



Kebony in recent and future applications

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ABSTRACT

The Kebony technology has been developed in Norway and in the first years of production the main concentration had been the home market with our process concentrating on locally sourced Scandinavian Scots Pine in the applications of decking and cladding. The Kebony technology and products have been embraced by architects who see the benefits of durability and life cycle cost saving in governmental, commercial and private projects including schools, hotels, offices and the high-end residential segment. As this market expanded the products have become widely accepted in the private sector with consumer demand leading to major DIY chains stocking Kebony products. During this period of market acceptance we have furthered our technology into other products including Southern Yellow Pine, Radiata Pine and European Maple. These products were introduced into the market as eco-friendly alternatives to tropical hardwoods, with the durability and aesthetics to match. Four years ago we launched Kebony internationally through the promotion of products to architects, and then working with local distributors who are able to service the market. Kebony has been widely accepted as an eco alternative to tropical hardwood with projects throughout Europe, Asia and the US. Kebony ambassadors include some of the World's largest architectural practices and developers with prestigious project installations in New York, Milan, London, Paris, Seoul and Hong Kong. The Kebony technology has now become widely accepted internationally as an eco-alternative to traditional impregnation technologies and to tropical hardwoods, with applications ranging from decking, cladding and marine applications to kitchen ware.

INTRODUCTION

Chemical modification of wood is driven by the demand for more sustainable use of renewable resources and the demand for higher quality wood. The use of furfuryl alcohol as a wood modifying agent is one possible method for changing and enhancing wood properties. Kebony AS is commercialising this principle, and this paper will show the status of that development.

Kebony AS started commercial production of furfurylated wood in 2003. The technology is based on inventions by Professor M. Schneider and Dr. Mats Westin, who introduced the term "furfurylation" about this wood treatment. Several wood species have been evaluated for different applications over the last fifteen years. Today Kebony focus on four wood species: Scots pine, Radiata Pine, Southern Yellow Pine (SYP) and European Maple.

The use of furfuryl alcohol (FA) as a wood modification agent has been known for decades. (Goldstein 1955). In the 1990s, Schneider and Westin (Schneider 1995, Westin 1996) simultaneously developed new catalytic systems for furfurylation of wood. These

new systems resulted in cost effective manufacturing processes for furfurylated wood with superior product properties.

The demand for Kebony overtook the production capacity of the first semi-industrial production plant in 2007, and a new plant was financed with external investors, and constructed during 2008. This plant has been operated since early 2009. The current plant has an annual capacity of 20 000 cubic metres, and again the capacity limit is approached.

The key product properties that are enhanced by the furfurylation process are durability, hardness, equilibrium moisture content - which is considerably lower than for the parent un-treated wood - and dimensional stability. More details on the properties of furfurylated wood can be found elsewhere (Lande 2008, Kebony 2014). The effect of each of the enhanced properties depends on the treatment level - most often expressed as the Weight Percent Gain of the wood.

Kebony's commercial priorities are based on both market factors and production related factors. The production is dependent on lumber raw materials – their availability and cost in different qualities and dimensions. Kebony is offering two main categories of products; products that are partly treated, analogous to the traditional preservative treatment of pine, and products that are fully homogeneously treated, where only sapwood raw materials are used, in order to achieve a full penetration of the wood.

The first product line is produced from Scots pine, *pinus sylvestris*, in qualities specially produced for Kebony.

The second product category is Kebony's high-end product line; where residential decking, boardwalk and cladding are the main products. This product offering can be accommodated by commercially available dimensions of clear sapwood, either from Southern Yellow Pine from the US, or Radiata pine, mainly from New Zealand. Since pure sapwood is required, there are natural constraints in dimensions. However, the dimensions required for cladding and decking products are commercially well available, giving a good fit between raw material availability and Kebony's main product offerings.

Research and technology development is a critical part of the process leading to commercial success. The serious dedication to product testing and documentation, along with constant attention to improvements in the production process, has given the tangible product platform that forms the basis of Kebony's commercial activities. However, in addition to the tangible product properties, the documentation surrounding the products is crucial. Thus emphasis is put on obtaining technical approvals; environmental declarations and eco-labels in markets and segments of priority.

In marketing textbook literature (McCarthy 1960) a common approach to the marketing mix is the "four P"s; Product, Promotion, Price and Placement, which again must be aligned to the fifth P – the value Proposition – the promise given to the customer. Thus Kebony strive to inform accurately about product benefits and product properties, in the philosophy of promising only what we can fulfil, and doing what we can to fulfil our promises.

However, there is no use in having premium products if the potential customer is unaware of their existence and their benefits. So in addition to technology, production and distribution, Kebony has put more emphasis on promotion and building its brand than what normally is seen in the building materials industry. A critical task in promotion is to install the right impression of Kebony in the mind of the potential customer. This is the essence of branding, - and Promotion (communication) is the tool. One promotion strategy has been direct communication with architects and builders about the factual properties of Kebony, i.e. working with the specifying party in

building projects. Traditional product documentation, Kebony's web pages and the promotion of reference projects have been crucial elements in this. A second important strategy has been the communication of Kebony as an environmentally friendly and novel wood technology in news media and business associations. This systematic work has led to a long chain of awards, recognitions and articles in the press, which again give high exposure of Kebony at a reasonable cost. Finally Kebony is also investing in traditional advertising, both directed towards the end user and towards professionals.

RESULTS AND DISCUSSION

The Kebony cladding and decking products are increasingly embraced by architects who see the benefits of durability and life cycle cost saving in governmental, commercial and private projects. Such projects include schools, hotels, offices and high-end residential buildings. As the project market expanded the products have become widely accepted and more easily available in the private sector, with end-user demand serviced by important Scandinavian Do-It-Yourself chains stocking several Kebony products in our home market.



Figure 1: Home market; Kebony decking and cladding, mainly with Kebony scots pine. a) Onda restaurant in Oslo, b) Elementary school, c) Private home, d) Coast cottage

Four years ago Kebony was launched in international markets through the promotion of products to architects. From then dedicated distributors, who are able to service their national markets, have been selected. The result of this development is that Kebony has been accepted as an environmentally responsible alternative to tropical hardwood, with rapid increase in sales in Europe, Asia and the US. Kebony "ambassadors" include

some of the world's largest architectural practices and developers with prestigious project installations in New York, Milan, London, Paris, Seoul and Hong Kong.

The Home Market – Scandinavia

In Scandinavia the main selling points have been durability and freedom from maintenance in combination with the rustic look of Kebony based on Scots pine. Also here the most important segments are cladding and decking. In Norway the building industry's expansion halted a couple of years ago, but Kebony has still been growing. Typical uses range from public schools and kindergartens to private mountain and coast cottages and private homes.

International markets – Europe

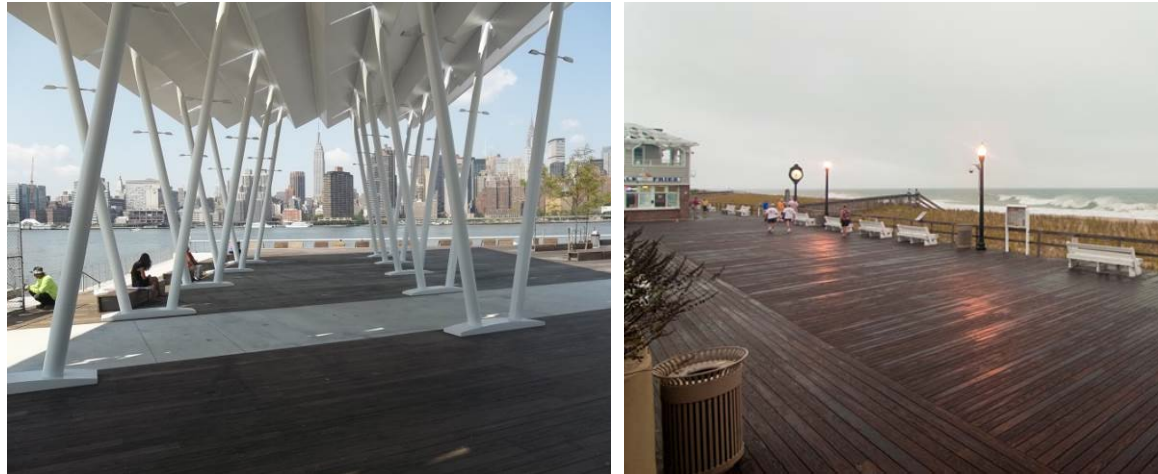
The main products for Kebony in Europe have been the high-end decking products, with many prestigious projects, and a few contractor customers who are using Kebony decking in their main offering to end users. Our single largest customer in this market is Architecture de Bois in France, who are using Kebony in their terrace systems. This year they alone will be using almost 1000 m³ of Kebony decking. Similarly we see many other customers changing from WPC products to Kebony, and customers changing from exotic lumber like ipe to Kebony. These factors are important drivers in the rapid growth in international sales of Kebony.



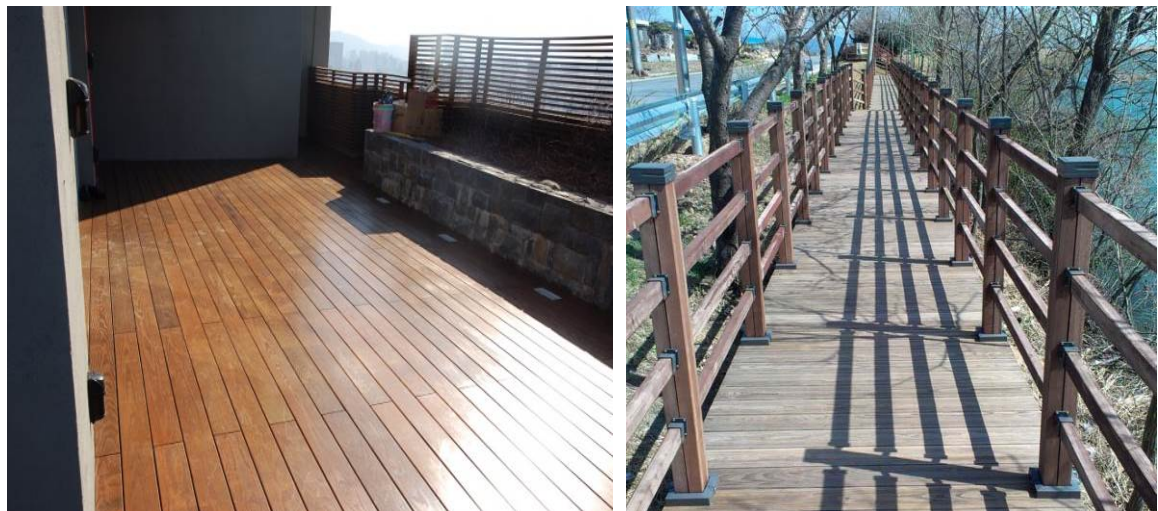
Figure 2: European market; a) Private home, London, UK, b) Residential deck in France, c) Decking in Spain, d) Creod pavilion in London

International markets – North America

Kebony's history in the US has been the familiar history of promoting Kebony to specifiers in the projects markets. Only last year did Kebony sign up with a large distributor, the Pine River Group belonging to the Biewer Lumber Company. PRG will promote Kebony in both private residential segments and the very attractive public sector boardwalk segment. Last year Kebony was installed in the prestigious Hunters Point South Park in New York City, which is a large riverside rejuvenation project in Queens. The main selling point for Kebony internationally is that Kebony provides an eco-friendly alternative to tropical hardwoods, in terms of cost, durability and aesthetics.



a) ***b)***
Figure 3: North-American market; a) Hunter's Point South Park, New York City, US b) Bethany Beach, Delaware, US



a) ***b)***
Figure 4: Other international markets; a) High-end residential decking in Seoul. b) Public walkway S. Korea

Other international markets

Perhaps the most exotic and in the outset most un-expected large customer for Kebony has been the Eagon group in Korea, who have been looking for alternatives to wood plastic composite products, especially for public sector landscaping applications like

walkways, pedestrian bridges and decks. With very little support this customer has up to now sold roughly one thousand cubic meters of Kebony decking products, with a steadily increasing off-take.

Future developments

Complying with various product approval and certification schemes is a costly - but very necessary – exercise for a small company. Kebony is working hard to mount these barriers in a structured, yet carefully selective, manner. Currently the main priorities are working with ICCES in the US, and VFF in Germany. The latter is almost complete, and will give Kebony a good set of credentials for the window industry. By expanding into industrial segments Kebony in various qualities can be utilised, which mean improved product raw material utilisation for Kebony, and cost effective product offerings to industrial customers. Kebony has already been used in a number of large window projects, and we expect this segment to grow rapidly in the near future. ICCES approval in the US is expected to hugely accelerate North American demand for Kebony, with very exciting prospects for the future.

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