan as alternative furnish for cement composites production, discusses the factors limiting the development of rattan cement composites manufacture and possible means of curtailment.



**Advantages of Rattan Canes Utilisation as Furnish for Cement Composites Production**

Wood has been used as furnish for cement bonded composites (CBCs) production over the years resulting in sound structural building components used for interior / exterior wall cladding, highway sound barriers, pre-cast building members among others. However, the demand for wood and wood products is increasing which has culminated into depletion of the forest and attendant scarcity of timber supply (FAO, 2006). Therefore, there is the need for an alternative furnish for CBCs manufacture. Olorunnisola (2005, 2006) reported that the choice of any particular lignocellulosic as furnish for CBC production is dependent on availability and accessibility. Rattan, a versatile climbing palm, available in many forests in southern Nigeria can therefore be considered as a potential material for CBC manufacture.

Rattans canes can be harvested in less than 7 years after planting and harvesting can be done periodically using simple tools. The assembly line from rattan harvesting to CBC production involves low capital investment and high labour input which can augment small scale industrial enterprise especially in the low income communities in Nigeria (Olorunnisola, 2005).

In solid form, rattan canes are reported to bond with cement (Lucas and Dahunsi, 2004). Furniture wastes and particles extracted from rattan canes have also been found suitable for cement-bonded composites production for both low-stressed indoor applications and bearing walls in housing construction (Olorunnisola and Adefisan, 2002, Olorunnisola, 2005, 2007). However, different rattan species exhibit different strength properties (Lucas and Dahunsi, 2004) and probably will carry over this property when utilised in CBC production.

The inherent sugar content of rattan canes make them susceptible to fungi and insect attacks (Liese, 2002; Lucas and Dahunsi, 2004). This makes the infested canes unsuitable for cane works. The use of rattan canes as furnish in CBC production can address issues of high level wastage during furniture manufacture, enhance complete material utilisation and enable the incorporation of numerous under-utilised rattan species of unacceptable qualities (Olorunnisola *et al.*, 2005b).

**Limiting Factors influencing Utilisation of Rattan canes as furnish for Cement Composite Production and Means of Curtailment**

Rattan canes like other woody materials contain elements which tend to inhibit the setting of cement. Inhibition of Portland cement setting by many lignocellulosics is a major limitation to the development of new cement-bonded composites. The incompatibility is usually ascribed to the presence of sugars, extractives, etc. in such lignocellulosics that obstruct the formation of strong crystalline bonds with cement (Adefisan and Olorunnisola, 2009). Hence, physical, chemical and biological (fungi infestation) pre-treatment methods are adopted to minimise such inhibitions (Badejo, 1989; Shi *et al.*, 1999, Sutigno, 2002). Semple and Evans (2004), Adefisan and Olorunnisola (2007) have observed that pre-treating lignocellulosics with chemical additives such as Calcium chloride, magnesium chloride etc. can remove / reduce the offending substances which impair cement bond formation.

Differences in anatomical structure exist in the three available rattan species in Nigeria. Dahunsi (2000) and Adefisan (2010) observed that *L. secundiflorum* had the highest proportion of sclerified strengthening tissues compared to the preponderance of storage tissues (Parenchyma) in the two other rattan species i.e. *Eremospatha macrocarpa* and *Calamus deerratus in* western and southern parts of Nigeria. Matthew and Bhat (1997) observed that the parenchyma cells in the Indian *Calamus* species contained starches and tannins which are cement inhibitors suggesting the likelihood of rattan furnish inhibiting cement setting. A probable means of containment is by aqueous extraction (cold or hot water pre-treatment) which will remove soluble inhibitory wood components such as tannins, gums, sugars, colouring matter and starches (Sutigno, 2002).

Peeling of the silified epidermis of rattan canes has been found to affect rattan-cement interactions. While particles extracted from *L. secundiflorum* species (peeled and unpeeled) and unpeeled *C. deerratus* formed hardened pastes with cement, those made from peeled *Calamus* did not form cohesive bonds with cement (Adefisan and Olorunnisola, 2007; 2009 and Adefisan, 2010). This variability is attributable to the distribution of the extractive contents in the rattan species. Whereas more inhibitory compounds were found at the periphery of the stems of *L. secundiflorum* than in the core, higher concentration of extractives were noticed in the core of the stems of the *Calamus* species than at the periphery (Adefisan and Olorunnisola, 2009 and Adefisan, 2010). It was therefore recommended that rattan canes need not be pre-processed prior to CBC production.

**Conclusion**

Rattan canes are potential furnish for cement bonded composites production. However, particles extracted from these canes need to be pre-treated prior to CBC production to enable the formation of strong crystalline bond. Utilisation of rattan canes in CBC production will address issues of high level wastage often encountered in the rattan furniture industry.

**References**

Adefisan, O.O and Olorunnisola A.O. 2007. Compatibility of rattan particles with ordinary Portland cement. *Journal of Applied Science Engineering and Technology* 1 (1): 61-71

Adefisan, O.O. and Olorunnisola, A.O (2009). Effects of Selected Pre-treatments on the setting of Cement composites from two Rattan Species. Journal of Applied Science Engineering and Technology 9:30-37

Adefisan,O.O. 2010. Anatomical and pre-treatment effects on the hydration Cement Bonded Composites from rattan canes (*Calamus deerratus* and *lacosperma secundiflorum*). A Ph.D Thesis in the Department of Agricultural and Environmental Engineering, University of Ibadan. 178pp

Badejo, S.O. 1989. Influences of Pre-treatment Temperature and Additive Concentration on the Properties of Cement-Bonded Particleboard from Plantation–
Grown Tropical Hardwoods. Tropical Science. 29: 285-296

Dahunsi, B.I.O. 2000. The Properties and potentials application of rattan canes as reinforcement materials in concrete. Ph.D. Thesis. Department of Agricultural
Engineering. University of Ibadan

Dransfield J and Manokaran N. 1993. Plant Resources of South-East Asia-Rattans. PROSEA. Jakarta, Indonesia. Pp137

http://www.fao.org/documents/show=Cdr.as?YrL_file=/DOCREP/004/X6762E/X6762E02.htm
Review and Improvement of Data related to Wood Products in
Nigeria. Retrieved May 20, 2006

Hunter, J.I. and Lou, Y. 2002: Presentation of INBAR's Programme on Rattan. In. J. Dransfield, F.O. Tesoro and N. Manokaran eds. Non-Wood Forest Products 14. Rattan Current Research Issues and Prospects for Conservation and Sustainable Development. P. 43 – 48. F.A.O., Rome

Olorunnisola, A.O. Pitman, A. and Mansfield-William, H. 2005. Hydration characteristics of cement–bonded composites made from rattan cane and coconut husk. *Journal of Bamboo and Rattan* 4.2:193-201

Olorunnisola, A.O. 2006. Strength and water absorption characteristics of cement-bonded particleboard produced from coconut husk. *Journal of Civil Engineering Research and Practice* 3.1:41- 49

Liese, W. 2002. Challenges and Constraints in Rattan Processing and Utilization. In. J. Dransfield, F.O. Tesoro and N. Manokaran eds. Non-Wood Forest Products 14. Rattan Current Research Issues and Prospects for Conservation and Sustainable Development. P. 35 – 42. F.A.O., Rome.

Lucas, E.B. and Dahunsi, B.I.O. 2004. Characteristics of three western nigerian rattan species in relation to their utilisation as construction material. *Journal of Bamboo and Rattan* 3(1):45-56

Matthew, A. and Bhat, K.M. 1997. Anatomical diversity of Indian rattan palms (*calaamoideae*) in relation to biogeography and systematics. *Botanical Journal of Linnean Society*. 125:71-86

Morakinyo, A.B. 1993. Herbarium Notes on species of rattan palm on exhibition at the herbarium of the Department of Botany, University of Ibadan (Unpublished).

Olorunnisola, A. O. and Adefisan, O.O. 2002. Trial production and testing of cement-bonded particleboard from rattan furniture waste. *Wood and Fibre Science*. 34.1: 116-124.

Olorunnisola, A.O. 2005. Dimensional stability of cement-bonded composites boards from rattan cane particles. *Journal of Bamboo and Rattan* 4.2:173-182

Olorunnisola, A.O. Pitman, A. and Mansfield-William, H. 2005a. Hydration characteristics of cement–bonded composites made from rattan cane and coconut husk. *Journal of Bamboo and Rattan* 4.2:193-201

Olorunnisola, A.O. Pitman, A. and Mansfield-William, H. 2005b. Strength *Properties and potential uses of Rattan-Cement Composites. Journal of Bamboo and Rattan* 4.4: 343-352

Olorunnisola, A.O. 2007. Effects of particle geometry and chemical accelerator on strength properties of rattan–cement composites. *African Journal of Science and Technology (AJST) Science and Engineering Series* 8(1): 22 – 27

Renuka, C. 2001. Uses of rattan in south asia. *Unasylva* Vol. 52(205):7 FAO Publication, Rome.

Semple, K. and Evans, P.D. 2004. Wood-Cement Composites- Suitability of Western Australian Mallee eucalypt, Blue Gum and Melaleucas. A Report for the RIRDC / Land & Water Australia / FWPRDC / MDBC 66p

Shi,S.Q., Gardner,D.J. and Wang, J.Z. 1999. Effect of the addition of polymer fluff to wood furnish on the mechanical and physical properties of wood fiberboard. *Forest Products Journal*. 49(2):32-38.

Sunderland, T.C.H. 2002. Status of Rattan Resources and Use in West and Central Africa. In. J. Dransfield, F.O. Tesoro and N. Manokaran eds. Non-Wood Forest Products 14. Rattan Current Research Issues and Prospects for Conservation and Sustainable Development. P. 77– 87. F.A.O., Rome.

Sunderland, T.C.H. and Dransfield, J. 2002. Species Profiles Rattans. (*Palmea: Calamoideae*) In. J. Dransfield, F.O. Tesoro and N. Manokaran eds. Non-

Wood Forest Products 14. Rattan Current Research Issues and Prospects for Conservation and Sustainable Development. P. 9 – 22. F.A.O., Rome.

Sutigno, P. 2002. Effect of Aqueous extraction of wood wool on properties of wood wool cement board manufactured from Teak (*Tectona grandis*) In: Evans, P.D. (ed.) Wood-Cement Composites in Asia-Pacific region. Proceeding of aWorkshop held at Rydges Hotel, Canberra, Australia 10 December, 2000. p24-28

Vongkaluang, I. 2002. Thai Rattan in the Early 2000. ) In. J. Dransfield, F.O. Tesoro and N. Manokaran eds. Non-Wood Forest Products 14. Rattan Current

Research Issues and Prospects for Conservation and Sustainable Development. P. 183 – 189. F.A.O., Rome.