Ten years after its invention, Torbed technology is moving into mainstream processing. Chris Dodson reports

Torbed or not Torbed?

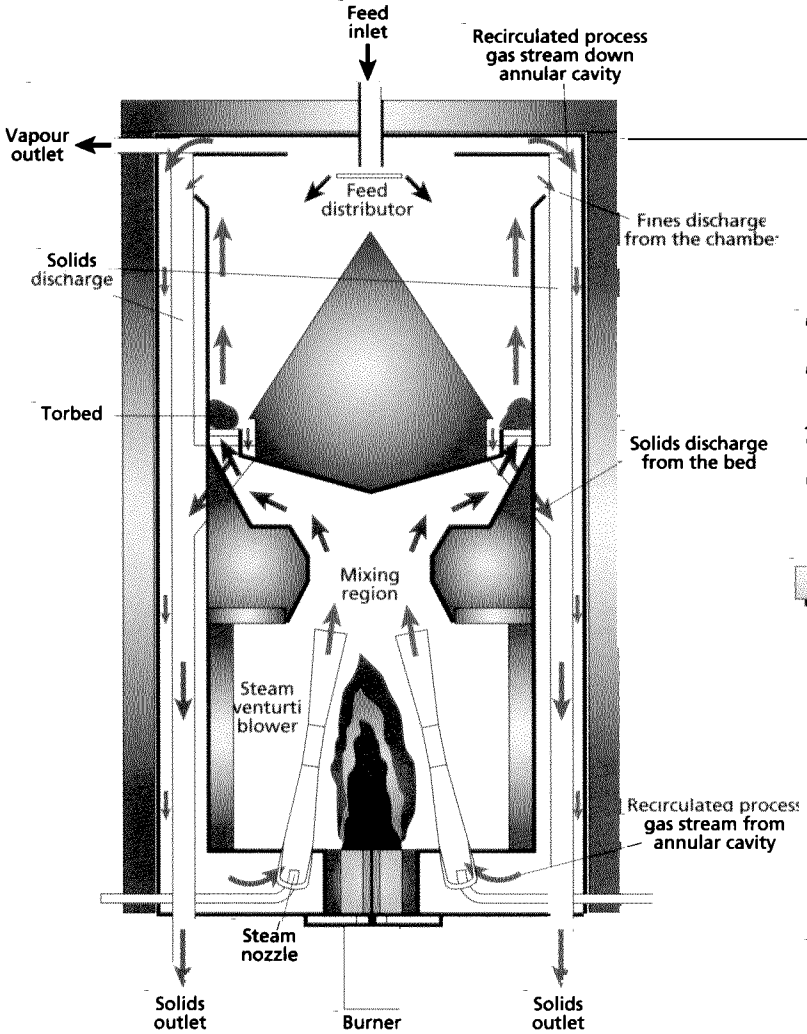


Figure 1: The Torbed volatilisation reactor

For years environmentalists have been pressing industry to reduce pollution, save energy and recycle precious resources wherever possible.

Torbed technology invented by Torftech of Berkshire in the UK is enabling organisations as oil and gas companies, metal refineries, forestry companies and hospitals to meet these demands far more effectively than ever before.

The Torbed was originally conceived as a highly efficient means of processing minerals, foodstuffs, chemicals and wastes. In essence, it is a toroidal compact bed which can process fine powders, granules, plates, rods, rings and virtually any other shape or particle or mixture of substances.

The material is fed into the ring-shaped Torbed chamber which has a fixed ring of angled blades near its base. An appropriate gas or vapour at a suitable temperature is then passed through the blades at high velocity to force the particles into a swirling or toroidal motion (see Figure 1). The whole process is controlled by microprocessors, with retention times ranging from less than a second to a few minutes (see Figure 2).

The result is a much faster, more controllable transfer of heat than in any comparable technology, such as fluidised beds. The design of the Torbed lends itself to recirculation of process gases, or in some processes, autothermal operation.

The Torbed therefore saves considerable energy. But in environmental terms, it has many other advantages, as numerous installations and pilot studies all over the world have proved.

Successful with swarf

The Torbed has proved immensely successful in the recycling of metal swarf, especially brass. Before brass swarf can be re-melted the contaminant cutting oils and coolant have to be removed from the feed to minimise the risk of explosion. This can be achieved by drying the material in rotary kilns, but strict control is crucial. If the swarf is subjected to too high a temperature, the oil can catch fire. Much of the constituent zinc also becomes oxidised and is lost as smoke, thereby contravening the directives from most environmental protection agencies. Oxidisation also contaminates the brass particles leading the higher melt losses, and means that more pure zinc has to be added to the re-melting process.

The Torbed's microprocessors enable the metal to be dried efficiently under the most stringently controlled conditions. Zinc oxidation is eliminated and the quality of the brass is consistently higher than that produced in rotary kilns. These findings all promote recycling of swarf and energy conservation.

The Torbed installed in Extruded Metals in Melbourne, Australia, processes up to 2 t/h of brass swarf containing up to 10% by weight of cutting oil and other contaminants. The system handles up to six times more throughput of clean dry metal per unit of energy input than the rotary kilns, producing almost 100% meltable brass compared with 80–90% in the older process.

The aluminium smelting industry is also looking towards Torbed technology for environmental reasons and already two main

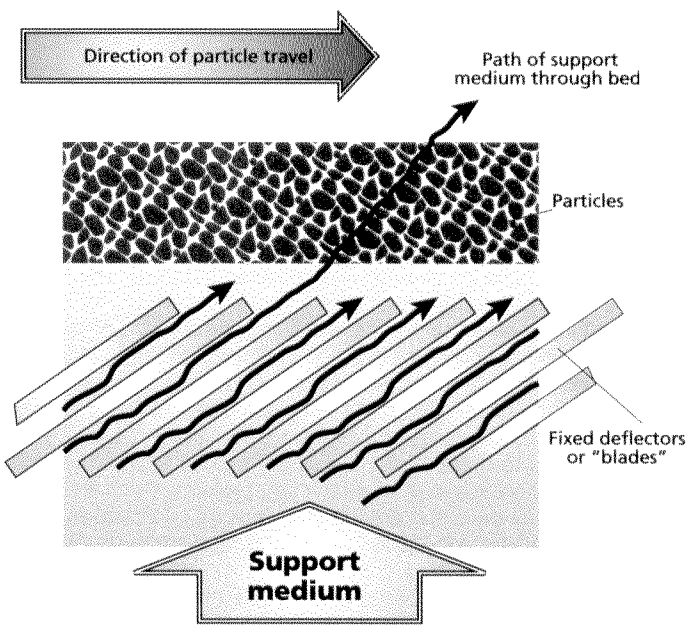
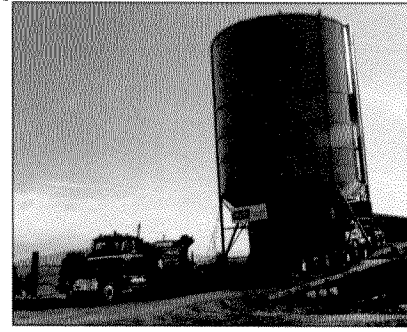
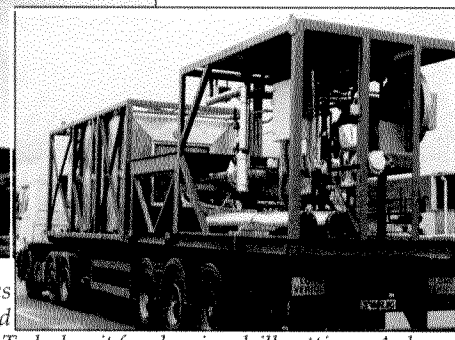
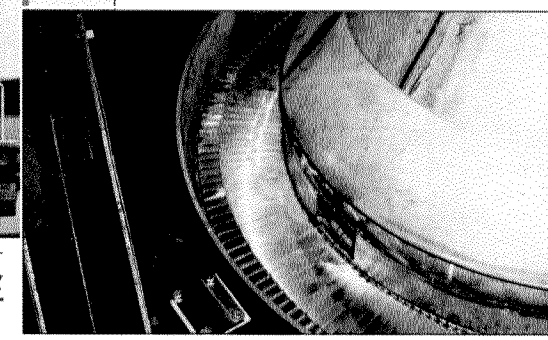


Figure 2: The Torbed principle







From left to right one of 13 Torbeds for gas scrubbing en route to the New Zealand aluminium smelters plant. In transit: a Torbed unit for cleaning drill cuttings. A characteristic Torbed blade ring

applications of the process are being exploited. These are gas scrubbing and detoxification for spent pot linings.

The fumes produced by the aluminium smelting process contain high levels of contaminants, including fluorides which are potentially damaging to vegetation. By feeding the fumes into a Torbed chamber containing alumina particles, the fluorides and other contaminants can be adsorbed and recycled back into the process. Cleansed of their harmful constituents, the residual fumes can then be safely expelled into the atmosphere.

Following a successful trial completed in 1991, New Zealand Aluminium Smelters is installing 13, 5 m-wide Torbeds in its South Island plant to further reduce air pollution by fluorides and other harmful by-products of the smelting process.

At the end of their working life the pot lipings in an aluminium smelter become heavily contaminated with cyanides, carbon and fluxes. With conventional technology, it is difficult to heat the spent pot linings to a sufficient temperature to destroy the cyanides without burning the carbon and agglomerating the fluxes which precludes further treatment. As Comalco of Australia has shown, the rapid, thorough and closely-controlled applications of heat in a Torbed processor provides the only safe and effective way of directly heating the spent pot linings without the addition of anti-agglomeration agents. The contaminants are successfully broken down without the risk of cyanides and other harmful substances escaping into the environment.

Very rapid heat transfer

Vermiculite is a naturally occurring mineral with exceptional fire retardant and insulating properties and is now commonly used instead of asbestos.

Manufacturing vermiculite involves crushing the raw mineral and feeding it into a furnace at 900°C when it expands or exfoliates to form lightweight particles. The process requires a very rapid heat transfer, making the Torbed ideal.

In 1990 Cape Industrial Products, one of the UK's largest manufacturers of vermiculite, replaced five rotary furnaces with a Torbed in its main Glasgow plant. The Torbed easily maintained the level of production while saving approximately £100,000 /y in reduced labour costs, raw materials and fuel. Unacceptable emissions were also eliminated by the Torbed and noise and dust within the factory was minimised to create a healthier working environment. The installation was commended under the National Environmental Awards promotion.

The Torbed offers such substantial savings in terms of reduced energy consumption and labour costs, improved final yield and minimal wastage of raw materials that it can pay for itself within months. Cape has shown that the payback period for its £136,000 Torbed is only 16 months.

In addition to these more established applications of the Torbed in industry, there is a host of interesting projects which are currently under development. One is reducing oil pollution at sea.

The drill bits used in oil and gas exploration are normally lubricated by circulating a drilling mud. It is preferable under many conditions to use an oil-based mud. However, the return mud flow from the drill bits contains solids produced by the drilling operation. Since these solids are mixed with the mud they are contaminated with oil.

Under the Paris Convention oil companies now have to ensure that cuttings discharged from exploration wells contain less than 1% oil. This requirement will be extended to production wells from 1 January 1997.

In view of this legislation, a consortium of ten oil and gas companies was formed in 1994 to test the Torbed's ability to remove the oil from the cutting. This consortium consisted of BP, Shell, Elf, Chevron, Deminex, Phillips, Marathon, Enterprise Oil, British Gas and Conoco, and the project was also supported by the UK's Offshore Supplies Office. The trials were conducted in BP's Sunbury laboratory in the UK and on a Torbed installed in France. More onshore tests are schedules for 1996 at a site in the UK.

The results to date have been highly encouraging. The Torbed has been demonstrated to clean the cuttings to less than 1% and levels of PCB and dioxins emitted were well below the US Environmental Protection Agency's guidelines. When steam is used as the process gas it is also possible to condense the resulting oil/water mixture. The oil can therefore be recycled and fed back into the system for re-use. At the same time, the steam creates an inert atmosphere inside the chamber, making the process inherently safe.

Torbeds are also being used onshore, where there is a need for the economic treatment of refinery wastes. Petroleum refining creates oily wastes which have been declared hazardous by the US EPA. Tortfech and Scaltech of Houston, Texas, have been working together to develop the Torbed as a means of safe and economic removal of the volatile hazardous components of this waste.

Used in conjunction with Scaltech's patented Scalfuel process to prepare the wastes, the Torbed technology offers a complete waste processing system which removes and returns clean oil to the refinery for refining and removes other volatile hazardous components of the waste by thermal desorption. The result is reduction of the original waste volume by up to 95% or more and residual waste solids that meet the EPA's standards for environmentally safe disposal in landfills.

These refinery wastes previously were treated by volume reduction and incineration of the residual solids, a costly process and less environmentally friendly than the Torbed's thermal desorption. By installing Torbed/Scalfuel units at the refineries, air pollution is minimised and the risks associated with transporting and incinerating hazardous wastes are avoided. The brief residence time of the solids in the Torbed required to achieve desorption of the hazardous volatiles allows the Torbed to treat greater volumes of waste at a lower cost and more safety than competing thermal desorption units such as indirect fired kilns or heated screws.

Scaltech is now licensed to use the Torbed for treatment of petroleum hazardous waste in North, Central and South America and plans to have the technology fully operational by mid-1996.

While the technology has undoubted economic advantages, its potential benefits to the environment are creating some of the greatest interest. New applications for the Torbed are constantly emerging as companies assess how its generic qualities can be used to address other environmental problems. ■

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