

Minimisation of Organic Solvents in Degreasing and Painting

Background

Thorn make light fittings from aluminium or steel sheets. Metal working, degreasing and painting are the main phases in this production process. The degreasing of the metal sections has been carried out in the past by using the volatile organic compound, trichloroethylene, which is a pollutant and is now recognised as an environmental hazard.

The painting plant consisted of an automatic liquid lacquer line, with differing colours using different organic solvents. The air pollution and the accumulated remaining products were a considerable problem, both within the plant and externally.

When the company planned to expand production the local authorities ordered the company to reduce its current air emissions. As a result the company intended to install equipment to capture the trichloroethylene and incinerate the solvents from the painting plant. However, an independent research organisation, by carrying out a pollution prevention audit, suggested an alternative approach having environmental benefits.

Cleaner Production

The pollution prevention audit started with an analysis of the material flow in the degreasing process. It was shown that by better housekeeping, the need for trichloroethylene degreasing could be reduced by 50%, but this has now been cut to zero. The cutting of aluminium sheets required cutting fluids which were difficult to remove without the use of chlorinated solvents. A change to biodegradable cutting oils allowed an alkaline degreasing procedure in place of the previous trichloroethylene method.

The degreasing is carried out in a new piece of equipment in the form of a totally enclosed 'tunnel', 30 metres long. The metal products are suspended from an overhead conveyor and then pass through five zones where they are sprayed with various liquids. The stages carried out are degreasing, water rinse, iron phosphating to aid the adherence of the paint, water rinse, a de-ionised water rinse and drying. The liquid runs off the metal items into tanks below where it is recirculated back to the spray nozzles.



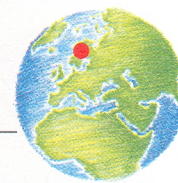
Electrostatic powder painting uses polymer based paints that do not have any solvent in their formulation. A long-term problem was that of changing to a different colour of paint. This is now accomplished by changing the whole module with containers of different colours. The company has now installed a new electrostatic powder painting line having twelve automatic powder guns. The paint is positively charged relative to the metal items. Now only 5% of the colours have organic solvents and are used only for the painting of short production runs in special colours or for retouching of the automatically sprayed items where necessary. Manual spraying is carried out in a ventilated booth fitted with two electrostatic guns.

Economic Benefits

The alkaline degrease turned out to be US\$25,200 cheaper a year than the trichloroethylene degrease and did not require the installation of recovery equipment.

The powder painting techniques have led to considerably lower working costs. The following costs for solvent painting have disappeared with the use of powder painting.

Cost savings	US\$/year
Paint	206,000
Cleaning	62,000
Disposal	47,000
Pumping	33,000
Labour	112,000
Total	460,000
Capital Investment	US\$430,000
Payback	11 months



Advantages

Changed degreasing techniques

The environmental advantages that have been achieved are external and also within the workplace. The company more than adequately meets the demands from the authorities.

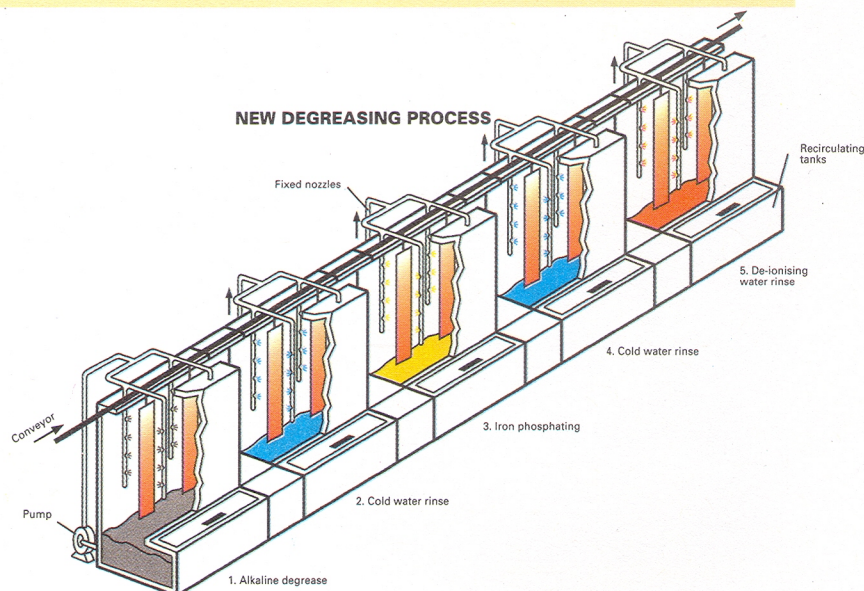
Environmental charge per annum	Previous trichloroethylene degrease	Present alkaline degrease
Air emission	11 ton trichloroethylene	0
Water emission	0	water purification plant
Hazardous waste	5 ton trichloroethylene sludge	< 2 ton sludge

The water purification plant, which is also used for other process baths, can be used for the alkaline degreasing too and results in little additional water pollution from the degrease stage.

Changed painting techniques

The environmental advantages are considerable with a large reduction of the discharge of organic solvents, reduction of hazardous waste, improved work environment and a situation which enabled production to expand without conflicting with environmental demands.

Environmental charge per annum	Previous liquid lacquering	Present powder painting (including 5% liquid lacquer)
Air emission (organic solvents)	65 ton	7 ton
Hazardous waste		
Solvents	10 m ³	2 m ³
Colour residues	47 ton	0.2 ton
Powder residues	< 0.5 ton	3 ton



Country

Sweden

Industry

Metal fabrication

Company

Thorn Järnkunst produces lighting fixtures for indoor and outdoor use. The production amounts to 750,000 units. They employ about 650 people and the turnover is US\$93.45m per year. In 1988 the company merged with Thorn EMI, the main branch being in England.

Suppliers

5-zone degreasing plant –
Br Michaelsen AB, Kungälv,
Sweden

Automatic powder plant –
Gema-Volstatic AG, St Gallen,
Switzerland

Manual powder painting plant –
Eisenmann AG, Böblingen,
Germany

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