Fact Sheet: Recycling of Medium Density FibreBoard

February 2006

What is MDF?

MDF stands for "medium density fiberboard." MDF is an engineered wood made from compressed and bonded wood fibers. MDF is very dense and stable, allowing for very fine tolerances when machined, and is used as a substrate for some sheet goods and doors.

Composition

A scientifically-devised board MDF is typically composed of 82 per cent wood fibre (predominantly softwood), 10 per cent synthetic resin binder, 7 per cent water, less than 1 per cent paraffin wax solids, less than 0.05 per cent total extractable formaldehyde, and less than 0.05 per cent silica.

UK MDF Statistics 2004

- In 2004 MDF sales accounted for around 8.9% of all timber product sales in the UK. This is equivalent to £227 million of sales of MDF.
- In 2004 MDF accounted for just lower than 7% of the total traded volume of timber products. This means there was around 1.19 million square metres of MDF traded in 2004.
- MDF consumption by industry is also on the increase. From 2003 to 2004 MDF consumption has increased by around 8.5%.

Recycling Options Assessment

At present there are only four main options for the recovery of material and value from medium density fibreboard:

- FibreSolve
- Micro Release
- Thermohydrolic Processes
- Composting

Whilst these options are being investigated, there are no established technologies in use for recovery of fibre or value from MDF. At present it appears that the most effective method of managing the impacts of MDF may be at the manufacturing end of the supply chain.

Autoclaving and the FibreSolve Process

The FibreSolve process involves subjecting wood fibres to a combination of vacuum and pressurised steam with mechanical agitation at temperatures of over 100° C. Pressures in the process are relatively low at 1 or 2 bar so as not to damage the fibres. Also there are little or no additional chemicals involved.

At present the technology is only at pilot plant scale, and with a throughput of roughly 1 tonne per hour this process could only competently handle 4000 – 5000 tonnes of MDF waste per annum. Concerns have also been raised over the process costs of FibreSolve when placed in context of its end value. However, there are possibilities for this technology to prove itself on a more industrial scale should it secure further financial backing. The process outputs are of a fibre nature remaining that can be reused in MDF manufacture. Recent work undertaken by Excelar and ICL has also shown that it is possible to use the fibres in paper and cardboard manufacture.

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• Can produce a good quality fibre for use in MDF manufacture • Very little effluent produced • Significant adhesive left on fibres for reuse in MDF manufacture • Coatings such as melamine can be removed with the process	• Process is untested on an industrial scale • Limited end uses for fibre • Process' emissions have not yet been monitored • Process and operating costs are unknown • Seen predominantly as pre processing option

Micro Release and Microwave Technology

High power RF (radio frequency) and microwave systems are a mature, environmentally sound technology with significant potential in many market sectors.

The High Power RF Faraday Partnership is a DTI initiative to stimulate innovation in UK industry to give UK companies a competitive edge by improving product quality and reducing costs.

Laboratory scale tests have demonstrated that microwaves can be used to recycle waste MDF by reclaiming the wood fibres from the resin. Laminated as well non-laminated samples of MDF waste board are cut into sections, immersed in water contained in a non-metallic container and then exposed to microwave radiation, which causes the panels to swell greatly in thickness. The wood fibres are then recovered. The appearance of the recovered fibres is very similar to those from the FibreSolve process, but is thought to have higher moisture content as the final process is agitation in water.

+ve	-ve
• No adverse effect on the physical or mechanical characteristic of the fibres • Potential for a wide range of end uses • Potential for a scalable continuous process	• Operating costs are unknown • Unavailable at present on an industrial scale • Unfocussed process for fibre end use • Seen predominantly as pre processing option

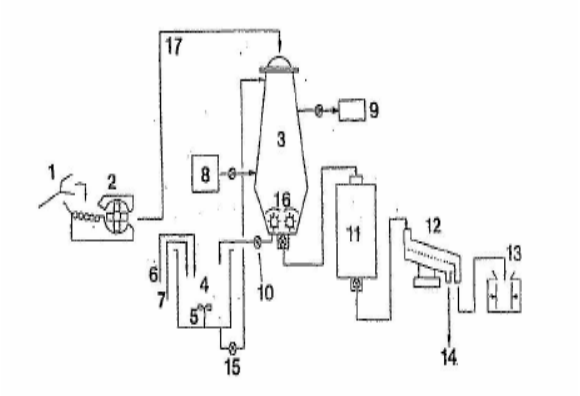
Thermohydrolic Processes

There are a range of Thermohydrolic processes dating back to 1965, operating with a range of characteristics but with a common central process. Thermohydrolic processes are essentially used to separate the glue from the wood fibres in MDF (bonded with urea formaldehyde) by hydrolysis in a pressurised saturated steam environment.

Thermohydrolic processes are integrally capital and energy intensive processes, predominantly due to the use of steam, pressures of up to 5 bar and temperatures of up to 120 degrees Celsius.

All Thermohydrolic processes share the same basic set up that includes:

- A macerator to chip the material
- An impregnation solution of urea and water to assist in the break up of material
- An autoclave that uses steam and high pressure
- A dryer for the processes material
- A drum screen for screening the final product



+ve	-ve
• Can operate with large scale capacities • Wood chips display less formaldehyde content in comparison with other processes	• Requires changes to MDF re-production processes • Process is capital and energy intensive • Operate predominantly on UF bonded MDF • Only the WKI process from Germany is commercially available

Composting MDF

There have been a number of well researched projects into the utilisation of MDF as a carbon feedstock within the composting process. Although the majority of this research has been in the United States, Canada, New Zealand and Australia, there has been recent work in the UK undertaken by WRAP and TRADA on the use of MDF as a composting feedstock.

The results of the research thus far have been relevantly consistent, in so much as that:

- MDF can be used as a source of carbon
- The urea formaldehyde component has a nitrogen value that can speed up the composting process
- The formaldehyde and glue substrates were not found to be influential in the final product
- Where older wood composites were used, there was a presence of organochlorines, a persistent organic pollutant

Whilst the evidence to date suggests that there would not be an issue with using MDF as a source for carbon and nitrogen in the composting process there are still no composters using this as a feedstock. Predominantly this is because:

- The mix / blend of MDF to organics can have a large effect on end C:N ratios
- Composters are unsure of end quality and are unwilling to invest in a low grade product
- PAS 100 composters have invested in a process that does not include MDF as feedstock
- There is not presently a need for MDF to be utilised in the process as a source of carbon as safer alternatives (such as sawdust, used bedding, vegetable food waste etc) are present or planned

To this end, the composting of MDF has reached somewhat of an impasse, although further research may be required to ascertain the potential in the Scottish market.

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• Well documented existing theoretical research • Low tech process with comparatively low costs • MDF can, theoretically, assist the organic composting process	• Unknown quantity in operational terms • Risk of processed organic material not meeting PAS 100 requirements • Risk of composted material not finding final markets as a low grade product is produced • Risk of contaminated end product

Further Reading

Mantanis, G. (2000) Novel Closed-Loop Technology for Panel Recycling. EC-supported research Project (contract no FAIR-CT96-1486) that ended 01.01.2000

WRAP (2004) Evaluation of the Market Development Potential of the Waste Wood and Wood Products Reclamation and Reuse Sector. The Waste and Resources Action Programme (WRAP), Banbury

WRAP (2004) Treated Wood Waste: Assessment of the Waste Management Challenge. The Waste and Resources Action Programme (WRAP), Banbury

WRAP (2004e) Compositional Assessment of Treated Wood Waste. The Waste and Resources Action Programme (WRAP), Banbury

TRADA Technology (Feb 2005) TRADA Technology Presentation on FibreSolve Technology, Antibes

FIRA (2003) Composting of Wood Waste from the Furniture Industry