



Project:

Waste-Solvent Management in Chemical Industry

Abstract

In the chemical industry, organic solvents are used in large amounts for a range of products (paints, coatings, adhesives), as raw material for product syntheses, as reaction media, and for equipment cleaning. About 250'000 tonnes are used annually in Swiss pharmaceutical and speciality chemical industry. Therefore, solvents belong to the most important industrial chemicals. Since many solvents may show high volatility, considerable environmental persistence, and high toxicity, the handling of solvents in the chemical industry represents a high priority environmental issue. After their use in the chemical production process, solvents often cannot be reused in the original process due to residual contaminations, quality requirements and/or legal restrictions such as regulations imposed by good manufacturing practices of the US Food and Drug Administration and become therefore waste solvents. Waste solvents in the chemical industry are mostly liquid at ambient temperature and vary largely with respect to their chemical composition. Mainly two different waste-solvent treatment options are applied: (1) thermal treatment in special waste-solvent incinerators and the cement industry and (2) solvent recovery. The most important technology for solvent recovery is distillation (rectification).

From an environmental perspective it is not known to date, whether waste solvent incineration or recovery is the preferable treatment option. Both treatment options enable a reduction of the demand of non-renewable resources. The use of light fuel oil is avoided by the use of waste solvents as fuel for steam and electricity production in the incineration and the use of coal and heavy fuel oil is avoided by the use of waste solvents in cement kilns respectively, whereas solvents from the petrochemical solvent production are saved by waste solvent recovery. Both types of avoided products correspond with the avoidance of environmental impacts.

The working steps of this project are:

1. To compare the environmental impacts of waste solvent recovery and incineration using case studies
2. To set up a method for the comprehensive assessment of the environmental impact of the solvent incineration. To this end multi-input allocation models were developed. The incineration models calculate inventory data of solvent combustion as a function of the elemental waste solvent composition and technology used.
3. To set up a method for the comprehensive assessment of the environmental impact of the solvent recovery techniques (especially solvent distillation). The distillation model is based on generic inventory data and data ranges. These data were derived from industry data of 150 waste solvent distillation processes.
4. The development of a generic inventory tool to support decision making in the waste-solvent management of chemical industry. This tool combines the assessment of incineration and distillation for specific waste-solvent compositions.

Collaboration

Swiss Federal Office of Energy (project no. 100065), Ciba Speciality Chemicals AG, Ems-Dottikon AG, Lonza Group Ltd., Novartis Pharma AG, Hoffmann-La Roche AG, Siegfried Ltd., Valorec Services AG, and Fachhochschule beider Basel.

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