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- Abstract-

Survey of Actual Conditions of Material Safety Data Sheet
and Quantitative Risk Assessment of Toxic Substances :
Substitutes for Degreasing Agents

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Since the regulation of MSDS (Material Safety Data Sheets) had started from July 1996, employers were required to furnish MSDS for the chemicals in use in their workplace. However, many MSDS did not contain upright information for the chemicals, and they were not updated regularly, and were not written in the standard format required by the Industrial Safety and Health Act (ISHA). The purposes of this study were 1) to examine the reliability of MSDS for mixed solvents, 2) to provide reliable MSDS to employers or employees, 3) to find out any difficulties in implementing MSDS after the initiation, and 4) to promote regular MSDS updating and to ensure the reliability of MSDS for chemical manufacturers. To check the reliability of MSDS of mixed chemicals, 21 samples of mostly degreasing solvents were collected along with their MSDS from the work place. The samples were analyzed by gas chromatography-mass selective detector(GC-MSD). Their components were classified as saturated hydrocarbon, cyclic hydrocarbon, aromatics, and halogen containing hydrocarbon, and the amount of each class were measured. Manufacture's MSDS were compared with the actual composition of the collected

samples, and further examined the reliability by checking whether the chemicals analyzed were included in the MSDS correctly. Finally, each item of MSDS was evaluated whether the MSDS correspond to the regulation required by ISHA. The results were following: 1) most of the degreasing solvents in MSDS were incorrect in their composition and contents, 2) the information in the MSDS including hazard classification, exposure level, toxicity, regulatory information were incorrectly provided, and 3) some MSDS did not disclose carcinogens in their MSDS. Continuous monitoring of MSDS was required to ensure reliability of MSDS. The Chemicals containing hydrocarbons from C10-C15 need to be tested to provide toxicity data. In addition, governmental support for providing correct MSDS was recommended to ensure reliability of MSDS. The MSDS regulation relating to the confidential business information may need to be revised to ensure reliability of MSDS.

Key Words : Quantitative Risk Assessment,
Substitutes for degreasing agent,
Workplace, Material Safety Data Sheets

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‡ : 1000,

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I. Freon gas (CFC) 1930 DuPont chlorofluorocarbon (Material Safety Data Sheets, MSDS) (41)

urethane sponge spray 1970 CFC가 Molina Rowland (1974)가 1% () 가 (1985) (1987) (, 1997a). MSDS CFC hydrochlorofluorocarbon (HCFC) 가 CFC 1999 1 MSDS 2010 , HCFC 2016 2040 , MSDS 2002 2015 , (, 1996a, 1996b). 2005 2010 , trichloroethylene (TCE) 가 MSDS 1.1.1-trichloroethane 2003 2015 hydrobromofluorocarbon(HBFC) 1996 1 1 가 CFC HCFC 가 (Filskov *et al.*, 1996). CFC (U.S. Occupational Safety and Health Administration: OSHA) MSDS OSHA 가 가 (U.S. General Accounting Office: GAO) (U.S. GAO, 1991; Kolp, 1995; Karstadt, 1998; Welsh *et al.*, 2000),

(1998) / 220 GC
MSDS
200:1
MSDS 가 50
3 가 100
1 /min 2 /min
GC-MSD , 250 10 /min
가
MSDS 30-300
Wiley 275 library ,
3.
1. 1997 3 4
4 (A, B, C, D 가)
95 21
+ % HPLC (Aldrich chemicals Co.,
U.S.A) GC-MSD 4. MSDS
GC[Model No. 6890, Hewlett Packard (HP), U.S.A]
MSD (Model No. 5970, HP, U.S.A) 1) MSDS GC-MSD
Gastight 1000 series MSDS GC-MSD
(Hamilton, U.S.A) GC-MSD ,
Wiley 275 Library
1 , 2 3 , 1 , 2 3
(, 117
2. GC-MSD 4 148 6)
가 가
. GC 2)
0.25mm, 50m HP- 1,
3.0psi 120ml/min
0.5- 1.0 μ l, 가 (NIOSH, 1996).

3) , 11 15

4)

가 (, 1998) 1.

5) 1997 가 21 4 ,

NIOSH RTECS (NIOSH, 1996) - () 4가 ,

6) (, 1997c) A 7 33 - 93% , 2

가 26 33%

7) MSDS , 3 가

MSDS 1 ,

2 , 3 A .

, 8

Table 1. Summary of analytical data from degreasing agents in A company

Analysis (%) of GC-MSD (No. of chemicals)								
Classification of HC		Material items						
		101	102	103	104	105	106	107
Saturated HC		41.28(7)	33.20(8)	90.67(7)	59.52(8)	68.02(13)	75.54(14)	93.00(8)
Cyclic HC		26.03(8)	33.80(11)	ND*	7.63(4)	5.55(4)	0.56(1)	ND
Aromatics		ND	ND	ND	ND	ND	ND	ND
Halogen containing	Aromatic	ND	ND	ND	ND	ND	ND	ND
	Aliphatic	ND	ND	ND	ND	ND	ND	ND

Note : GC-MSD=gas chromatography-mass selective detector; HC=hydrocarbon.

* not detected.

B 2 10%
 가 72% (Table 2).

Table 2. Summary of analytical data from degreasing agents in B company

Analysis (%) of GC-MSD (No. of chemicals)			
Classification of HC		Material items	
		201	202
Saturated HC		19.76(4)	ND*
Cyclic HC		80.24(5)	17.50(1)
Aromatics		ND	10.42(2)
Halogen containing	Aromatic	ND	ND
	Aliphatic	ND	72.08(2)

Note : GC-MSD=gas chromatography-mass selective detector; HC=hydrocarbon.
 * not detected.

C 5 2 () 1 66 %
 가 100% , 2
 90 % (Table 3).

Table 3. Summary of analytical data from degreasing agents in C company

Analysis (%) of GC-MSD (No. of chemicals)						
Classification of HC		Material items				
		301	302	303	304	305
Saturated HC		ND*	ND	90.37(7)	97.96(9)	66.39(9)
Cyclic HC		ND	ND	ND	ND	25.29(5)
Aromatics		ND	ND	ND	ND	4.75(2)
Halogen containing	Aromatic	ND	ND	ND	ND	ND
	Aliphatic	100(1)	100(1)	ND	ND	ND

Note : GC-MSD=gas chromatography-mass selective detector; HC=hydrocarbon.
 * not detected.

D 7 6 4 21
 , , 21
 , 1 가 18, 14, 9,
 (Table 4). () 3
 (Table 5).

Table 4. Summary of analytical data from degreasing agents in D company

Analysis (%) of GC-MSD (No. of chemicals)								
Classification of HC		Material items						
		401	402	403	404	405	406	407
Saturated HC		45.07(10)	41.21(6)	31.80(1)	27.16(6)	47.71(9)	50.32(9)	83.11(13)
Cyclic HC		27.95(6)	29.76(5)	43.89(1)	53.42(9)	1.81(1)	2.04(1)	ND*
Aromatics		18.01(3)	14.41(2)	24.31(1)	7.92(2)	22.44(5)	22.81(5)	3.99(1)
Halogen containing	Aromatic	ND	ND	ND	ND	ND	ND	ND
	Aliphatic	ND	ND	ND	ND	ND	ND	ND

Note : GC-MSD=gas chromatography-mass selective detector; HC=hydrocarbon.

* not detected.

Table 5. Distribution of chemicals in total material items

Classification of HC		No. of detected chemical / total items
Saturated HC		18 / 21
Cyclic HC		14 / 21
Aromatics		9 / 21
Halogen containing	Aromatic	0 / 21
	Aliphatic	3 / 21

Note : HC=hydrocarbon.

2. MSDS

가 , .

MSDS 16 6 1 , 21 MSDS “

2 , 가 가 ”

3 , 8 , 38% .

11 , 15 , 가 33 %

Table 6 . 가

21 MSDS 19% .

33%가

“ 가 ” 70%

MSDS

MSDS 가

가 가

Table 6. Compare to the actual conditions of manufacturer's MSDS and MSDS regulations of industrial safety and health act in Korea

Item of MSDS Regulations		Actual conditions of manufacturer's MSDS (%)
1	Information of chemical product and company	- classification error of harmful chemical substance : 61.91 %
2	Component and content	- business secret : 33.3 % (unrecording of component)
3	Toxicity	- no care to low level toxic : 38.1 %
8	Exposure protection and personnel protective devices (PPD)	- put on PPD : 33.3 % - refer to TLV yes : 23.8 % no : 19.0 % - technological management yes : 0 % no : 28.6 %
11	Information of toxic	- refer to LD50 : 33.3 % - refer to LC50 : 23.8 % - no record of TLV : 66.7 %
15	Regulations in force	0 %

Note : TLV=threshold limit value;

LD50=lethal dose to 50 percent of the test organisms;

LC50=lethal concentration to 50 percent of the test organisms

(1987)

CFC HCFC, methylbromide TCE 1997 4 ,

21 HBFC 21 ,

1996 1 1 ,

CFC 가 -

HCFC 가 ,

가 18 , 가 14 , 가 9 ,

가 3 ,

(Park et al., 1997)가 CFC HCFC ,

가 MSDS 가 , trichloroethylene

trichloroethane

MSDS

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3 5

KOSHA-NET MSDS

1997c)

, MSDS

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MSDS

MSDS

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가 MSDS

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(, 1997b),

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REFERENCES

ICP- AES
 MSDS
 1998;8(2):196-208
 96-24 , 1997a.
 97-27 , 1997b.
 , 1997c.
 97-65 , 1998.
 (3), 1996a.
 (Material Safety Data Sheets), (96-20-107), 1996b.

Filskov P, Goldschmidt G, Hansen MK, Höglund L, Johansen T, Pedersen CL and Wibroe L. Substitutes for hazardous chemicals in the work-place. Lewis Publishers; 1996.
 Karstadt M. Report on how well Material Safety Data Sheets are prepared. Harvard School of Public Health, Final report prepared for OSHA; 1988
 Kolp PW. Assessment of the Accuracy of Material Safety Data Sheets. Am Ind Hyg Assoc J 1995;56:178- 183
 Molina MJ and Rowland FS. Stratospheric Sink for Chlorofluoromethanes: Chlorine atom catalysed destruction of ozone. Nature 1974;249:810
 Montreal Protocol on Substances that Delete the Ozone Layer; 1987
 National Institute for Occupational Safety and Health(NIOSH). Registry of Toxic Effects of Chemical Substances (RTECS); 1996
 Park JS, Kim YH, Park DW, Choi KS, Park SH and Moon YH. An outbreak of hematopoietic and reproductive disorders due to solvents containing 2-bromopropane in an electronic factory, South Korea: epidemiological survey. J Occup Health 1997;39:138- 143
 United States General Accounting Office: Occupational Safety and Health: OSHA action needed to improve compliance with hazard communication standard. GAO/HRD- 92- 8; 199.
 Vienna Convention for the Protection of the Ozone layer; 1985
 Welsh MS, Lamesse M and Karpinski E. The verification of hazardous ingredients disclosures in selected Material Safety Data Sheets. Appl Occup Environ Hyg 2000;15(5):409- 420