



Evaluation and Classification of Chemical Wastes

Introduction

The evaluation of wastes is very important for their recycling or disposal in an appropriate way. For the correct classification and assessment, the producer resp. provider of these hazardous materials are responsible.

Classification of Wastes according to the Ordinance for Dangerous Goods

The basis for the assessment of wastes according to the ordinance for dangerous goods are the **dangerous properties**, which these materials can have:

- Flammability (combustibility)
- Oxidizing properties
- Toxicity
- Corrosivity
- Formation of flammable gases in contact with water
- Contamination with infectious and pathogenic materials
- Radioactive radiation
- Water polluting properties
- Release of hazardous dusts

Further differentiation among the classes of dangerous goods can be made by **substance registers**. These registers do not contain only well defined substances (e.g., gasoline, boiling point 60-100 °C) but also summarizing categories, e.g., petroleum products, n.f.d. (n.f.d. = not further described). The classification and assessment of hazardous wastes are made according to their physical-chemical properties (solid/liquid, boiling point, ignition point, toxicity data).

The assignment of wastes to one of the listed hazard categories is difficult, if they are mixtures of solids or liquids (solutions). The dangerous goods ordinance gives guidance how to classify. But for this, it is necessary to know the constituents and hazardous properties of the waste. Classification of hazardous wastes is, therefore, usually the task of a chemist. Amateurs can only do that if there exist certain categorization as it is usually the case for



common wastes (e.g., contaminated operating materials like cloth, content of coalescer/separator) or the substances can be assigned by simple test methods.

For the **transportation of wastes over traffic roads** there exist special directives like GGVS/E (in Germany: Gefahrgutverordnung für Straße und Eisenbahn = Dangerous goods ordinance for road and railroad transportation), which necessitate the evaluation and classification of hazardous substances. Then, hazardous wastes must be assigned to **hazard classes** in accordance with their dangerous properties.

Tab. 1: Examples for wastes in different dangerous goods classes

Class	Notation	Examples
1	Explosive substances and materials containing explosives	Firework, ammunition
2	Gases	Propane, butane, acetylene
3	Flammable liquid substances	Alcohols, spent acetone (solvents)
4.1	Flammable solid substances	Wastes of nitrocellulose, rubber waste
4.2	Self-igniting substances	Wastes of celluloid, oil containing cotton waste
4.3	Substances forming flammable gases in contact with water	Wastes of calcium carbide, alkaline metals
5.1	Oxidizing substances	Ammonium nitrate containing formulations
5.2	Organic peroxides	Peroxyacetic acid
6.1	Toxic substances	Uncleaned empty pesticide containers, certain chemicals
6.2	Infectious material	Hospital wastes (surgical material, syringes)
7	Radioactive material	Radioactive wastes with low specific activity (e.g., tritium from biological research)
8	Corrosive substances	Spent nitrating acid, spent sulfuric acid
9	Various hazardous substances and materials	Asbestos, various water polluting substances



Classification of Wastes according to OECD Registers

In the member states of the OECD (Organization for Economic Cooperation and Development) there exists the so called “Traffic Light List” which has to be obeyed while transboundary waste transportation. For recyclable wastes there are tapered controls oriented on the hazardous properties of the wastes and which are listed up in three colors (green, yellow, and red list).

Green List:

Wastes categorized into the green list after OECD agreement will not be controlled. This category comprises materials like scrap metals, steel, non-iron metals, plastics, paper, glass, textiles, and wood. Hazardous substances like chemical wastes are not included into this category!

Yellow List:

These wastes underlie a limited control and they need the approval of the recipient country. This group comprise ashes, sludges and dusts of non-iron metals, arsenic, mercury and oil containing wastes, municipal and other wastes containing less than 50 mg/kg polychlorinated biphenyls (PCB), polychlorinated terphenyls (PCT), and polybrominated biphenyls (PBB).

Red List:

Wastes of this category have to be handled like wastes for disposal purposes. Transportation is only permitted if the providing country as well as receiving country have agreed in written declarations. These wastes comprise especially wastes containing more than 50 mg/kg PCB/PCT, and those containing polyhalogenated dibenzo-p-dioxins and furans, cyanides, and asbestos.

Classification of Wastes according to TRGS 201 (July 2002)

In TRGS 201 (Technical Directive for Hazardous Substances) directives for the classification and labeling of wastes for disposal purposes are given. It is also valid for wastes to recover thermal energy, but not for those for material recycling. Classification is oriented at risks may arise. The highest risk possible determines the classification.


Tab. 2: Possible risks may arise from wastes

Physical-chemical Risks		Health Risks		Environmental Risks	
Code Letter for Hazard Symbol	Hazard Description	Code Letter for Hazard Symbol	Hazard Description	Code Letter for Hazard Symbol	Hazard Description
E	Explosive	T+	Very Toxic	N	Dangerous for the Environment
O	Oxidizing	T	Toxic		R52-53: Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment
F+	Extremely Flammable	C	Corrosive		R53: May cause long-term adverse effects in the aquatic environment
F	Highly Flammable	Xn	Harmful		R59: Gefährlich für die Ozonschicht
	R10: Flammable	Xi	Irritant		

As a rule, not more than one hazard description should be selected from each group.

It must be excluded that constituents in the wastes undergo dangerous reactions with each other.