Converting tannery waste to energy

By

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Background

The global tanning industry generates 4 million tonnes of solid waste per year. As the economic and environmental costs of tannery waste disposal and the cost associated with the use of fossil fuels to generate energy continue to spiral, the search for viable alternative waste solutions and sources of energy becomes increasingly critical.

The implementation of gasification has the potential to provide significant cost benefits in terms of power generation and waste disposal, and increase sustainability within the industry. UK based BLC is the leading leather technology centre and has the expertise to provide solutions to a multitude of environmental problems. BLC has developed the gasification process over the last five years, and is now at the stage where in conjunction with an engineering partner, anything from full scale solutions to on site trials using a pre-existing containerised pilot unit can be provided.

The gasification process converts any carbon-containing material into a combustible gas comprised primarily of carbon monoxide, hydrogen and methane, which can be used as a fuel to generate electricity and heat.

Research has demonstrated the application of large scale gasification plants to the leather sector. It has been demonstrated that a wide range of tannery wastes can be macerated, flash dried, densified and gasified to generate a clean syngas for reuse in boilers or other Combined Heat and Power systems. As a result up to 70% of the intrinsic energy value of the waste can be recovered as syngas, with up to 60% of this being surplus to process drying requirements so can be recovered for on-site boiler or thermal energy recovery uses.

Description

Tanneries generate considerable quantities of sludge, shavings, trimmings, hair, buffing dusts and other general wastes and can consist of up to 70% of hide weight processed. The incineration (in free air) of chrome containing wastes is not an option due to the potential for the creation of carcinogenic chrome (VI). The gasification technology that has been developed by BLC, by virtue of chemically reducing conditions provides a viable alternative thermal treatment for Chrome containing materials, and generates a chrome (III) containing ash. This ash has significant commercial value as it can be reconstituted. This however is just one aspect of this cost effective, highly sustainable process.

Figure 1: Incineration and gasification reactions

Incineration	Gasification
$C + O_2 \rightarrow CO_2$	$2C + O_2 \rightarrow 2CO$
$4H + O_2 \rightarrow 2H_2O$	$2H \rightarrow H_2$

Currently leather waste is predominantly sent to landfill. This waste contains more than half of the energy value of coal, at nominally 20 MJ/ kg as dry material (10 B.t.u. / lb). The pressures upon global landfill disposal are growing, via restrictions to disposal routes and increases to costs / tonne. The EU landfill directive requires that the amount of biodegradable waste disposed of to landfill be reduced to 35% of 1995 levels by 2010. In addition more stringent controls on effluent discharges have ensured improved on site wastewater treatment processes that have yielded much greater volumes of waste sludge. On site gasification is one way of recovering the energy from all such leather wastes and reducing the demand for landfill disposal.

Tanneries are also major energy users, which according to Best Practice requires up to 30 kW of energy to produce a single finished hide. The gasification plant promotes the production of electricity from de-centralised renewable energy sources. Implementing it would significantly reduce electricity demand and afford considerable cost benefits to leather manufacturers, with payback periods of up to 3 years or less having been estimated for a full scale plant. Currently energy and waste disposal typically account for 4-5% of annual operating costs across Europe. Should these costs be recovered through gasification, it is significant to note that potentially, the competitive advantage which Far Eastern competition currently has over EU leather manufacturers (currently they are able to undercut EU prices by 5-10%) could be offset.

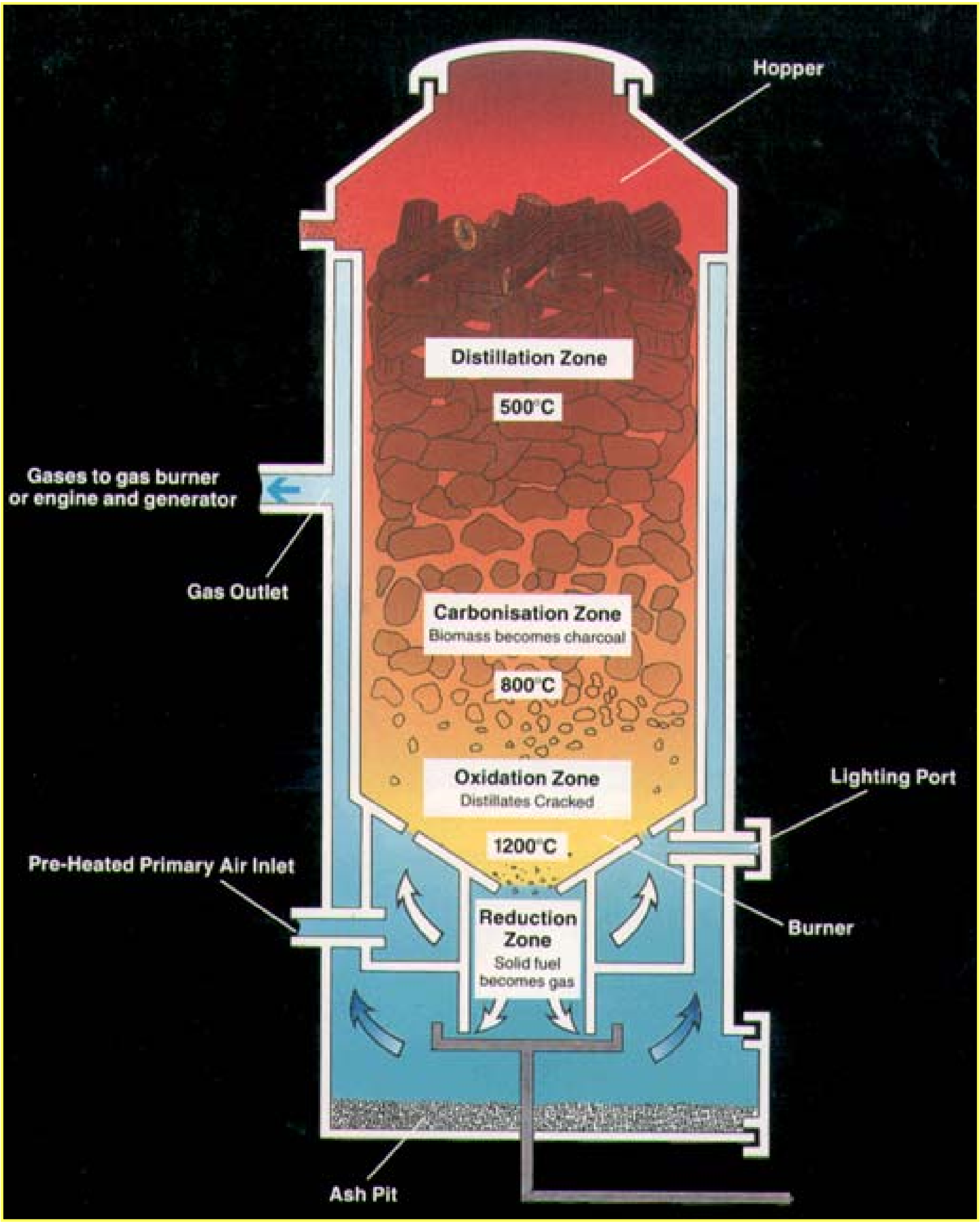

Figure 2. The gasification process

All of the wastes created by the tannery can be gasified following pre-treatment methods such as maceration, drying and subsequent densification or bricketting. A combined drying and gasification process could eliminate solid waste, whilst providing a combustible gas as a tax-exempt renewable energy source, which the tannery can directly reuse. Gasification trials have illustrated that up to 70% of the intrinsic energy value of the wastes currently disposed can be recovered as “synthesis gas” energy. This can be put to useful work, in both drying the wastes prior to gasification and as an energy source for the tannery’s own boilers (furnaces), CHP or electricity export from the site. At least 60% of the syngas energy recovered is surplus to the gasification process requirements and can be reused by the tannery directly. At full scale this could approach the thermal energy requirement actually consumed during leather manufacture, thus making it entirely self-sufficient.

Further environmental benefits include a contribution towards the European Climate Change Programme (ECCP). Uptake of the technology would result in net overall reduction of CO_2 emissions, which could help attain the EU target of a 15% reduction by 2010. This would be beneficial in the future to companies engaged in CO_2 emissions trading, and globally have further impact on the application of the principles of the Kyoto agreement and the targets that it set.