The modern alchemist

Alchemy sought ways to change lead or iron into gold or silver and to find the mysterious elixir of life conferring longevity. Murdoch MacTaggart learns from a modern-day Paracelsus how Accsys works its alchemical miracles on wood.

Hardwoods have been used for thousands of years as building and cladding materials. Earlier generations worked their way through ancient oak forests or stands of chestnut, beech or elm and slipped across the world vast quantities of exotic woods like teak or mahogany, valuing them for their beauty and their durability. Some of these sources have now vanished completely while others have become unsustainable at previous use levels.

Hardwoods are expensive and increasingly scarce. Time to maturity is generally much longer than that of softwoods. Hardwoods are typically denser and heavier and so more costly to transport to and from machine. For these reasons hardwood use has declined greatly.

Softwoods have few of these disadvantages. They’re fast growing and can be managed easily like any other crop. Softwood is generally easy to work and relatively cheap. Their major disadvantage, however, is being susceptible to decay. Softwoods used in construction invariably need to be protected in some manner, usually with a coating such as paint or varnish to protect them or through some toxic treatment which makes the wood unsuitable as a food source for micro-organisms.

The chemically functional group acetyl occurs naturally in many plant substances and the essence of the Accsys process is to increase greatly the acetyl content of the wood used.

“Perhaps you left corks in a glass of vinegar overnight to harden them.” says Paterson-Brown. “That’s a simple form of acetylation. Our innovation is the development of a complex technology that improves the performance of wood.”

Wood cellulose has a large number of hydroxyl groups which can release water according to climatic conditions and are thought to be the sources of decay initiated through enzyme action. In the Accsys process the wood is brought into contact with pressurised and heated acetic anhydride, the condensation product of two molecules of acetic acid. The acetyl group bonds with the problematic free hydroxyl groups and increases significantly the acetyl content of the wood. For instance in pine an acetyl content of 2% and oak 4% whereas the percentage for acetylated wood is higher, sufficient to give it the best durability rating – Class 1.

Changing the wood species

“Fundamentally you change the core molecular structure of the wood during the process.” explains Paterson-Brown. “You’ve effectively created a new wood species which we’ve named Accoya™. You take a piece of pine, for example, and modify it to a point where it will perform at least as well as the best tropical hardwoods. It has greater stability, durability, UV resistance and swelling and shrinkage are reduced by 75% or more so you get better coatings adhesion.”

Accoya replaces steel

Although Accoya isn’t available at your local DIY store the UK’s largest sawmilling company, BSW Timber, has taken it on and sells it through a number of specialist joineries and timber merchants. One of the first direct public uses of it has been as cladding for an architect-designed house in Fife but a more spectacular proposed application is in constructing two bridges at Sneek, in the Netherlands. The idea of building heavy traffic road bridges mainly out of wood seems extraordinary and it’s an indication of confidence in the strength, stability and low maintenance requirements of Accoya that it was chosen. Despite being produced from relatively inexpensive wood Accoya isn’t cheap although Paterson-Brown points out, reasonably enough, that if you take into account the very low wastage that occurs with Accoya and allow for the durability and very low maintenance, Accoya’s costs are actually among the lowest over the life of a project.

Thermoplastics, and in particular uPVC, have become ubiquitous in the construction industry and have severely damaged the traditional wooden window, door and cladding markets largely because of easy mechanical construction and low maintenance needs. However, quite apart from the dreary appearance they present there are wide concerns around environ-

mental issues both as regards production and disposal with particularly strong local government opposition in the likes of the Netherlands, Germany and some Scandinavian countries.

Accoya is, of course, simply wood and has far greater thermal neutrality than does PVC meaning that its use helps to keep buildings warmer in winter and cooler in summer. Further, although the acetylation process gives Accoya far more durability than ordinary softwood it remains inflammable and non-toxic and so can be burnt at the end of its life or recycled.

Worldwide market

“We’ve concentrated on pointing out the quality of the product: that Accoya is the best wood you can buy for exterior applications, that it performs better than anything Class 1 in the wood industry” says Paterson-Brown “but we haven’t emphasised the environmental benefits. Sustainability is certainly increasingly important and our focus is very much on sustainable forestry, and certifications such as Forest Stewardship Council.”

Considering merely the most appropriate uses for Accoya and taking a conservative view. The wood is that Accoya is competing in a market worth some €100m although the complete wood industry is worth considerably more. Add in markets such as thermoplastics or metals where Accoya could become a replacement material and a serious rival to steel, and the potential market is huge. Accsys’ market cap has grown from an initial €50m three years ago to some €50m today and is likely to continue increasing given the significant global interest in licensing the technology. Paracelsus probably wouldn’t care much about the economics but, given his important place in the history of science and his interest in alchemy, would undoubtedly be hugely impressed at this modern transmutation of inexpensive and degradable softwoods into a material suitable for use in complex civil engineering projects and a serious rival to steel.

“It may be an old process but our approach is a cutting-edge step change, really modern transmutation” says Paterson-Brown. “It’s a first class product, environmentally friendly and there’s demand all over the world. All these things that they were talking about to develop. We’re having fun with it!”

"Today you have a very limited capability of using hardwoods for external commodity-based applications, such as windows, doors and cladding,” explains Willy Paterson-Brown, Executive Chairman of Accsys Technologies. "It's expensive, supplies and quality are unreliable. There are issues around sustainability and environmental legislation. Softwoods used outdoors are prone to decay and have a limited life span. There is strong demand for a reliable alternative."