

Abstract

Case Series for Occupational Dermatitis in a Factory Treating Liquid Waste Mixtures

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**Objectives:** A dermatologic outbreak occurred in a factory using liquid waste mixtures at Gyeongju. We conducted this study to identify causative factors.

**Methods:** We conducted a questionnaire interview composed of general and job characteristics. A dermatologist carried out medical examination, European standard patch test and 'as is' patch test. We evaluated the cases with over 5 criteria of Mathias's 7 definitions of occupational dermatologic diseases.

**Results:** Seven of 9 workers were diagnosed with dermatosis and 3 subjects (cases 2, 4 and 6) with Mathias's 7 criteria were confirmed as having occupational dermatologic diseases and were diagnosed as irritant contact dermatitis. Two subjects (cases 1 and 9) with over 5 criteria were evaluated as suspicious status. The remaining 2 subjects (cases 3 and 5) were not compatible with those criteria. The main sources of this outbreak were suggested to be the wasted solvents in the factory of car accessories and aluminum products because the subjects (cases 2, 4, 6, 1 and 9) had the positive skin reaction against those sources in 'as is' patch test. Furthermore, 4 of the 5 subjects (cases 2, 4, 6 and 9) had some skin reactions against the waste solvents of chemical material in 'as is' patch test.

**Conclusion:** This outbreak occurred by direct skin contact of liquid waste mixtures of a factory making car accessories and aluminum products. The cutting oils and metal working fluids in those liquid waste mixtures were estimated as the most suspected materials. In addition, this outbreak may have been caused by the hazard effect of mixed waste organic solvents of manufacturing of chemical materials.

**Key Words:** Occupation, Contact dermatitis, Liquid waste mixtures, Mixed waste organic solvents

< : 2004 6 3 , : 2004 7 6 >  
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2.

30% (Adams, 1997).

1982

7

(, 1995).

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6

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(Table 1)

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2

(%) 가

‘+’, ‘-’

가

4

가

4.

가

‘+’, ‘-’

가

‘+’, ‘-’

Mathias(1989)

가

가 4

가

‘+’, ‘-’

가

5가

‘as is’ test

‘1+’

‘+’, ‘-’

가

‘±’, ‘-’

가

‘++’, ‘+’, ‘0’

가

가

( As is test )

**Table 1.** The list of the sources for the patch tests

| Routine patch test (European standard series) |                              | ‘As is’ patch test                                    |
|---|------------------------------|---|
| No.Sources                                    | No.Sources                   | No.Sources  |
| 1 potassium diclomite                         | 12 wool alcohols             | 23 Braun tube manufacturing / waste solvents          |
| 2 4-phenylenediamine                          | 13 mercapto mix              | 24 Braun tube manufacturing / waste solvents          |
| 3 thiuram mix                                 | 14 thiomersol                | 25 Purification of chemical material /waste solvents  |
| 4 neomycin sulfate                            | 15 balsam of peru            | 26 Manufacturing of chemical material /waste solvents |
| 5 cobalt chloride                             | 16 butylphenol formal resine | 27 Purification of petroleum /waste solvents          |
| 6 mercury ammonium chloride                   | 17 mercaptovenzothiazole     | 28 Production of car accessories/waste oils           |
| 7 nickel sulfate                              | 18 formaldehyde              | 29 Aluminum product /waste oils                       |
| 8 quinoline mix                               | 19 fragrance mix             | 30 Preparation of petroleum /waste oils               |
| 9 colophony                                   | 20 imidazolodiny l urea      | 31 Purification of petroleum /waste oils              |
| 10 parabens                                   | 21 quaternium 15             | 32 Production of texture /waste oils                  |
| 11 black rubber mix                           | 22 captan                    |   |

(Table 2).

1.

9, 2, 4, 5, 3, 4, 1,

38 (28 42 ) . 2, 3 6

(Table 2).

2, 3

2

6 ( 1 10 ) .

2

2.

6 1 1

3

3, 7 1

1 1

Fig 1

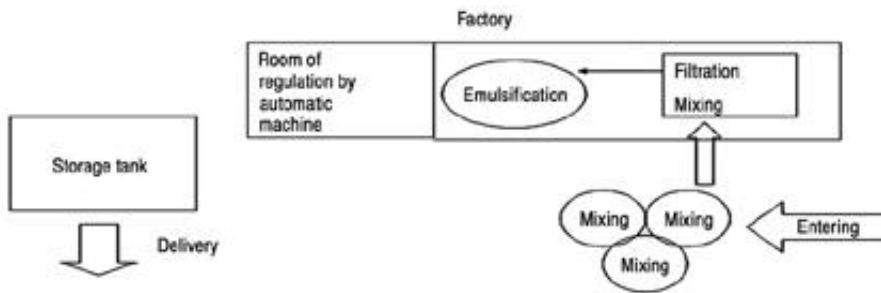


Fig. 1. Working process in a factory handled liquid waste mixtures

Table 2. The general characteristics of study subjects

| Department | No. of cases | Age | Education         | Job duration (months) | Job contents for recent 3 months        | Wearing of protective devices |
|------------|--------------|-----|-------------------|-----------------------|---|-------------------------------|
| Production | 1            | 38  | College           | 7                     | Entering and mixture                    | Sometimes                     |
|            | 2            | 41  | Middle school     | 2                     | Entering, Mixture                       | Sometimes                     |
|            | 3            | 36  | Elementary school | 1.5                   | Entering and delivery from storage tank | Always                        |
|            | 4            | 38  | High school       | 9                     | Entering, Mixture                       | Sometimes                     |
|            | 5            | 42  | High school       | 10                    | Entering, Mixture                       | Sometimes                     |
|            | 6            | 40  | Over college      | 9                     | Entering, Mixture                       | Sometimes                     |
|            | 7            | 36  | High school       | 6                     | Driver of transport car                 | Always                        |
| Laboratory | 8            | 28  | College           | 1                     | Experiment                              | Always                        |
|            | 9            | 33  | University        | 10                    | Experiment                              | Always                        |

Table 3. The evaluation table for occupational dermatitis

| Depart-ment | No. of cases | Complaint of dermatosis | Areas in direct contact of exposure sources              |                                    | Dermatosis       |                                     | Management           |   | Supportive management   | Impression of dermatological doctor |
|-------------|--------------|-------------------------|--|------------------------------------|------------------|-------------------------------------|----------------------|---|---|-------------------------------------|
|             |              |                         | Sympto-ms  | Site                               | Time of Starting | Time of relieving                   | Management by doctor |   |   |                                     |
| Product-ion | 1            | Yes                     | Feet: small amounts                                      | Both dorsum pedis, back            | Before 40 days   | Before 30 days                      | No                   | Frequent washing, Skin protective cream   | Not evaluated because of vacation of subject  |                                     |
|             | 2            | Yes                     | Hand, Feet: large quantity/Face: small quantity          | Both dorsum pedis, forearm & thigh | Before 80 days   | Before 35 days                      | Yes                  | No  | In initial hospital visit, the doctor observed the pustule, vesicle, and erythema and the patient complained early burning pain at forearm, / After 1 month, he doctor diagnosed postinflammatory hyperpigmentation and desquamation at forearm, thigh & dorsum pedis caused by contact dermatitis, irritant type |                                     |
|             | 3            | Yes                     | None   | Back & thorax                      | Before 40 days   | Before 37 days                      | No                   | No  | Not specific  |                                     |
|             | 4            | Yes                     | Hand, Feet: large quantity/<br>Lower legs small quantity | Both dorsum pedis/Right thigh      | Before 80 days   | Before 30 days                      | No                   | Frequent washing waring protective device | Postinflammatory, hyperpigmentation, fissuring, desquamation at dorsum pedis, R/O contact dermatitis  |                                     |
|             | 5            | Yes                     | Hand, Feet: large quantity/Face: small quantity          | Back & thorax                      | Before 240 days  | Itching was not relieving until now | No                   | No  | Not specific  |                                     |
|             | 6            | Yes                     | Hand: small quantity                                     | Both dorsum pedis & thigh          | Before 85 days   | Before 40 days                      | Yes                  | No  | Postinflammatory, hyperpigmentation, desquamation at dorsum pedis R/O contact dermatitis  |                                     |

가

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(3 )

(3 )

(1 )

(2 ).

1

( )

**Table 3.** The evaluation table for occupational dermatitis (continued)

| Depart-ment | No. of cases | Complaint of dermatosis | Areas in direct contact of exposure sources |              | Dermatosis                          |                   | Management           |    |    | Supportive management | Impression of dermatological doctor |
|-------------|--------------|-------------------------|---|--------------|-------------------------------------|-------------------|----------------------|----|----|-----------------------|-------------------------------------|
|             |              |                         | Symptoms                                    | Sites        | Starting Time                       | Time of relieving | Management by doctor |    |    |                       |                                     |
|             | 7            | No                      | None  | None         | -                                   | -                 | -                    | -  | -  | -                     | Not specific                        |
| Laborat-ory | 8            | No                      | Hand, face: small quantity                  | None         | -                                   | -                 | -                    | -  | -  | -                     | Not specific                        |
|             | 9            | Yes                     | Hand: small quantity                        | Itching only | Both hands, axillary area & forearm | Before 90 days    | Before 70 days       | No | No | No                    | Desquamation at both hand           |

(Table 3).

3. 1 40 30  
 , 2, 4, 6  
 8 가 80-85 30 40  
 6 , , 9 90  
 , , 70 .  
 (p>0.1), 3 40  
 1 , 37 3 가  
 가 3 , , 가  
 (case 7), 6 240 가  
 1 (Table 3).

(case 8) 가 6 가 가 ,  
 (Table 3). 6 2 , 가  
 , 2 , 1  
 (Table 3). ,

(case 8) , 5 2, 4, 6 가  
 , 가 , , 3

6 2 가 , 2  
 , , ,

6 9 , 6 가 ,  
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가 1 가 ,  
 , 가 ,  
 3 가 1.5 9 가  
 , 가 5 , 3

가 , 가  
 가 (Table 3).  
 (case 2, 4, 6) 6 2 ( 2  
 가

**Table 4.** The evaluation table for occupational dermatitis

| Department | No. of case | Evaluation time of patch test | Number of sources on patch tests suggested in table 1. |   |   |   |    |    |    |    |    |                    |    |    |    |    |    |   |   |
|------------|-------------|-------------------------------|--|---|---|---|----|----|----|----|----|--------------------|----|----|----|----|----|---|---|
|            |             |                               | European standard patch test                           |   |   |   |    |    |    |    |    | 'As is' patch test |    |    |    |    |    |   |   |
|            |             |                               | 2  | 3 | 6 | 9 | 13 | 14 | 22 | 23 | 24 | 25                 | 26 | 27 | 28 | 29 | 30 |   |   |
| Production | 1           | First-48hr                    | Not evaluated  |   |   |   |    |    |    |    |    | Not evaluated      |    |    |    |    |    |   |   |
|            |             | Second-48hr                   | All negative   |   |   |   |    |    |    |    |    | ++                 | +  | ±  | ±  | +  |    |   |   |
|            |             | Second-96hr                   |  |   |   |   |    |    |    |    |    | ++                 | +  | ±  | ±  | -  |    |   |   |
|            | 2           | First-48hr                    | All negative   |   |   |   |    |    |    |    |    |                    |    | +  | +  | +  |    |   |   |
|            |             | Second-48hr                   | Not evaluated  |   |   |   |    |    |    |    |    |                    |    | +  | ++ | ++ |    |   |   |
|            |             | Second-96hr                   |  |   |   |   |    |    |    |    |    |                    |    | +  | ±  | ±  |    |   |   |
|            | 3           | First-48hr                    | All negative   |   |   |   |    |    |    |    |    | All negative       |    |    |    |    |    |   |   |
|            |             | Second-48hr                   | Not evaluated  |   |   |   |    |    |    |    |    | +                  |    |    |    |    |    |   |   |
|            |             | Second-96hr                   |  |   |   |   |    |    |    |    |    | +                  |    |    |    |    |    |   |   |
|            | 4           | First-48hr                    | ±  |   |   |   |    |    |    |    |    | ±                  |    | +  | ±  | +  | +  |   |   |
|            |             | Second-48hr                   | Not evaluated  |   |   |   |    |    |    |    |    |                    |    | +  | +  | ++ | ++ |   |   |
|            |             | Second-96hr                   |  |   |   |   |    |    |    |    |    |                    |    | ++ | -  | ±  | ±  |   |   |
|            | 5           | First-48hr                    | ±  | ± | + |   |    |    |    |    |    |                    | -  |    |    |    |    |   |   |
|            |             | Second-48hr                   | Not evaluated  |   |   |   |    |    |    |    |    | ±                  |    |    |    |    |    |   |   |
|            |             | Second-96hr                   |  |   |   |   |    |    |    |    |    | +                  |    |    |    |    |    |   |   |
|            | 6           | First-48hr                    |  |   |   |   |    |    | ±  | +  |    |                    |    |    |    |    | +  | + |   |
|            |             | Second-48hr                   | Not evaluated  |   |   |   |    |    |    |    |    | +                  |    |    |    |    |    |   |   |
|            |             | Second-96hr                   |  |   |   |   |    |    |    |    |    | -                  |    |    |    |    |    |   |   |
|            | 7           | First-48hr                    |  |   |   |   |    |    |    |    |    |                    |    |    |    |    |    | ± | ± |
|            |             | Second-48hr                   | Not evaluated  |   |   |   |    |    |    |    |    | ±                  |    |    |    |    |    |   |   |
|            |             | Second-96hr                   |  |   |   |   |    |    |    |    |    | -                  |    |    |    |    |    |   |   |
| Laboratory | 8           | First-48hr                    | ±  |   |   |   |    |    |    |    |    | ±                  |    |    |    |    |    |   |   |
|            |             | Second-48hr                   | Not evaluated  |   |   |   |    |    |    |    |    |                    |    |    |    |    |    |   |   |
|            |             | Second-96hr                   |  |   |   |   |    |    |    |    |    |                    |    |    |    |    |    |   |   |
| 9          | First-48hr  |                               |  |   |   |   |    | ±  |    |    |    |                    |    |    | ±  | +  | +  |   |   |
|            | Second-48hr | Not evaluated                 |  |   |   |   |    |    |    |    | +  |                    |    |    |    |    |    |   |   |
|            | Second-96hr |                               |  |   |   |   |    |    |    |    | +  |                    |    |    |    |    |    |   |   |

The empty cell indicated the negative result.

The result of no. 1, 4, 5, 7, 8, 10, 12, and 15-21 on 'European standard patch test' were all negative.

The result of no. 31 and 32 on 'As is test' were all negative.

6), 1, 4, 4. 4. 1, 4, 48 가 (Table 3). 5, 8, 2 (4-phenylenediamine) 5가



**Table 5.** The proportion of disconcurrence (%) in patch test

| No. on patch test | As Is Test<br>No. of Concurrence | No. of Disconcurrence |
|-------------------|----------------------------------|-----------------------|
| 23                | 8                                |                       |
| 24                | 7                                | 1                     |
| 25                | 8                                |                       |
| 26                | 7                                | 1                     |
| 27                | 7                                | 1                     |
| 28                | 7                                | 1                     |
| 29                | 7                                | 1                     |
| 30                | 8                                |                       |
| 31                | 8                                |                       |
| 32                | 8                                |                       |
| Total             | 67                               | 5                     |

Proportion of disconcurrence in ' As is test ' = 6.9%

3 (thiuram mix) , 4가 6 1 8 , 48  
 (mercury ammonium chloride) , 9가 가 6.9%(=5/72)  
 13 (mercapto mix) , 8 (Table 5).  
 14 (thiomersol) , 6 22  
 (captan) . 5 5. 가  
 9 (colophony) +1  
 . 96 Mathias (1989)  
 (Table 4). , Table 6 .  
 ' As is test ' 28( 2  
 ) 29( )  
 1, 2, 4, 6, 7, 9 48 가 (case 7)  
 , 96 (case 8)  
 가 1 가 .  
 48 가 가  
 26( )  
 1, 2, 4, 5, 9 48 가 ,  
 , 96 가 48 가 , 2, 4, 6  
 가 가 28, 29 ,  
 . 25( ) 26 25 1+ ,  
 1 3 , 96 ,  
 가 48 가 , 가 가  
 23( ) 6 ,  
 27( ) 4  
 (Table 4). 2, 4, 6 7가  
 ' As is test ' ,

**Table 5.** The evaluation of occupational origin

| Case Complaints of dermatoses | Criteria of Occupational dermatitis (Mathiasis, 1989) |  |  |  |   |  |   | Final evaluation for the dermatosis of occupational origin |
|-------------------------------|---|--|--|--|---|--|---|--|
|                               | 1. Diagnosis of clinical contact dermatitis           | 2. Exposure of allergen or primary irritant in workplace | 3. Consistency in the area between dermatitis and job-related exposure | 4. Association of disease occurrence with exposure | 5. Exclusion of nonoccupational factors | 6. Relief after removal of causative factors | 7. Evidence on patch test or provocation test |  |
| 1 Yes                         | Not evaluated   | +  | +  | +  | +                                       | +  | +   | Suggestive   |
| 2 Yes                         | +   | ++   | +  | +  | +                                       | +  | +   | Confirm  |
| 3 Yes                         | -   | -  | -  | -  | +                                       | +  | +   | Not possible   |
| 4 Yes                         | +   | ++   | +  | +  | +                                       | +  | +   | Confirm  |
| 5 Yes                         | -   | ++   | -  | -  | Common skin trouble & dry skin          | -  | -   | Not possible   |
| 6 Yes                         | +   | +  | +  | +  | +                                       | +  | +   | Confirm  |
| 9 Yes                         | ++  | ++   | +  | +  | +                                       | +  | +   | Suggestive   |

가 (80 85 ) (30)

28, 29 가 , (48 1+

, 96 48

가 가 2, 4, 6

3 가 .

가 , 가

가 , 3

5 가 가 .

가 -

(dermatographism)

240 가 .

가 , ' As is test ' 48

가 가 48

가 26

9 가 .

가 가 5

2, 4, 6

28, 29 , 26 1+

가 2, 4, 6 5 10

6 , 가 70 2, 4, 가 96 가가 가  
 1 , , 2 4 ,  
 가 1 , 2 4 ,  
 가 9 가 가  
 가가 가  
 9 가 가 가

6.

(1989) , Mathias  
 가  
 2, 4, 6 1, 9  
 (28 ) (29 가  
 ) , 48 , 1  
 가 가, 96 (Yushiron Cut SF-36) 1  
 가 가 1 (Yushiron Cut MIC-100K), 2  
 가 (JE 291 Superedge 44)

28, 29 ,  
 28 29 3.5 가  
 3  
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2, 4, 6 가 가

가  
 2, 4, 6 1, 9 4 ( 1, 2, 4, 9) 가  
 26 ( 가 96 가  
 ) 48 가 96 가  
 1+

40 -30 , 2가 80 -35 ,  
 4가 80 -30 , 가  
 26 1.5 15 ,  
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48

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 (Sheretz & Storrs, 1994).  
 가 , 가 ( , 1996),  
 4 가 , 가 ( , 1996).  
 , 1, 2, 4, 6, 9  
 가 , 48 가  
 가 96  
 1 (Marks and Deleo, 1992; Habif,  
 가 6 1990) 28, 29

(Alomar, 1985; Fisher, 1979).  
 가 (Mathias, 1994), 가 가 (Sprince 1994; Nethercott, 1990).  
 1, 2, 4, 6, 9 가 90% 가 가 가 가  
 5 4 가 10 50  
 26 가 , 가 , 가 , 96 가가  
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 가 (Sprince , 1994). Finn chamber  
 가 가 scanpor tape가 3 scanpor tape 가  
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 ( ), , 가 가 가 가 가  
 가 가 , 2  
 가 (Alomar, 1994; , 1996).  
 가 (Alomer, 1994).  
 가 (provocation test)  
 가 ,  
 (Sprince , 1994), 가 1990 ( , )  
 (Rycroft, 1990), 1991 가 ( , 1991)  
 1982). 가 ( , 1991)  
 80%가 가 , (Marks & Deleo, 1992), ( , 1996)  
 (Boer , 1989; Grattan (1996)  
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3 2 Mathias(1989) 7가  
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28 ( ), 29 ( )  
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2004;16(7):18-41.

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6 3 1995. pp 100-3.

가

1991;29(3):298-303.

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Working Fluid

( ) 1+  
, Mathias(1989) 7가

1990;28(3):283-7.

- 1996;29(3):617-37.
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