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JANKA HARDNESS RATING OF MALAYSIAN TIMBERS

AW Mohd Jamil

Introduction

Janka hardness is one of the important mechanical properties of timber material. Janka hardness value indicates the capability of a timber to resist indentation force on its surface. The test to determine Janka hardness simulates the condition of a pointed loading, coerce on the surface of the timber perpendicular to the grain, or, in a few studies parallel to the grain. Janka hardness scale is the industry benchmark in evaluating the performance of timber for non-suspended flooring applications such as parquet and floor strip. It is a practical method in considering whether a timber floor can sustain dents, scratches, scuffs, impact forces, prolonged loading and other mechanical wear and tear.

Janka hardness value is not really an absolute value for design. Comparatively, it indicates which timbers are harder than others. Numerous other factors affect the mechanical performance of timber flooring, for example thickness, moisture content, inherent defects, biological deterioration, specific gravity, etc. It should be noted that the value is not appropriate for evaluating the hardness of engineered flooring products which compose of different types of materials. The value relates to the specific gravity of the timber, though special processes such as high temperature drying and chemical impregnation may increase the hardness of a timber material. Regardless of any hardness value a timber is rated, it will dent under certain degree of force or impact.

Although higher Janka value shows the harder the timber, it does not mean that it is the best preference. Beside timber hardness, there are other qualities to consider when choosing a timber for flooring material. Consumers' choice is normally based on the mechanical properties, aesthetic value as well as timber price. Timber with a suitable colour and grain texture will suit with the style, furniture, space and surrounding. The price of the timber flooring products is not necessarily based on Janka hardness or any other mechanical properties. Cost consideration should also be given to very hard timbers since they are more difficult to saw, drill, and nail, thus requiring more time and labour works to install. Principally, Janka hardness is used as part of the decision aspects, but not the only factor.

Test method

The method of testing for the Janka hardness value of Malaysian timbers was based on ASTM D 143 (2009). The test is similar to BS 373 (1957) for 2 in. specimens. The Janka hardness test was made on 50 by 50 by 150 mm specimen. Load was applied at a constant rate of 6 mm min^{-1} using a universal testing machine equipped with a semi-circular-end steel bar of 11.28 mm in diameter. The load corresponding to the penetration depth of 5.64 mm was recorded as the Janka hardness value. The results are presented in newtons (N) or kilonewtons (kN). Sometimes, the measurement unit is in pounds-force (lbf). Higher value rated a timber as a harder timber. To obtain a fair average result of a test piece, indentations were made on both tangential and radial surfaces. Points of indentations were far from the edges to prevent splitting and chipping. Figure 1 show the schematic diagram of Janka hardness test arrangement. Test configuration for the determination of Janka hardness and a tested specimen are illustrated in Figures 2 and 3 respectively. The records of Janka hardness of Malaysian timbers are mostly compiled in Timber Trade Leaflet No. 34 (Lee et al. 1993). Some data are reported in various journals, test reports and other publications. This bulletin provides a ready and easy reference, in a form of a chart, for Janka hardness of some popular Malaysian timbers.

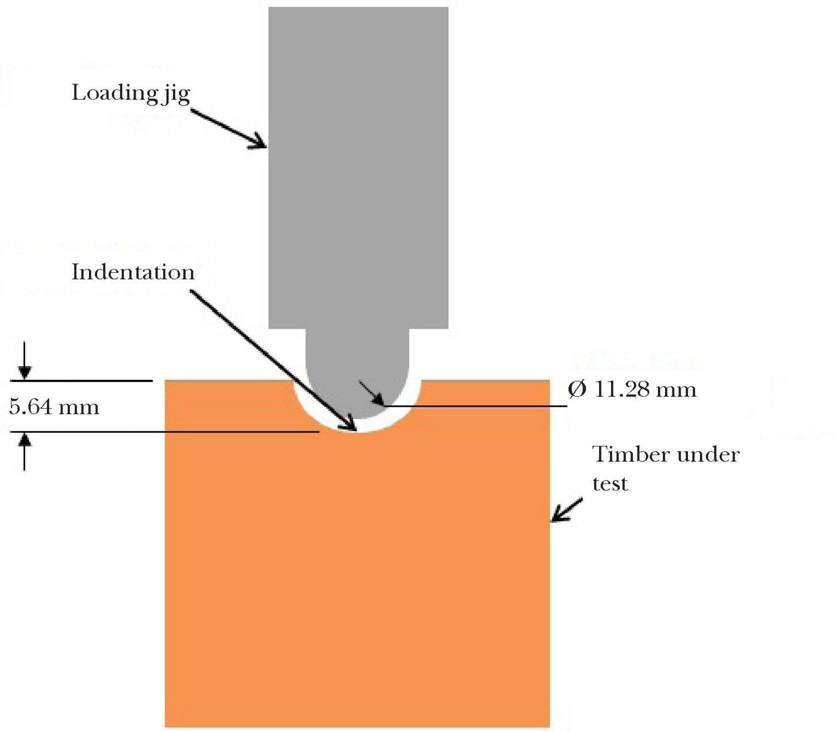


Figure 1 Schematic diagram of Janka hardness test arrangement

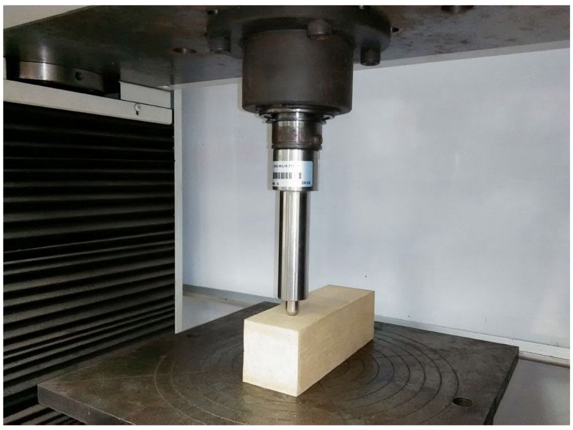


Figure 2 Janka hardness test

Figure 3 A Janka hardness tested specimen

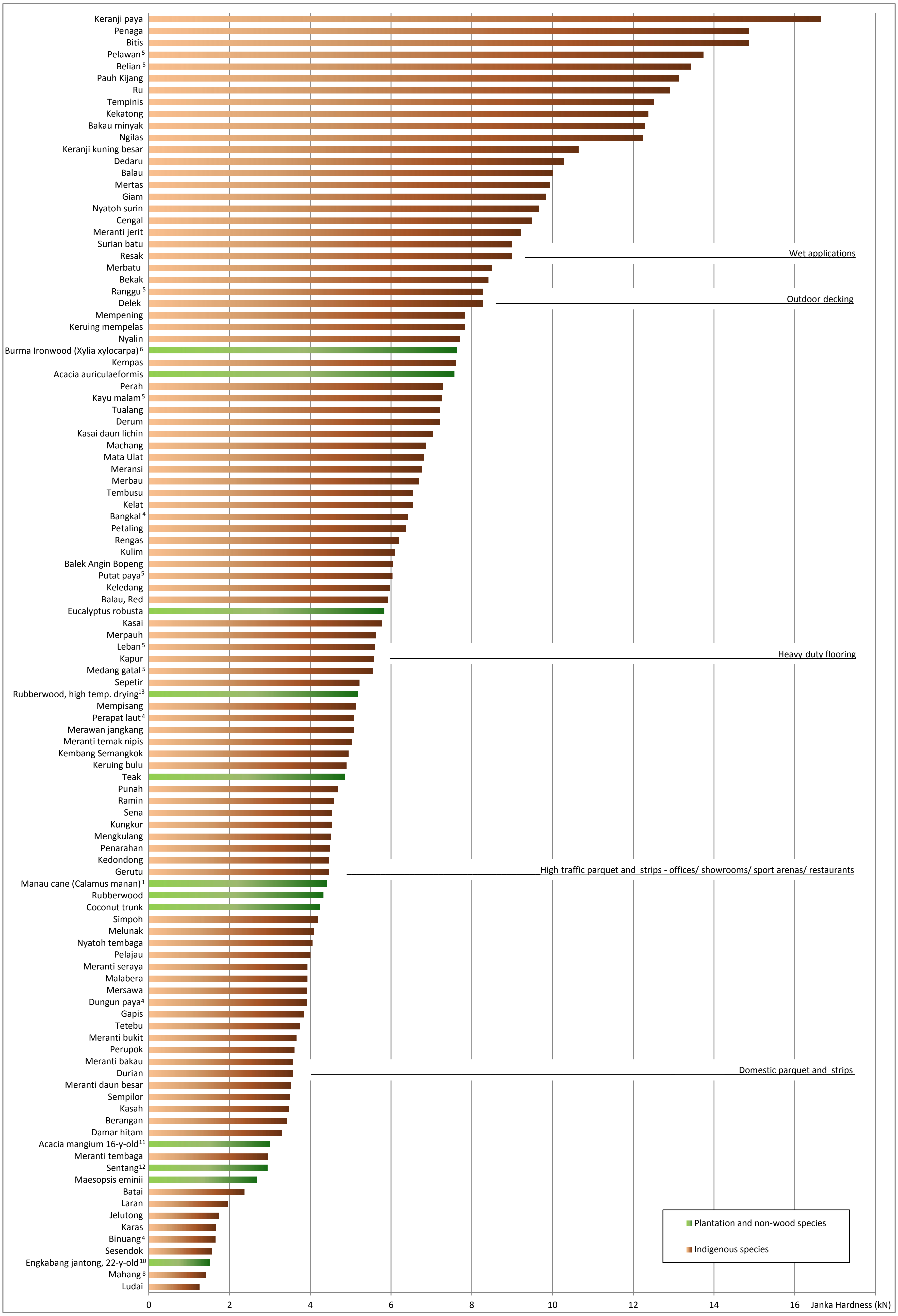
Summary of the Janka hardness chart

The average values of Janka hardness of Malaysian timbers are presented in a form of rating, sorted from highest to lowest value in newtons. Most timbers are listed based on trade names. For some timbers which require specific indication due to variation of test results within the same timber group, the vernacular name is regarded as the reference name. The chart is a simple and practical guide to gauge the hardness of timber for flooring applications. Janka hardness values of some plantation and non wood species are also presented.

The 'uses' quoted in the chart refer to the existing and potential utilisation of the timbers, meant only as general guides and are not limitations (Wong 2002). Wet application timbers are commonly used in marine environment such as for boat decking, wharves and piers. The usage requires a hygroscopically stable and very durable material. Outdoor decking timbers are known to have a moderate degree of resistance to biological deterioration. Timbers for heavy duty flooring have reputable performance such that they are suitable for applications with heavy loads and prolonged loading. This is approximately the Janka rating of northern red oak timber, recorded at 5.7 kN. Red oak is a benchmark in comparing Janka hardness, as red oak is a popular and widely selected timber for flooring application. High foot-traffic parquet and strips are suitable for flooring in offices, showrooms, indoor sport arenas, restaurant, etc. Having a lower Janka hardness value and presumably lower in density, domestic flooring timbers are fit for residential uses. Some examples of dented floor board are shown in Figure 4.

Figure 4 Some examples of dented floor board (a) impact force has damaged the grooved profile; (b) dimple marks were caused by pointed loads; (c) a trench-like indentation was caused by drop of a sharp object; (d) scratch marks were caused by office chair

Janka hardness values of some Malaysian species



Janka indentation load (kN)@5.64 mm depth

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