EKA CHEMICALS AKZO NOBEL EPD®

Certified Environmental Product Declaration (EPD) for Hydrogen peroxide (H_2O_2)

Description of the product and the company

The product

Hydrogen peroxide (H_2O_2) is an efficient oxidising agent. Hydrogen peroxide from Eka Chemicals is supplied as aqueous solution at a maximum concentration of 70 wt%.
Hydrogen peroxide (H_2O_2) is produced from hydrogen and atmospheric oxygen. The reactions take place in an organic solvent, which is circulated in the process, with palladium as a catalyst. In the first step hydrogen gas is added, and the solvent is hydrogenated. The next step is the oxidation where oxygen from the air is added. Now hydrogen peroxide is formed. The peroxide is extracted from the solvent with water and distilled to the wished concentration, varying from 5-70 wt%. Finally, a small quantity of stabiliser is added. The manufacturing of hydrogen peroxide takes place in Bohus and Alby, Sweden and in Rjukan, Norway.

The functional unit in this study is 1000 kg of 100 wt% hydrogen peroxide. This means that the environmental load presented is valid for 1000 kg of hydrogen peroxide. The displayed figures include all production processes but the results have been recalculated as 100% product and are given as an average for Eka Chemicals production in Sweden and Norway. The average is weighted according to production volumes from the plants. Since the product is sold as a water solution it is very important to notice the concentration referred to.

Hydrogen peroxide from Eka Chemicals contains max 500 mg/kg stabiliser and 30-95 wt% water. Hydrogen peroxide (100%) is classified and labelled corrosive and oxidising.

Table 1 Declaration of content and labelling

	Category of danger	Symbol letters	Risk phrases
Hydrogen peroxide	Corrosive, Oxidising	C, O	R8, R34
Stabiliser	-	-	-
Water	-	-	-

R8: Contact with combustible material may cause fire
R34: Causes burns

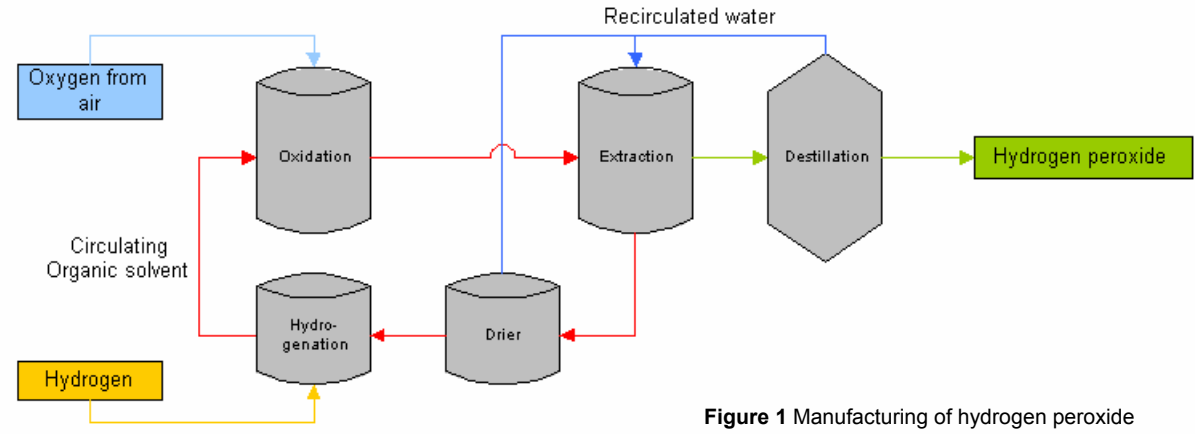

Figure 1 Manufacturing of hydrogen peroxide

The company

Akzo Nobel serves customers throughout the world with healthcare products, coatings, and chemicals. Akzo Nobel run operations in 80 countries and has about 70,000 employees.
Eka Chemicals, who manufactures hydrogen peroxide, is a Business Unit within Akzo Nobel and has 3000 employees in 30 countries. The headquarters are located in Bohus, just north of Gothenburg, Sweden. Eka Chemicals is a supplier of chemicals for pulp bleaching processes and paper manufacturing but also markets chemicals for certain speciality applications as well as fine chemicals.

Presentation of environmental performance

All major steps, from the extraction of natural resources until the products leave the gates in Alby, Bohus and Rjukan are included in the environmental performance of the manufacturing phase. A few of these are displayed in the simplified flowchart below.

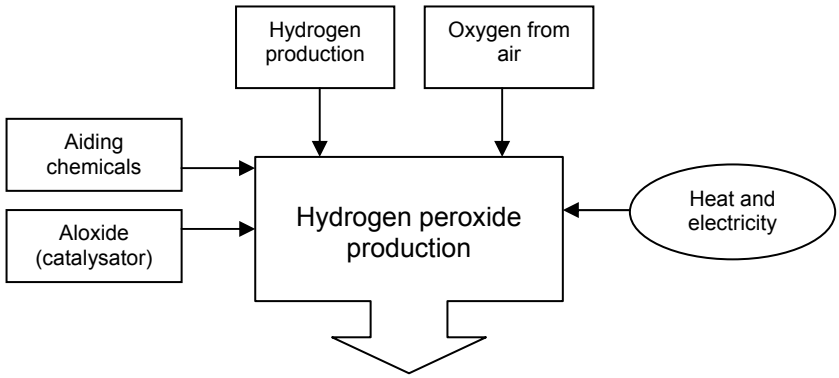

Figure 2 Flowchart for production of hydrogen peroxide

The data used were collected for year 2000 and others are said to be valid for that time according to suppliers. Site-specific data have been retrieved for all major raw materials or have been guaranteed to correspond with site-specific data according to suppliers.

In this study economical allocation has been the base for calculations, meaning the environmental load from a production has been divided according to economical value of the products produced. From the hydrogen peroxide production no by-products are produced and there is no need for any allocations in that specific process.

The manufacturing phase

The figures displayed below cover not only the environmental load derived from the production site of hydrogen peroxide. All other steps during the life cycle up until the product leaves the gates in Alby, Bohus and Rjukan are included like natural resource extraction, raw material production, energy production and transportation. All figures are given for 1000 kg of hydrogen peroxide.

Table 2 Non renewable resources

Without energy content	kg	With energy content	MJ
Bauxite	13	Nuclear energy	5400
Sodium chloride	9,1	Crude oil	2100
Limestone	2,5	Natural gas	2100
Copper ore	1,1	Coal	80
Phosphate rock	0,9		

This table displays the total use of non renewable resources, including feedstock, needed for 1000 kg hydrogen peroxide.

Table 3 Renewable resources

Without energy content	kg	With energy content	MJ
-	-	Hydro energy	4400
		Biomass	50
		Wind energy	1

The net electricity consumption is not a resource use since the resources used for, and emissions and waste derived from, electricity production are included in the other displayed figures. It simply displays how much electricity that has been consumed within the system studied. Within the system 1-2 MWh has been consumed.

Table 4 Electricity sources

Electricity production source	%
Hydro power	64
Nuclear power	35
Natural gas	<0,5
Biofuel	<0,5
Coal	<0,5
Unspecified	<0,5

Unspecified means that the electricity grid is not known and is represented by a mix of electricity production sources.

Note that energy is not the same as electricity. For example nuclear energy is a measure of the total energy content in the uranium fuel in the same way as crude oil is a measure of energy content. Hence nuclear energy is not the same as nuclear electricity (here named Nuclear power), like crude oil is not the same as electricity produced from oil.

In accordance with the guidelines for EPDs, the most important air and water emissions are expressed both as inventory data and as influence on different environmental impact categories. The result is displayed below.

Table 5 Emissions to air

Emissions to air	g
CO_2	371 000
HC	640
NOx	400
SO_2	180
Particles	90
CH_4	70
CO	50
Hg	0,002

Table 6 Emissions to water

Emissions to water	g
COD	190
NaCl	80
N total	0,5
Hg	3,1E-05

Table 7 Waste generation

Waste	kg
Other waste	116
Hazardous waste	0,14

Table 8 Emissions, expressed in terms of environmental impact

Category of impact	Equivalent unit	Impact
Global warming (GWP)	g CO_2	373200
Acidification (AP)	mole H^+	14
Ozone depletion (ODP)	g CFC-11	0,004
Photochemical ozone creation (POCP)	g ethene	230
Eutrophication (EP)	g O_2	2600

An explanation of these impact categories is found at the end of this EPD.

Some of the emissions presented as special parameters have indexes in the different impact categories and are therefore influencing them. The environmental flows shown are in some cases demanded by the Product-Specific Requirements (PSR) for chemical products. In other cases they are displayed because they are considered to be significant for the production of hydrogen peroxide.

The use phase

Hydrogen peroxide from Eka Chemicals is mainly used at pulp mills for bleaching of pulp but is also used for bleaching of recycled paper in the de-inking process, and in textile bleaching. Hydrogen peroxide is also used in many other important applications in the chemical industry. The product is not considered to contribute to an increased environmental load during the use phase and its decomposition products are water and oxygen.

The environmental impact from the transport to customer is given for the transport of 1000 kg of product, 100 km for the means of transport in question. This makes it possible for customers to assess the environmental load derived from transportation of hydrogen peroxide. The actual means used depend on where the customer is situated. Some times all three means are used.

Table 9 Envrionmental impact from transport to customer

Impact	Unit	Train[1]	Truck[2]	Ship[3]
Crude oil	MJ	-	91	22
Hydro energy	MJ	23	-	-
CO_2	g	0,4	6720	1540
CO	g	0,01	6	0,9
HC	g	0,001	6	2
NOx	g	0,001	42	43
SO_2	g	0,0006	1,4	26
Particles	g	0,0001	0,7	2

The means of transport are approximated with a train transport, a truck transport and a ship transport.

1. *The train is a Swedish electric train.*
2. *The truck has a maximum weight of 60 ton, a Euro III engine and is using EC1-diesel. The loading factor is 50%.*
3. *The ship has a maximum weight of more than 8000 ton and a loading factor of 50-60%.*

Information from the company and the accredited certification body

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Information from the accredited certification body

This Environmental Product Declaration has been reviewed and approved by an accredited certification body - the Swedish National Testing and Research Institute (SP) - according to the Product-Specific Requirement, PSR 2000:5 for Chemical Products and the Swedish Environmental Council requirements for environmental product declarations, MSR 1999:2.
Valid until: August 30, 2005
Registration number: S-P-00031

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Other information

More information about environmental product declarations - the EPD system – can be found on the Internet: http://www.environdec.com

References

- LCA documentation for hydrogen peroxide, 2002
- Product-Specific Requirements Chemical Products, (PSR 2000:5)
- Requirements for Environmental Product Declarations, EPD (MSR 1999:2) – an application of ISO TR 14025.

Glossary

Acidification potential, AP. Chemical alternation of the environment, resulting in hydrogen ions being produced more rapidly than they are dispersed or neutralised. Occurs mainly through fallout of sulphur and nitrogen compounds from combustion processes. Acidification can be harmful to terrestrial and aquatic life.

Eutrophication potential, EP. Enrichment of bodies of water by nitrates and phosphates from organic material or the surface runoff. This increases the growth of aquatic plants and can produce alga blooms that deoxygenate water and smother other aquatic life.

Global warming potential, GWP. The index used to translate the level of emissions of various gases into a common measure to compare their contributions to the absorption by the atmosphere of infrared radiation. GWPs are calculated as the absorption that would result from the emission of 1 kg of a gas to that from emission of 1 kg of carbon dioxide over 100 years.

Life Cycle Assessment, LCA.. A management tool for appraising and quantifying the total environment impact of products or activities over their entire life cycle of particular materials, processes, products, technologies, services or activities.

Ozone depletion potential, ODP. The index used to translate the level of emissions of various substances into a common measure to compare their contributes to the breakdown of the ozone layer. ODPs are calculated as the change that would result from the emission of 1 kg of a substance to that from emission of 1 kg of CFC-11 (a freon)

Photochemical ozone creation potential, POCP. The index used to translate the level of emissions of various gases into a common measure to compare their contributions to the change of ground-level ozone concentration. POCPs are calculated as the change that would result from the emission of 1 kg of a gas to that from emission of 1 kg of ethene.