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Innovation: *How to* Spin Straw *into* Gold

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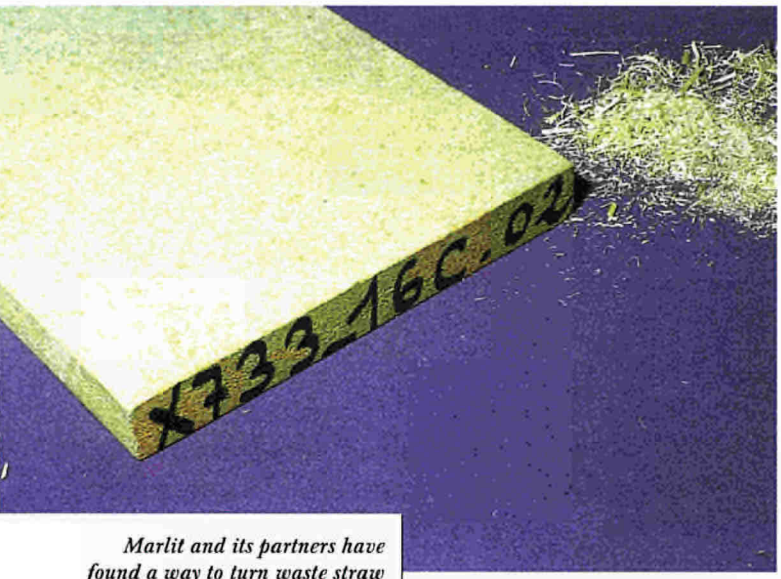
How to Spin Straw into Gold

An innovative technology which allows a valuable building material to be produced from agricultural waste promises to solve two serious environmental problems – and has massive economic potential both in southern Europe and in the developing world.

Since the 1980s, depletion of the world's forests has steadily forced up the price of wood and wood-based materials such as medium-density fibreboard (MDF), now widely used in the construction and furniture-making industries. Today, legislation designed to mitigate the ecological consequences of deforestation is being introduced in many countries. When this starts to bite, the price of wood will skyrocket.



Marlit and its partners have found a way to turn waste straw into competitively priced, high-quality board.

At the same time, the burning of straw and other agricultural by-products is also a serious environmental hazard. In some countries, straw-burning has already been banned.

Completed at the end of 1996, a CRAFT co-operative research project[1], led by the small Greek company Marlit, successfully developed a laboratory prototype of a new production technology which enables board to be made entirely from straw. Marlit is now engaged in a follow-up Innovation project[2], in which the new process will be scaled up for industrial production.

With the price of strawboard likely to be 20% lower than that of conventional MDF, and world-wide sales of chipboard and fibreboard worth over €7 billion each year, the potential of the technology is huge.

Patented process

"In straw, the fibrous cells are surrounded by a waxy layer," explains Marlit's Panagiotis Nakos. "Until now, this has prevented the cheap, water-based urea formaldehyde (UF) resins used to make normal fibreboards from forming a sufficiently strong bond between the fibres."

But with the help of university research teams in France, Germany and the United Kingdom, Marlit and six other small and medium-sized enterprises found a way of removing this wax layer. The technology, now patented in 40 countries, employs mechanical shear forces, boiling water and chemical treatment to break open the straw, allowing ordinary UF resin to penetrate and bind to individual fibres.

Strawboards which match conventional MDF in appearance, surface smoothness and strength are not only cheaper to produce, but also emit much less formaldehyde – well within the limits imposed by European Union regulations.

Rice straw

The transition to the current Innovation project was smooth, thanks to an extended implementation phase, Nakos says. "It took us some time to find the new partners we wanted," he recalls. "A couple simply did not believe that we could make strawboard with UF resin, and only agreed to take part after they had seen the process for themselves."

The project involves process plant and chemicals suppliers, the Greek board manufacturer Acretas and one of its largest customers, and the Agro-Industrial laboratory at the Ecole Nationale Supérieure de Chimie de Toulouse (ENSCT), one of the research performers in the earlier project.

By mid-2001, the partners will install and commission the first full-scale production line at the Acretas factory, demonstrating both the technical and the commercial performance of the technology. "We expect to show that a board manufacturer can recover its investment in a modified production facility in under three years, thanks to strawboard's improved cost-quality profile," says Nakos.

The technology will be licensed world-wide, and the partners anticipate interest from southern Europe and north Africa, as well

as China and India – where there are large populations and very little wood, but straw is plentiful.

Additive-free

The tight focus maintained by Marlit and its partners on the practical obstacles to industrial scale-up will not prevent them from continuing to develop the underlying technology. "The chemicals and the treatment process have been progressively refined," Nakos confirms. "Now we want to replace UF with a resin binder made from straw itself. That would make the process completely self-contained – from straw to fibreboard with no other ingredients." ●

(1) CR-1638-91 – Advanced environmentally friendly composite materials for the furniture and construction industries.

(2) IN20551D – Innovative technology for panel manufacture from fiberised agriwaste.

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CERAMIC GLAZES

A Polished Performance

The only factor holding back growth in the popularity of glossy, white ceramic floor tiles is their limited durability. Now, a consortium of tile and glaze manufacturers and merchants has employed advanced research facilities to perfect a new glaze which meets the requirements of the market in full.

Attractive and easy to keep clean, tiles provide an ideal floor surface for a wide range of commercial and domestic applications. The variety of colours and designs available, as well as their strength and resistance to staining, have made them increasingly popular as a cost-effective flooring material, especially in shops and restaurants.

Demand for glossy white tiles has grown particularly fast in recent years, and this type now constitutes around 10% of the total market. But to date, customers have too often been disappointed by their long-term performance. "Light-coloured, high-gloss glazes have a comparatively low resistance to abrasion," explains Dr Agustin Escardino Benlloch of Spain's Instituto de Tecnología Cerámica (ITC). "In heavily trafficked areas, the surface gets scratched and quickly picks up dirt, impairing its appearance."

Manufacturability

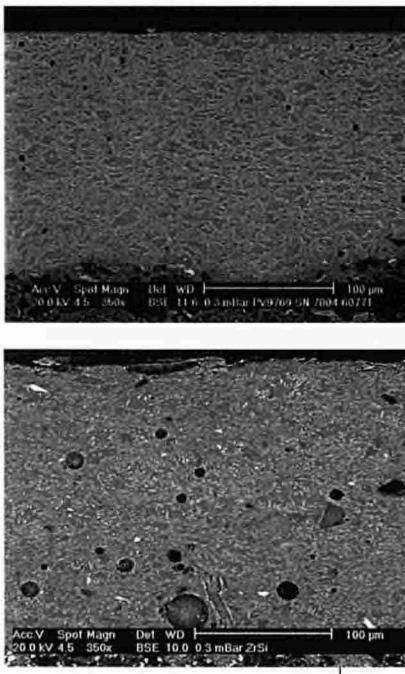
In 1993, two Spanish tile-makers, Keraben and Gres de Nules, together with Italian glaze manufacturer Esmalglass, approached ITC with a request for help in the development of a new glaze that would overcome this problem.

Eventually, the three companies formed a consortium with tile merchants in Ireland, Germany and the United Kingdom to undertake a CRAFT co-operative research project(1), in which the laboratories of ITC and the Centre Recherche de l'Industrie Belge de Ceramique (CRIBC) acted as specialist research performers.

"The involvement of the tile merchants provided market intelligence of the most direct kind," Escardino recalls. "The brief the partners gave us was to develop a glaze with improved hardness and abrasion resistance, which could nevertheless be applied to existing tile bodies using traditional manufacturing processes." ●

Tile glazes are aqueous suspensions of glass particles – known as 'frit' – and crystalline materials. After a layer of glaze has been applied, the clay is sintered in successive firings at temperatures of up to 1,160°C, to achieve the desired mechanical strength and hardness. Firing bonds the glaze to the tile body, producing both internal crystalline phases and a smooth, glassy surface. ●●●

(1) CR-1001 – Obtaining smooth ceramic glazes with improved wear resistance and hardness.



Cross-sections of (top) a gahnite glaze developed in the CRAFT project, and a conventional white zirconium glaze. The low porosity (darker regions) of the new glaze greatly reduces dirt retention.