Fluororesin products for various pharmaceutical and pharmaceutical intermediate manufacturing processes

Lining tank (PTFE), lining piping (PTFE, PFA), lining valve (PTFE, PFA), insertion tube (PTFE, PFA), gasket (PTFE), bellows (PTFE, PFA)
Flexible hose (PTFE, PFA), pliable hose (PTFE, PFA)

・ PFAS used in the products is PTFE and PFA, which are polymer materials, and there is no concern about exposure, leakage, or environmental release of eluates.
(Reference: SDS of PTFE in Daikin Industries, SDS of PFA in Daikin Industries)

· This product is to be used under the following conditions.

Subject to use: Piping, storage, and reaction systems in the manufacturing process of various pharmaceuticals and pharmaceutical intermediates.
Wetted parts

Fluid to be used: The medicines themselves are diverse and cannot be identified.

Usage Environment: RT～180℃

Use Conditions: Not to be affected by fluids in the use environment and no leakage.
No elution of metal ions in chemicals

＊1 Not to contaminate medicines. Due to batch production, it must have excellent cleaning properties after manufacturing

＊1 Due to batch production, many different products are manufactured on the same line.

For this reason, chemical resistance to various chemicals is required.

Required to meet the above specification conditions, and no perfect alternative product is considered to be available at this time,
(Reference:Kogyo Chosakai Publishing Co., Ltd. Plastic Data Handbook, VALQUA Handbook Technical Section)

As mentioned above, the presence of Fluororesin products is essential for chemicals used in various pharmaceutical and pharmaceutical intermediate manufacturing processes

We propose a regulatory exemption for the above reasons.

Attachment 1: PTFE Safety Date Sheet

DAIKIN

Safety data sheet

Printing date 06.02.2023 *Version number 1* *Revision: 06.02.2023*

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Trade name: POLYFLON PTFE M-12, 18, 18F, 391S, 392, 393
Article number: *M*
1.2 Relevant identified uses of the substance or mixture and uses advised against:
No further relevant information available.

1.3 Details of the supplier of the safety data sheet
Manufacturer/Supplier:
DAIKIN INDUSTRIES, LTD. CHEMICALS DIVISION:
OSAKA UMEDA TWIN TOWERS SOUTH, 1-13-1 Umeda, Kita-ku, Osaka-shi, Osaka, 530-0001, Japan
Phone: [redacted] *Fax:* [redacted]

Further information obtainable from: *http://www.daikin.com/*
1.4 Emergency telephone number:
Japan: [redacted]
China: [redacted] *+86-21-34151689*
South Korea: [redacted]
Americas: CHEMTREC [redacted] *(Outside US/Canada:* [redacted]*)*
Europe: +49-211-179 225-0

SECTION 2: Hazard identification

2.1 Classification of the substance or mixture
Classification according to Regulation (EC) No 1272/2008
The substance is not classified, according to the CLP regulation.

2.2 Label elements
Labelling according to Regulation (EC) No 1272/2008: *Not applicable*
Signal word: *Not applicable*

SECTION 3: Composition/information on ingredients

Information on ingredients:

CAS: 9002-84-0 Polytetrafluoroethylene *100%*

SECTION 4: First aid measures

4.1 Description of first aid measures
General information: *Seek medical treatment.*
After inhalation: *In case of inhaling decomposed gases: supply fresh air and consult a doctor in case of complaints.*
After skin contact:
Immediately wash with water and soap and rinse thoroughly.
After contact with the molten product, cool rapidly with cold water.
Do not pull solidified product off the skin.
After eye contact:
Rinse opened eye for several minutes under running water.
Consult an ophthalmologist in case of complaints.
After swallowing: *If symptoms persist consult a doctor.*
4.2 Most important symptoms and effects, both acute and chronic: *No further relevant information available.*
4.3 Indication of any immediate medical attention and special treatment needed:
No further relevant information available.

SECTION 5: Firefighting measures

5.1 Extinguishing media
Suitable extinguishing agents: *Use fire extinguishing methods suitable for surrounding conditions.*
For safety reasons unsuitable extinguishing agents: *No further information available.*
5.2 Special hazards arising from the substance or mixture:
Formation of toxic gases is possible during heating or in case of fire.

5.3 Advice for firefighters:
Protective equipment:
Wear self-contained breathing apparatus and protective suit.
Do not inhale explosion gases or combustion gases.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:
Ensure adequate ventilation before entering the area.
Keep out unauthorized persons.
Wear appropriate protective devices (See Section 8 Exposure Controls/Personal Protection).
Avoid contact with eyes and skin.
Do not swallow the product.
6.2 Environmental precautions: Do not allow product to reach sewage system or any water course.
6.3 Methods and material for containment and cleaning up: Pick up mechanically.
6.4 Reference to other sections:
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

SECTION 7: Handling and storage

7.1 Precautions for safe handling:
Ensure good ventilation/exhaustion at the workplace.
Extractors are required on all machines used for thermal processing or powder handling processes.
Do not handle until all safety precautions have been read and understood.
Information about fire - and explosion protection: Keep ignition sources away - Do not smoke.
7.2 Conditions for safe storage, including any incompatibilities:
Storage
Requirements to be met by storerooms and receptacles: Store in a cool and dry location.
Information about storage in one common storage facility:
Store away from oxidising agents.
See section 10 for information on incompatible materials.
Further information about storage conditions:
Protect from heat and direct sunlight.
Store containers in a well ventilated area.
7.3 Specific end use(s): No further relevant information available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters No further information available.
Ingredients with limit values that require monitoring at the workplace: Not required.

8.2 Exposure controls
Individual protection measures, such as personal protective equipment
General protective and hygienic measures:
Wash hands before breaks and at the end of work.
Do not eat or drink while working.
Keep away from tobacco products.
Respiratory protection:
Use respiratory protective device with filters for organic and acid gas (or airline respirators in some cases), if the product is heated above 260 °C and toxic gas is formed.
Dust respirator, simplified dust respirator
Hand protection

Protective gloves

Material of gloves: Rubber

Eye/face protection

Safety glasses

Body protection: Protective work clothing

*

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

General Information	
Physical state	Powder
Colour:	Milky-white
Odour:	Odourless
Melting point/freezing point:	320-330 °C
Boiling point or initial boiling point and boiling range	Undetermined.
Flammability	Product is not flammable.
Lower and upper explosion limit	
Lower explosive limit:	No further information available.
Upper explosive limit:	Not determined.
Flash point:	Not applicable.
Decomposition temperature:	480-490 °C (1%TG)
pH	Not applicable.
Viscosity:	
Kinematic viscosity	No further information available.
Solubility	
water:	Insoluble.
Partition coefficient n-octanol/water (log value)	No further information available.
Vapour pressure:	Not applicable.
Density and/or relative density	
Density:	Not determined.
Relative density	2.1-2.2
Vapour density	No further information available.
Particle characteristics	No further information available.

9.2 Other information:

Form:	Powder
Auto-ignition temperature:	Product is not self-igniting.

Information with regard to physical hazard classes

Explosives	Not applicable
Flammable gases	Not applicable
Aerosols	Not applicable
Oxidising gases	Not applicable
Gases under pressure	Not applicable
Flammable liquids	Not applicable
Flammable solids	Not applicable
Self-reactive substances and mixtures	Not applicable
Pyrophoric liquids	Not applicable
Pyrophoric solids	Not applicable
Self-heating substances and mixtures	Not applicable
Substances and mixtures, which emit flammable gases in contact with water	Not applicable
Oxidising liquids	Not applicable
Oxidising solids	Not applicable
Organic peroxides	Not applicable
Corrosive to metals	Not applicable
Desensitised explosives	Not applicable

SECTION 10: Stability and reactivity

10.1 Reactivity No further relevant information available.
10.2 Chemical stability
Thermal decomposition / conditions to be avoided:
Even at the temperatures reached during the normal hot processing of fluoropolymers, fume that presents a potential health hazard may be generated.
To avoid thermal decomposition do not overheat.
10.3 Possibility of hazardous reactions: No dangerous reactions known under normal conditions of use.
10.4 Conditions to avoid: Keep away from heat, sparks, flame, high temperature.
10.5 Incompatible materials:
Metal powder (e.g. Al, Mg) and fluorine oxidizer. There is a danger of chemical reactions that could cause fire or explosion when the product is heated with them.
10.6 Hazardous decomposition products:
As for decomposition products, particulate matters and extremely toxic/corrosive fumes may be generated (HF, carbonyl fluoride, monomers, perfluoroisobutylene).
Decomposition products differ depending on the temperature and conditions.

SECTION 11: Toxicological information

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008
Acute toxicity no data
LD/LC50 values relevant for classification: No further information available.
Skin corrosion/irritation No further information available.
Serious eye damage/irritation No further information available.
after inhalation: No further information available.
Respiratory or skin sensitisation Based on available data, the classification criteria are not met.
Germ cell mutagenicity Based on available data, the classification criteria are not met.
Carcinogenicity Based on available data, the classification criteria are not met.
Reproductive toxicity Based on available data, the classification criteria are not met.
STOT-single exposure Based on available data, the classification criteria are not met.
STOT-repeated exposure Based on available data, the classification criteria are not met.
Aspiration hazard Based on available data, the classification criteria are not met.
Other information (about experimental toxicology): No further information available.
Subacute to chronic toxicity No further information available.
Additional toxicological information:
General effects:
Fumes generated during burning may cause "polymer fume fever" (flu-like symptoms such as fever, chill, cough).
This may last for a whole day and night.
Fumes are not absorbed in skin. No sensitizing effect known.

Effects of hydrogen fluoride:
Low concentration of hydrogen fluoride may cause feeling of dyspnea, cough, irritation in eyes, nose, throat, fever, chill for 1-2 days.
After that, dyspnea, cyanosis and pulmonary edema may be seen.
High concentration of hydrogen fluoride damages liver and kidney.

Effects of carbonyl fluoride:
Skin: Irritation or eruption
Eye: Ulcer in cornea, conjunctiva
Respiratory system: Irritation
Lung: Temporary symptoms such as cough, pain, dyspnea
Persons who have experienced lung diseases are vulnerable to toxicity caused by excessive exposure to pyrolysis products
11.2 Information on other hazards
Endocrine disrupting properties

Substance is not listed.

DAIKIN **Safety data sheet**

Printing date 06.02.2023 *Version number 1* *Revision: 06.02.2023*

Trade name: POLYFLON PTFE M-12, 18, 18F, 391S, 392, 393

*
SECTION 12: Ecological information

12.1 Toxicity
Aquatic toxicity: *No further relevant information available.*
12.2 Persistence and degradability: *The product is thought to be non-biodegradable.*
Other information: *The product is slightly biodegradable.*
12.3 Bioaccumulative potential: *No further relevant information available.*
12.4 Mobility in soil: *No further relevant information available.*
12.5 Results of PBT and vPvB assessment
PBT: *No further relevant information available.*
vPvB: *No further relevant information available.*
12.6 Endocrine disrupting properties *The product does not contain substances with endocrine disrupting properties.*
12.7 Other adverse effects: *No further relevant information available.*

SECTION 13: Disposal considerations

13.1 Waste treatment methods
Recommendation:
Landfill disposal is recommended.
In case of incineration, the temperature must be higher than 800 °C.
Treat exhaust gas such as HF in a suitable way.
Disposal must be made according to official regulations.

Uncleaned packaging
Recommendation: *Disposal must be made according to official regulations.*

*
SECTION 14: Transport information

14.1 UN number or ID number
ADR, ADN, IMDG, IATA *Not applicable*
14.2 UN proper shipping name:
ADR, ADN, IMDG, IATA *Not applicable*
14.3 Transport hazard class(es):

ADR, ADN, IMDG, IATA
Class: *Not applicable*
14.4 Packing group:
ADR, IMDG, IATA *Not applicable*
14.5 Environmental hazards:
Marine pollutant: *No*
14.6 Special precautions for user: *Not applicable.*
14.7 Maritime transport in bulk according to IMO instruments *Not applicable.*
Transport/Additional information: *Avoid direct sunlight. Make sure of no damage, corrosion, leaks on the receptacles.*
Take necessary measures for preventing cargo shift.
UN "Model Regulation": *Not applicable*

*
SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
No further relevant information available.
Labelling according to Regulation (EC) No 1272/2008 *Not applicable*
Hazard pictograms *Not applicable*
Signal word *Not applicable*
Hazard statements *Not applicable*

National regulations *No further information available.*
15.2 Chemical safety assessment: *A Chemical Safety Assessment has not been carried out.*

SECTION 16: Other information

The product is for the industrial use only. We do not guarantee the safety in case the product is used for the other purposes. When using the product for health-care application or food/feed application, consult us in advance.
This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Department issuing SDS: *EHS Department*
Contact: *http://www.daikin.com/*
Abbreviations and acronyms:
RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)
IATA-DGR: Dangerous Goods Regulations by the "International Air Transport Association" (IATA)
ICAO: International Civil Aviation Organisation
ICAO-TI: Technical Instructions by the "International Civil Aviation Organisation" (ICAO)
ADR: Accord relatif au transport international des marchandises dangereuses par route (European Agreement Concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
IATA: International Air Transport Association
GHS: Globally Harmonised System of Classification and Labelling of Chemicals
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
**** Data compared to the previous version altered.***

Attachment 2: PFA Safty Date Sheet

DAIKIN

Safety data sheet

Printing date 06.02.2023 *Version number 1* *Revision: 06.02.2023*

* SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Trade name: ***NEOFLON PFA AP-201, 202, 210, 220, 230, 201SH, 211SH, 215SH,221SH, 230SH, 231SH***
Article number: *AP2 STD*
1.2 Relevant identified uses of the substance or mixture and uses advised against:
No further relevant information available.

1.3 Details of the supplier of the safety data sheet
Manufacturer/Supplier:
DAIKIN INDUSTRIES, LTD. CHEMICALS DIVISION:
OSAKA UMEDA TWIN TOWERS SOUTH, 1-13-1 Umeda, Kita-ku, Osaka-shi, Osaka, 530-0001, Japan
Phone: [redacted] *Fax:* [redacted]

Further information obtainable from: *http://www.daikin.com/*
1.4 Emergency telephone number:
Japan: [redacted]
China: [redacted], *+86-21-34151689*
South Korea: [redacted]
Americas: CHEMTREC [redacted] *(Outside US/Canada:* [redacted]*)*
Europe: +49-211-179 225-0

SECTION 2: Hazard identification

2.1 Classification of the substance or mixture
Classification according to Regulation (EC) No 1272/2008
The product is not classified, according to the CLP regulation.

2.2 Label elements
Labelling according to Regulation (EC) No 1272/2008: *Not applicable*
Signal word: *Not applicable*

SECTION 3: Composition/information on ingredients

Information on ingredients:

CAS: 26655-00-5 Perfluoro(alkoxy alkane) *100%*
Additional information: *For the wording of the listed hazard phrases refer to section 16.*

SECTION 4: First aid measures

4.1 Description of first aid measures
General information: *Seek medical treatment.*
After inhalation: *In case of inhaling decomposed gases: supply fresh air and consult a doctor in case of complaints.*
After skin contact:
Immediately wash with water and soap and rinse thoroughly.
After contact with the molten product, cool rapidly with cold water.
Do not pull solidified product off the skin.
Consult a doctor in case of complaints.
After eye contact:
Rinse opened eye for several minutes under running water.
Consult an ophthalmologist in case of complaints.
After swallowing: *If symptoms persist consult a doctor.*
4.2 Most important symptoms and effects, both acute and chronic: *No further relevant information available.*
4.3 Indication of any immediate medical attention and special treatment needed:
No further relevant information available.

SECTION 5: Firefighting measures

5.1 Extinguishing media
Suitable extinguishing agents: *Use fire extinguishing methods suitable for surrounding conditions.*
For safety reasons unsuitable extinguishing agents: *No further information available.*
5.2 Special hazards arising from the substance or mixture:
Formation of toxic gases is possible during heating or in case of fire.

5.3 Advice for firefighters:
Protective equipment:
Wear self-contained breathing apparatus and protective suit.
Do not inhale explosion gases or combustion gases.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:
Ensure adequate ventilation before entering the area.
Keep out unauthorized persons.
Wear appropriate protective devices (See Section 8 Exposure Controls/Personal Protection).
Avoid contact with eyes and skin.
Do not swallow the product.
6.2 Environmental precautions: Do not allow product to reach sewage system or any water course.
6.3 Methods and material for containment and cleaning up: Pick up mechanically.
6.4 Reference to other sections:
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

SECTION 7: Handling and storage

7.1 Precautions for safe handling:
Ensure good ventilation/exhaustion at the workplace.
Extractors are required on all machines used for thermal processing or powder handling processes.
Do not handle until all safety precautions have been read and understood.
Information about fire - and explosion protection: Keep ignition sources away - Do not smoke.
7.2 Conditions for safe storage, including any incompatibilities:
Storage
Requirements to be met by storerooms and receptacles: Store in a cool and dry location.
Information about storage in one common storage facility:
See section 10 for information on incompatible materials.
Further information about storage conditions:
Protect from heat and direct sunlight.
Store containers in a well ventilated area.
7.3 Specific end use(s): No further relevant information available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters No further information available.
Ingredients with limit values that require monitoring at the workplace:
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

8.2 Exposure controls
Appropriate engineering controls No further data; see item 7.
Individual protection measures, such as personal protective equipment
General protective and hygienic measures:
Wash hands before breaks and at the end of work.
Do not eat or drink while working.
Keep away from tobacco products.
Respiratory protection:
Use respiratory protective device with filters for organic and acid gas (or airline respirators in some cases), if the product is heated above 260 °C and toxic gas is formed.
Dust respirator, simplified dust respirator
Hand protection

Protective gloves

Material of gloves: Rubber

Eye/face protection

Safety glasses

Body protection: Protective work clothing

*

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

General Information	
Physical state	Powder
Colour:	Whitish
Odour:	Odourless
Odour threshold:	Not determined.
Melting point/freezing point:	300 °C
Boiling point or initial boiling point and boiling range	Undetermined.
Flammability	Not determined.
Lower and upper explosion limit	
Lower explosive limit:	No further information available.
Upper explosive limit:	Not determined.
Flash point:	Not applicable.
Decomposition temperature:	No further information available.
pH	Not applicable.
Viscosity:	
Kinematic viscosity	Not applicable.
Dynamic:	Not applicable.
Solubility	
water:	Not miscible or difficult to mix.
Partition coefficient n-octanol/water (log value)	No further information available.
Vapour pressure:	No further information available.
Density and/or relative density	
Density at 25 °C:	2.1-2.2 g/cm³
Relative density	Not determined.
Vapour density	Not applicable.
Particle characteristics	No further information available.

9.2 Other information:

Form:	Pellets
Auto-ignition temperature:	Product is not self-igniting.
Explosive properties:	Product does not present an explosion hazard.
Evaporation rate	Not applicable.

Information with regard to physical hazard classes

Explosives	Not applicable
Flammable gases	Not applicable
Aerosols	Not applicable
Oxidising gases	Not applicable
Gases under pressure	Not applicable
Flammable liquids	Not applicable
Flammable solids	Not applicable
Self-reactive substances and mixtures	Not applicable
Pyrophoric liquids	Not applicable
Pyrophoric solids	Not applicable
Self-heating substances and mixtures	Not applicable
Substances and mixtures, which emit flammable gases	
in contact with water	Not applicable
Oxidising liquids	Not applicable
Oxidising solids	Not applicable

Organic peroxides	Not applicable
Corrosive to metals	Not applicable
Desensitised explosives	Not applicable

SECTION 10: Stability and reactivity

10.1 Reactivity No further relevant information available.
10.2 Chemical stability
Thermal decomposition / conditions to be avoided: To avoid thermal decomposition do not overheat.
10.3 Possibility of hazardous reactions: No dangerous reactions known under normal conditions of use.
10.4 Conditions to avoid: Keep away from heat, sparks, flame, high temperature.
10.5 Incompatible materials:
Metal powder (e.g. Al, Mg) and fluorine oxidizer. There is a danger of chemical reactions that could cause fire or explosion when the product is heated with them.
10.6 Hazardous decomposition products:
As for decomposition products, particulate matters and extremely toxic/corrosive fumes may be generated (HF, carbonyl fluoride, monomers, perfluoroisobutylene).
Decomposition products differ depending on the temperature and conditions.

SECTION 11: Toxicological information

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008
Acute toxicity Based on available data, the classification criteria are not met.
LD/LC50 values relevant for classification: No further information available.
Skin corrosion/irritation No further information available.
Serious eye damage/irritation No further information available.
after inhalation: No further information available.
Respiratory or skin sensitisation Based on available data, the classification criteria are not met.
Germ cell mutagenicity Based on available data, the classification criteria are not met.
Carcinogenicity Based on available data, the classification criteria are not met.
Reproductive toxicity Based on available data, the classification criteria are not met.
STOT-single exposure Based on available data, the classification criteria are not met.
STOT-repeated exposure Based on available data, the classification criteria are not met.
Aspiration hazard Based on available data, the classification criteria are not met.
Other information (about experimental toxicology): No further information available.
Subacute to chronic toxicity No further information available.
Additional toxicological information:
General effects:
Fumes generated during burning may cause "polymer fume fever" (flu-like symptoms such as fever, chill, cough). This may last for a whole day and night.
Fumes are not absorbed in skin. No sensitizing effect known.

Effects of hydrogen fluoride:
Low concentration of hydrogen fluoride may cause feeling of dyspnea, cough, irritation in eyes, nose, throat, fever, chill for 1-2 days.
After that, dyspnea, cyanosis and pulmonary edema may be seen.
High concentration of hydrogen fluoride damages liver and kidney.

Effects of carbonyl fluoride:
Skin: Irritation or eruption
Eye: Ulcer in cornea, conjunctiva
Respiratory system: Irritation
Lung: Temporary symptoms such as cough, pain, dyspnea
Persons who have experienced lung diseases are vulnerable to toxicity caused by excessive exposure to pyrolysis products
11.2 Information on other hazards
Endocrine disrupting properties

None of the ingredients is listed.

*
SECTION 12: Ecological information

12.1 Toxicity
Aquatic toxicity: No further relevant information available.
12.2 Persistence and degradability: The product is thought to be non-biodegradable.
Other information: The product is insoluble in water and the biodegradation and ecotoxicity is expected to be low.
12.3 Bioaccumulative potential: No further relevant information available.
12.4 Mobility in soil: No further relevant information available.
12.5 Results of PBT and vPvB assessment
PBT: No further relevant information available.
vPvB: No further relevant information available.
12.6 Endocrine disrupting properties For information on endocrine disrupting properties see section 11.
12.7 Other adverse effects:
Ecotoxical effects: no data

SECTION 13: Disposal considerations

13.1 Waste treatment methods
Recommendation:
Landfill disposal is recommended.
In case of incineration, the temperature must be higher than 800 °C.
Treat exhaust gas such as HF in a suitable way.
Disposal must be made according to official regulations.

Uncleaned packaging
Recommendation: Disposal must be made according to official regulations.

SECTION 14: Transport information

14.1 UN number or ID number	
ADR, ADN, IMDG, IATA	Not applicable
14.2 UN proper shipping name:	
ADR, ADN, IMDG, IATA	Not applicable
14.3 Transport hazard class(es):	
ADR, ADN, IMDG, IATA	
Class:	Not applicable
14.4 Packing group:	
ADR, IMDG, IATA	Not applicable
14.5 Environmental hazards:	
Marine pollutant:	No
14.6 Special precautions for user:	Not applicable.
14.7 Maritime transport in bulk according to IMO instruments	Not applicable.
Transport/Additional information:	Avoid direct sunlight. Make sure of no damage, corrosion, leaks on the receptacles. Take necessary measures for preventing cargo shift.
UN "Model Regulation":	Not applicable

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
No further relevant information available.
Labelling according to Regulation (EC) No 1272/2008 Not applicable
Hazard pictograms Not applicable
Signal word Not applicable
Hazard statements Not applicable

National regulations No further information available.
15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

SECTION 16: Other information

The product is for the industrial use only. We do not guarantee the safety in case the product is used for the other purposes. When using the product for health-care application or food/feed application, consult us in advance.
This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Department issuing SDS: *EHS Department*
Contact: *http://www.daikin.com/*
Abbreviations and acronyms:
ADR: Accord relatif au transport international des marchandises dangereuses par route (European Agreement Concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
IATA: International Air Transport Association
GHS: Globally Harmonised System of Classification and Labelling of Chemicals
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
**** Data compared to the previous version altered.***

Attachment 3: Chemical resistance of various resins

(176) Chemical Resistance of Various Plastics

◎ Superior: weight change < ±2% ○ Good: 2 to +14%, −2 to −3%

Environmental agent \ Resin name / Test conditions	Vinyl chloride resin Stress-free condition by 1 month immersion test at 21°C and 60°C unless otherwise specifically mentioned	Vinylidene chloride resin Stress-free condition by 1 month immersion test at 52°C for disc-shaped samples with 1/8" thick and 2" diameter	Polyethylene (low density) Stress-free condition by 1 month immersion test at 52° C for disc-shaped samples with 1/8" × 2"
Environment 1 (High humidity)	◎	◎	◎
2 (Factory)	◎	Discolored at high temperatures	◎
3 (Ship)	◎	◎	◎
4 (Countryside)	◎	◎	◎
5 (Salt spray)	◎	◎	◎
Sulfuric acid	10% 70°C : △, 30% Room temperature ◎, 98% Room temperature △	98% : △ Discolored, Hardened	Discolored
Nitric acid	◎	65% : ○ Discolored, Hardened	Concentrated: Cracked
Hydrochloric acid	Up to 35% : ◎	35% : ○ Dark brown, Brittle	Slightly discolored
Hydrofluoric acid	50% 22°C : ◎, 60°C : ×	48% : ○ Discolored, Hardened	◎
Chlorine	◎	Saturated : ◎	Slightly discolored
Hydrogen sulfide	◎	◎	Barely discolored
Sulfur dioxide	Dry gas : ◎, Wet gas : ○	Dry gas : ◎	◎
Arsenic acid	80% : ◎	Concentrated : ◎	Concentrated : ◎
Boric acid	◎	◎	Saturated : ◎
Phosphoric acid	70 to 80% : ○, 85% : ×	85% : ×	◎
Potassium hydroxide	◎	○ Discolored, Hardened	Slightly discolored
Sodium hydroxide	◎	50% : ○ Discolored, Hardened	Slightly discolored
Ammonia	Dry gas : ◎, Wet gas : ×	×	Slightly swollen
Anhydrous ammonia	◎	Dark color	◎
Calcium hydroxide	×	×	Significantly brittle
Water	◎	◎	◎
Sodium chloride	◎	◎	◎
Ammonium nitrate	◎	Saturated: Slightly hardened	◎
Sodium nitrate	◎	◎	◎
Calcium carbonate	◎	◎	◎
Magnesium carbonate	◎	◎	◎
Calcium chloride	◎	15% : Dark color, Hardened	◎
Magnesium chloride	◎	◎	◎
Magnesium nitrate	◎	◎	◎
Magnesium sulfate	◎	◎	◎
Zinc sulfate	◎	◎	◎
Zinc chloride	◎	◎	◎
Sodium hydrogen sulfate	◎	◎	◎
Hydrogen peroxide	◎	◎	◎
Chromic acid	10%, 22.2°C : ◎, 50% : ×	◎	50% : ◎
Potassium dichromate	◎	◎	◎
Acetic acid	10, 80%, 22°C : ◎ Glacial acetic acid 22°C : ◎, 60°C : ×	Glacial acetic acid ◎ (Slightly brittle)	Slightly swollen
Acetic anhydride	×	Softened	Slightly swollen
Sodium acetate	◎	◎	Slightly swollen
Formic acid	22°C : ◎, 60°C : ×	○ : Hardened, Brittle	◎
Maleic anhydride		◎	◎
Citric acid	◎	◎	◎
Fatty acid	◎	◎ Turned dark brown	◎
Phthalic anhydride	—	◎	◎
Hydrocarbon	×	Softened	Swollen, cracked
Alcohol	<96%, 60°C : ◎	Slightly softened	◎
Isopropyl alcohol	○	◎	◎
Butyl alcohol	◎	×	Slightly discolored and swollen
Glycerin	◎	◎	◎
Glycol	◎	◎	◎
Ester	×	Softened	Slightly swollen
Ethyl acetate	×	× Softened	Slightly swollen
Ethyl chloride	×	Room temperature: ×	Slightly swollen
Ketone	×	Softened	Slightly swollen
Acetaldehyde	×	○	◎
Urea	◎	◎	◎
Detergent	◎	Slightly discolored	Soap solution : ◎
Tar oil	◎	—	◎
Rosin	Wood rosin, Room temperature : ×	Wood rosin, Room temperature : ×	Wood rosin, Room temperature : ×
Chlorinated solvent	CCl_4 : ×	Slightly softened	Swollen

Note: * Use limit temperature is a maximum temperature at which the resin is usable.

△ Acceptable: +14 to +19%, −3 to −4% × Unacceptable: unusable This evaluation is by W.H. Adans

Polypropylene	Polystyrene (for general use)	ABS resin	AS resin
Test results obtained at room temperature unless otherwise specifically mentioned	Immersed at 21°C for 7 days unless otherwise specifically mentioned	Immersed at 21°C for 7 days	Immersed at 21°C for 7 days
◎	◎	◎	◎
◎	◎	◎	◎
◎	◎	◎	◎
◎	◎	◎	◎
◎	◎	◎	◎
2 to 10%, 100°C : ◎ 100% : ×	10, 50% : ○, Concentrated : ×	10% : ◎	30% : ◎
Fume : ×, 50% 60°C : ◎	20, 70% : ×	10% : Slightly affected	—
30% 60°C : ◎, 10% 100°C : ○ 38 to 40% 20°C : ◎	10% : ◎, 30% : △ 1% : △, 48% : ×	10% : ◎ 10% : ◎, Concentrated : ×	10% : ◎ 10% : ◎
Dry gas : △, Wet gas : △, Liquid : ×	◎	Anhydrous liquid : ×	◎
◎	×	◎	◎
Gas, 100°C : ◎	—	Slightly affected by dry and wet gases. Stained	—
◎	—	—	—
◎	◎	◎	◎
85% 100°C : ◎	50% : ◎	Concentrated : ◎	Concentrated : ◎
◎	10~30% : ◎, Saturated : ○	10% : ◎	10% : ◎
◎	◎	10% : ◎	10% : ◎
30% 20°C : ◎ Liquid ○	—	Ammonia hydroxide ◎ Gas or liquid : ×	◎ —
◎	◎	◎	◎
◎	Saturated : ◎	◎	◎
Total concentration Use limit temperature ✱ : ◎	◎	10% : ◎	10% : ◎
◎	◎	◎	—
Total concentration, Use limit temperature ✱ : ◎	Total concentration Use limit temperature ✱ : ◎	◎	◎
—	◎	◎	◎
—	◎	◎	◎
Total concentration, 90°C : ◎	◎	◎	◎
◎	◎	◎	◎
—	◎	◎	◎
Total concentration, Room temperature to 60°C : ◎ Total concentration, Use limit temperature ✱ : ◎	◎	◎	◎
—	◎	◎	◎
—	◎	◎	—
30% 20°C : ◎, 30% 48.9°C : ×	◎	◎	◎
1%, 60°C : ◎, 10%, 60°C : ○	20% : ◎	6% Slightly affected Slight liquid stain	6% : ◎
◎	◎	◎	◎
100% Glacial acetic acid < 20°C : ◎ 10% < 60°C : ◎	5, 25% : ◎ Glacial acetic acid : ×	5% : ◎	5% : ◎
○	—	△*	—
Total concentration Use limit temperature ✱ : ◎	◎	◎	◎
100% : ◎ 10%, 60°C : ◎	90% : △	10% : ◎	10% : ◎
—	—	—	—
10%, 60°C : ◎	10% : ◎, 20% : △	10% : ◎	10% : ◎
△	◎, 60°C : ×	◎	◎
—	—	—	—
Benzene : ◎ Toluene : ×	Benzene, Toluene, Xylene : Dissolved Ethanol : ◎	Toluene: Dissolved Slightly affected by methyl and 95% ethanol	Toluene : × Methanol 95% Ethanol : ○
◎	◎	◎	◎
—	◎	◎	◎
◎	◎	◎	◎
—	◎	◎	◎
Butyl acetate : × △ (Swollen)	Dissolved Dissolved	× ×	× ×
Room temperature : ×	×	×	—
Acetone : ◎	Acetne : ×, MEK : Dissolved	Generally dissolved	×
○	△*	×	—
—	—	—	—
◎	◎	◎	◎
—	◎	◎	◎
Wood rosin, Room temperature : × CCl_4 : ×	—	—	—
	CCl_4 : Dissolved Paracol : ×	Generally affected	△

Environmental agent \ Resin name / Test conditions	Acrylic resin Data obtained at room temperature unless otherwise specifically mentioned	Trifluorochloroethylene resin Immersion test at room temperature	Tetrafluoroethylene resin At room temperature unless otherwise specifically mentioned
Environment 1 (High humidity)	◎	◎	◎
2 (Factory)	◎	◎	◎
3 (Ship)	◎	◎	◎
4 (Countryside)	◎	◎	◎
5 (Salt spray)	◎	◎	◎
Sulfuric acid	Weak acid (60%) : ○, Strong acid : ×	◎	30%, 12 months, 71℃ : No weight change ◎
Nitric acid	10% Room temperature : △, 10% 70℃ : ×, 30% 70℃ ×	◎	10% 24℃ : No weight change 71℃ : +0.1%
Hydrochloric acid	38%, Room temperature : ○	◎	Room temperature, No weight change at 10% to 20% ◎
Hydrofluoric acid	Weak acid (30%) : ○, Strong acid : ×	◎	≦60%, Room temperature to 100℃ : ◎
Chlorine	Dry gas : ○, Wet gas : ×	◎	Dry gas, wet gas, liquid, Use limit temperature * : ◎
Hydrogen sulfide	◎	◎	◎
Sulfur dioxide	Dry gas : ○, Wet gas : ×	◎	◎
Arsenic acid	○	◎	◎
Boric acid	◎	◎	Total concentration 200℃ : ◎
Phosphoric acid	50% Room temperature : ○, 50% 70℃ : △ 75% Room temperature : ○	◎	Total concentration Room temperature to 150℃ : ◎
Potassium hydroxide	◎	◎	Total concentration, Room temperature to 150℃ : ◎
Sodium hydroxide	◎	◎	◎ (No weight change)
Ammonia	Aqueous solution : ○	◎	Total concentration, Boiling point : ◎
Anhydrous ammonia	Yellowed	◎	◎
Calcium hydroxide	◎	◎	Aqueous solution or lime milk, 100℃ : ◎
Water	◎	◎	◎
Sodium chloride	◎	◎	Total concentration, use limit temperature * : ◎
Ammonium nitrate	◎	◎	Total concentration, boiling point : ◎
Sodium nitrate	◎	◎	Total concentration, use limit temperature * : ◎
Calcium carbonate	◎	◎	—
Magnesium carbonate	◎	◎	—
Calcium chloride	◎	◎	Total concentration, boiling point : ◎
Magnesium chloride	◎	◎	Total concentration, room temperature to boiling point : ◎
Magnesium nitrate	◎	◎	—
Magnesium sulfate	◎	◎	Total concentration, room temperature to 150℃ : ◎
Zinc sulfate	◎	◎	Total concentration, use limit temperature * : ◎
Zinc chloride	◎	◎	◎
Sodium hydrogen sulfate	◎	◎	Total concentration, use limit temperature * : ◎
Hydrogen peroxide	Up to 50% : ○	◎	◎
Chromic acid	×	◎	◎
Potassium dichromate	◎	◎	Total concentration, room temperature to boiling point : ◎
Acetic acid	Weak acid 15% : △, Strong acid : ×	◎	Total concentration, room temperature to boiling point : ◎
Acetic anhydride	×	◎	Boiling point : ◎
Sodium acetate	◎	◎	—
Formic acid	Weak acid 30% : ○, Strong acid : ×	◎	◎
Maleic anhydride	—	◎	—
Citric acid	◎	◎	Total concentration, crude cure, room temperature to boiling point : ◎
Fatty acid	◎	◎	Room temperature ~200℃ : ◎
Phthalic anhydride	—	◎	—
Hydrocarbon	×	◎	Benzene, 24℃, 12 months : +0.3% : ◎
Alcohol	Ethyl alcohol 50% : ○ Methyl alcohol 60% : ○	◎	95% ethyl alcohol 48.9℃, 12 months: no weight change
Isopropyl alcohol	Up to 50% : ○	◎	◎*
Butyl alcohol	—	◎	Boiling point : ◎
Glycerin	◎	◎	Pure or aqueous solution, Use limit temperature * : ◎
Glycol	—	◎	—
Ester	×	○	◎
Ethyl acetate	×	○	24℃, 12 months : +0.5%
Ethyl chloride	×	◎	Room temperature to boiling point : ◎
Ketone	×	◎	Acetone, boiling point : ◎
Acetaldehyde	×	◎	Total concentration, Room temperature to 100℃ : ◎
Urea	—	◎	—
Detergent	At low concentration ○ ~ ◎	◎	Soap solution : ◎
Tar oil	—	◎	—
Rosin	—	◎	Wood rosin, Room temperature ~150℃ : ◎
Chlorinated solvent	×	○	CCl_4, 24℃, 12 months : +0.6%

Vinylidene fluoride resin	Chlorinated polyether	Acetal resin	Polycarbonate
Immersion test at room temperature	Immersion test conducted at room temperature unless otherwise specifically mentioned	Room temperature	Room temperature
◎	◎	◎	◎
◎	For acid and alkali fume : ◎ For fungi production ◎	△ – ○	◎
◎	◎	◎	◎
◎	◎	◎	◎
◎	◎	◎	◎
○	◎	×	75% : ◎
○	◎	×	75% : ◎
○	50% : ◎	×	20% : ◎
○	30% : ◎	×	25% : ○ (Slightly affected)
○	<120℃ : ◎	×	Wet state : ×
○	<105℃ : ◎	Wet gas : △, Dry gas : ○	◎
◎	(×) No data	Dry gas : ○, Wet gas : ◎	◎
○	◎	×	◎
◎	◎	◎	◎
○	◎	×	10% : ◎
○	<120℃ : ◎	△ – ×	×
○	70%<120℃ : ◎	△ – ×	×
○	Gas, aqueous solution <105℃ : ◎	×	×
○	Liquid : ◎, Gas (cold) : ◎ Gas (hot) : ○	×	×
○	<120℃ : ◎	◎	◎
◎	◎	◎	◎
◎	<120℃ : ◎	◎	◎
◎	<120℃ : ◎	△	◎
◎	<120℃ : ◎	○	10% : Crazed, Cracked
◎	<120℃ : ◎	○	×
◎	<120℃ : ◎	◎	◎
◎	<120℃ : ◎	◎	◎
◎	<120℃ : ◎	◎	◎
◎	<120℃ : ◎	◎	◎
◎	<120℃ : ◎	◎	◎
◎	<120℃ : ◎	△	◎
◎	<105℃ : ◎	△	◎
◎	<105℃ : ◎	○	Total concentration, use limit temperature * : ◎
◎	90%< 65℃ : ◎ 35%<100℃ : ○	×	◎
○	Complicated results shown, test required	×	◎
◎	<120℃ : ◎	×	◎
○	◎	△	5% : ◎
○	<105℃ : ◎	○	×
○	<120℃ : ◎	◎	◎
◎	◎	×	◎
○	<120℃ : ◎	○	◎
◎	◎	◎	◎
◎	◎	○	◎
◎	< 65℃ : ◎	◎	Dimethyl ether : ◎ Benzene, Toluene : ×, Methanol : △ (Crystallization), Ethyl alcohol : ◎
◎	◎	◎	◎
◎	<105℃ : ◎	◎	◎
◎	<105℃ : ◎	◎	◎
◎	< 65℃ : ◎	◎	◎
◎	<105℃ : ◎	—	◎
○	Butyl acetate, 60℃ : ◎, Methyl acetate : ◎		×
○	< 65℃ : ◎	◎	×
○	<105℃ : ◎	◎	×
△ (Slightly degraded by acetone)	< 65℃ : ◎	◎	Acetone : × (Crystallization)
○	< 65℃ : ◎	◎	×
○	<120℃ : ◎	◎	◎
○	<120℃ : ◎	△ – ○	2% : ◎
◎	<105℃ : ◎	◎	—
◎	120℃ : ◎	◎	Wood rosin, Room temperature : ×
◎	<105℃ CCl_4 : ◎	◎	CCl_4 : Crazed, Stress cracking

Environmental agent \ Resin name / Test conditions	Polyamide	Phenolic resin	Phenoxy resin
	Room temperature	Numerical value indicates weight increase after immersion at room temperature for 7	Weight change in 7 days is indicated by (%) Temperature: room temperature
Environment 1 (High humidity)	◎	◎	◎
2 (Factory)	◎	◎	◎
3 (Ship)	◎	◎	◎
4 (Countryside)	◎	◎	◎
5 (Salt spray)	◎	◎	◎
Sulfuric acid	×	30% : 0.98	38% : 0.21
Nitric acid	×	10% : 1.97	Weight increase, dimension increase
Hydrochloric acid	×	10% : 1.49	10% : 0.25, Weight increase
Hydrofluoric acid	×	≦60%, Room temperature to 100°C : ◎ (Carbon filling)	Concentrated: weight increase in 0.16 Dimension increase in 0% to 0.36% —
Chlorine	◎	Dry gas, wet gas, room temperature to 80°C : ◎ (Carbon filling)	×
Hydrogen sulfide	◎	—	◎
Sulfur dioxide	◎	No change at room temperature in 72 h ◎	◎
Arsenic acid	◎	◎	◎
Boric acid	△		◎
Phosphoric acid	△ – ×	1 to 85%, Room temperature to 100°C : ◎	◎
Potassium hydroxide	◎	×	◎
Sodium hydroxide	◎	1% : 0.85, 10% : 2.78	◎
Ammonia	◎	—	—
Anhydrous ammonia	◎	0% : No weight change	◎
Calcium hydroxide	×	—	◎
Water	◎ (Dimension change occurred)	1.06	◎ (Absorbed, dimension change occurred)
Sodium chloride	◎	Total concentration, use limit temperature ✱ : ◎	◎
Ammonium nitrate	◎	◎	◎
Sodium nitrate	◎	Total concentration, use limit temperature ✱ : ◎	◎
Calcium carbonate	◎	—	◎
Magnesium carbonate	◎		◎
Calcium chloride	◎	5% : 1.04	◎
Magnesium chloride	◎	Total concentration, room temperature to 120°C : ◎	◎
Magnesium nitrate	◎		◎
Magnesium sulfate	◎	Total concentration, room temperature to 95% : ◎ (Glass-reinforced)	◎
Zinc sulfate	◎	Total concentration, use limit temperature ✱ : ◎	◎
Zinc chloride	Dissolved at high temperature	—	◎
Sodium hydrogen sulfate	Total concentration, use limit temperature ✱ : ◎	5% : 1.05, 10% : 0.524	◎
Hydrogen peroxide	△	3% : 1.04	0.4, Dimension change
Chromic acid	×	×	◎
Potassium dichromate	×	90%, room temperature : △	◎
Acetic acid	×	5% : 0.98	Swollen, dimension increased
Acetic anhydride	×	—	—
Sodium acetate	◎		◎
Formic acid	×	25% room temperature : ◎, 50% room temperature : ◎ 90% room temperature : ◎	—
Maleic anhydride	—	—	◎
Citric acid	△	10% : 0.655	◎
Fatty acid	◎	—	Stress cracking
Phthalic anhydride			◎
Hydrocarbon	◎	Toluene : 0.016	Toluene: Increase in 8.2
Alcohol	○ (Affected, dimension change occurred)	95% ethanol : 0.041	95% ethanol : 4.3
Isopropyl alcohol	○ (Affected)	○	Stress cracking
Butyl alcohol	◎	◎	Stress cracking
Glycerin	○ (Affected)	◎	Increase in 0.12
Glycol	○ (Affected)		0.03, Dimension change
Ester	◎	Butyl acetate ◎ Methyl acetate : ◎	Swollen
Ethyl acetate	◎	0.8%	Swollen
Ethyl chloride	◎	—	×
Ketone	◎	Acetone : 0.086	Swollen
Acetaldehyde	◎	40%, 60°C : ◎	—
Urea	—	—	◎
Detergent	◎	Soap solution : ◎	Increase in 0.26, Stress cracking
Tar oil	◎	—	Stress cracking
Rosin	◎	—	◎
Chlorinated solvent	◎	CCl_4 : 0.906	CCl_4 : Increase in 0.09

Urea resin (α-cellulose filling casting)	Melamine resin (α-cellulose filling casting)	Alkyd resin (mineral filling)	Polyester (glass fiber-reinforced)
Room temperature unless otherwise specifically mentioned	Room temperature unless otherwise specifically mentioned	Room temperature	Room temperature
Swollen and cracked in long term ◎ × ◎ ×	Dimension changed in long term ◎ ◎ ◎ ◎	Not affected by sunlight	◎ ◎ ◎ ◎ ◎
24°C, 7 days : ×	1%, 23.9°C, 7 days : ◎	—	50% : △ - ○
△ (Long term, low concentration ×) △ (Long term, low concentration ×)	× Low concentration : ◎	Not affected by dilute acid Not affected by organic solvent	20% : △ △
△ (Long term, low concentration ×)	—	—	×
×	×	Not affected by alkali	△
—	○	Affected by concentrated acid	◎
—	—	—	△
◎	◎	—	◎ 71°C : ◎, 100°C : △
—	—	—	○
△ (Long term, low concentration ×)	Discolored 10%, 24°C, 7 days : ◎	—	× ×
—	—	—	Ammonium hydroxide : ○
—	—	—	Liquid : ×, Gas (cold) : ×, Gas (hot) : ×
Short term : ○, Long term : ×	Long term : × ◎	Weight increase in 0.15% to 0.8% (ASTM D 570)	○ ◎ (× at high temperature)
Total concentration, use limit temperature ∗ : ◎	◎	—	○
Total concentration, use limit temperature ∗ : ◎	Total concentration, use limit temperature ∗ : ◎	—	○ ○ ○ ○
—	—	—	○
◎	◎	—	○
◎	◎	—	○
—	—	—	—
◎	—	—	Total concentration, room temperature to 95°C : ◎
Total concentration, use limit temperature ∗ : ◎ Total concentration, use limit temperature ∗ : ◎ Total concentration, use limit temperature ∗ : ◎	◎ Total concentration, use limit temperature ∗ : ◎ Total concentration, use limit temperature ∗ : ◎	— Total concentration, use limit temperature ∗ : ◎ Total concentration, use limit temperature ∗ : ◎	○ ○ ○
—	—	—	≥30%, 71°C : ×
5% : ×	Slightly affected at 5% and 24°C in 4 hours	—	△ - ○
—	◎	—	○
—	—	—	75%, 71°C : ○
—	—	—	×
—	—	—	○
—	—	—	△
—	—	—	—
10% : ×	10% : ◎	—	○ - ◎
—	◎	—	○
—	—	—	○
—	◎	—	△
—	◎	—	◎
—	◎	—	90°C : ◎
—	◎	—	○
—	◎	—	○
—	—	—	○
—	◎	—	△
—	—	—	—
—	○	—	△
—	—	—	×
24°C 7 日 : ◎	24°C, 7 days : ◎	—	△
—	—	—	×
—	◎	—	—
Soap solution : ◎	◎	—	○
—	—	—	—
—	—	—	—
—	CCl_4 : ○	—	△

Environmental agent \ Resin name / Test conditions		Epoxy resin (glass fiber-reinforced) Room temperature unless otherwise specifically mentioned	Diallyl phthalate resin (diallyl dilate resin) Room temperature unless otherwise specifically mentioned. Numerical value indicates weight change %	Polyalomer (ethylene-propylene copolymer) Numerical value obtained after immersion at 23°C in 1 month indicates weight change %
Environment	1 (High humidity)	◎	◎	◎
	2 (Factory)	◎	◎	◎
	3 (Ship)	◎	◎	◎
	4 (Countryside)	◎	◎	◎
	5 (Salt spray)	◎	◎	◎
Sulfuric acid		10% : ◎ (Low temperature), ○ (High temperature) 70% : ◎ (Low temperature), × (High temperature) 5% : △ (Low temperature), × (High temperature) 20% : × (Low and high temperatures)	30% : 0.48	30% : +0.01
Nitric acid		Low temperature : ○, High temperature : △	10% : +1.29 20%, 80°C : ×	70% : +0.7 Yellowed 10% : +0.1
Hydrochloric acid		—	—	—
Hydrofluoric acid		Low temperature : ◎, High temperature : ○	×	-
Chlorine		◎	◎	—
Hydrogen sulfide		◎	—	—
Sulfur dioxide		◎	—	—
Arsenic acid		◎	—	—
Boric acid		◎	◎	—
Phosphoric acid		Low temperature : ◎, High temperature : ○	50% Room temperature : ◎, 50% 70°C : ○	-
Potassium hydroxide		◎	5% aqueous solution : ◎, Alcohol potash (warm) : ×	—
Sodium hydroxide		≦50%, Room temperature to 80°C : ◎	2.26%, 71.1°C : ○	10% aqueous solution : +0.01%
Ammonia		Ammonia hydroxide : ◎	1.2% aqueous solution : ◎	—
Anhydrous ammonia		Gas (low temperature) : ○, Gas (high temperature) : △, liquid : ×	—	—
Calcium hydroxide		Wet : × (low and high temperatures) Dry : ◎ (low temperature), × (high temperature)	○	—
Water		◎	◎ (+0.9% in 1 month in distilled water)	◎
Sodium chloride		◎	◎	10% aqueous solution : +0.02%
Ammonium nitrate		◎	-	—
Sodium nitrate		Low temperature : ◎, High temperature : ○	◎	—
Calcium carbonate		◎	—	—
Magnesium carbonate		◎	—	—
Calcium chloride		◎	◎	40% aqueous solution : +0.1%
Magnesium chloride		Low temperature : ◎, High temperature : ○	◎	—
Magnesium nitrate		—	—	—
Magnesium sulfate		Low temperature : ◎, High temperature : ○	◎	—
Zinc sulfate		Low temperature : ◎, High temperature : ○	◎	—
Zinc chloride		Total concentration, use limit temperature ✱ : ◎	Total concentration, Use limit temperature ✱ : ◎	—
Sodium hydrogen sulfate		◎	—	—
Hydrogen peroxide		×	—	30% : +0.1%
Chromic acid		Low temperature : ◎, High temperature : △	1.2% (71°C)	—
Potassium dichromate		10%, Room temperature : △	—	—
Acetic acid		10% : ◎ (Low temperature), △ (High temperature) 75% : △ (Low temperature), × (High temperature)	◎	5% : +0.1%
Acetic anhydride		×	—	-
Sodium acetate		Low temperature : ◎, High temperature : ○	-	—
Formic acid		50% Low temperature : ○	—	—
Maleic anhydride		—	—	-
Citric acid		Low temperature : ◎, High temperature : ○	3% : +1.2% (71°C)	10% : +0.1%
Fatty acid		Low temperature : ◎, High temperature : ○	-	Oleic acid : 0.4 to 0.7%
Phthalic anhydride		—	—	—
Hydrocarbon		Low temperature : ○, High temperature : △	0.025% : ◎	+1 to 20%
Alcohol		Low temperature : ◎, High temperature : △	+0.2% : ◎	+0.1%
Isopropyl alcohol		△	—	—
Butyl alcohol		△	◎	-
Glycerin		Pure or aqueous solution, Use limit temperature ✱ : ◎	—	+0.1%
Glycol		-	-	+0.1%
Ester		Methyl acetate, Butyl acetate : △	◎	+6 to 10%
Ethyl acetate		△	◎	—
Ethyl chloride		×	-	-
Ketone		Low temeprature : ◎, High tempreature : △	Slightly swollen : △	2 to 3%
Acetaldehyde		○	—	-
Urea		-	-	-
Detergent		Soap solution : ◎	◎	—
Tar oil		—	-	-
Rosin		-	-	-
Chlorinated solvent		CCl_4 : ○	○ - △	+10 to 20%

Ethyl cellulose	Acetyl butyl cellulose	Polystyrene (foam)	Polyurethane (foam)
Room temperature	Numerical value obtained at 20°C unless otherwise specifically mentioned, Weight change % in 1 month	Test conducted at 52°C unless otherwise specifically mentioned	Room temperature
◎	◎	◎	Gradually hydrated
○	Slightly swollen (not softened)	◎	Affected by nitrogen oxide
○	◎	◎	Very slowly hydrated
◎	◎	◎	◎
○	◎	◎	Very slowly hydrated
—	10% : +1.5%, 20% :	—	Hydrated
	Only surface was slightly eroded in 1 year		
△	Degraded in 8 months	Significantly brittle	High concentration : ×
	Significantly brittle		
○	10% : 1.4%,	Cell structure was affected	Hydrated
	Surface was slightly eroded in 1 year		
—	10% : +10%	Cell structure was affected	Hydrated
◎	+8%	◎	Hydrated
—	Wet gas : +3% Saturated solution : +6%	—	△
—	Gas >20%	—	Dry gas : ◎
—	—	—	Gradually hydrated
—	5% : +1.3%	◎	Gradually hydrated
△	30% : +1.3%, 50% : 1.6%	—	Hydrated
	75% : Degraded in 2 months		
◎	—	—	Hydrated
◎	1% aqueous solution : 1%, 10% : +1.4	—	Aqueous solution: Hydrated
	Brittle in 8 months		
◎	—	Room temperature or less : ◎	Aqueous solution: Gradually hydrated
◎	—	Room temperature or less : ◎	○
—	Saturated solution : +1.7%	Significantly brittle	×
◎	◎	◎	Gradually hydrated
◎	10% : +1.3% Saturated solution : 0.8%	◎	Dry : ◎
—	Solid : +0.2%,	—	Gradually oxidized
	10% aqueous solution : +1.7%		
◎	Solid : +0.08%, 10% aqueous solution	◎	Dry : ◎
	: 1.5%, Saturated solution : 0.9%		
◎	—	—	Hydrated
○	—	◎	Dry : ◎
○	2.5% aqueous solution : 1.5%	◎	Dry : ◎
	40% : +0.4%		
—	—	◎	Dry : ◎
—	—	◎	Dry : ◎
—	Total concentration, room temperature to 60°C : ◎	◎	Dry : ◎
—	—	◎	Dry : ◎
—	Saturated solution : +1.6%	◎	Dry : ◎
◎	1% : +1.3% (38°C, After 3 days)	◎	Dry : ◎
—	3% : 1.7%, 5% : 1.4%	—	Polyester type was oxidized
×	6% : +2% (38°C, After 8 days)	Cell structure was affected	×
—	—	—	Oxidized
Diluted : ○, Concentrated : ×	5% : +3%, 10% : +5%,	Glacial acetic acid: Softened	High concentration : ×
	30% : 14%		
△	Degraded	—	Gradually reacted
◎	3% : +1.3% (38°C, After 3 days)	—	Dry : ◎
—	—	—	Hydrated
△	—	—	◎
—	10% : +1.6%	Cell structure was affected	Gradually hydrated
	(60°C, After 4 months)		
Softened	Oleic acid : −2.3	Cell wall was slightly cracked	△
△	—	◎	Room temperature : ◎
×	In fatty acid ○ − ◎, Some degraded	—	Slightly expanded
×	15% : +2%	—	Expanded a little
×	>20%	Cell structure was slightly broken	Swollen a little
×	+3.6%	Slightly cracked	—
×	+0.03%	◎	◎
×	0.8%	◎	◎
×	Degraded	—	Expanded a little
×	×	—	Expanded a little
×	—	—	Expanded a little
×	Degraded	—	Swollen
×	—	—	◎ ~ ○
◎	—	—	◎
◎	◎	Cell structure was slightly broken	Gradually hydrated
×	—	—	△
◎	—	—	◎
×	Swollen, Degraded	—	Slightly expanded

(Yanagihara: plastics, 22(5), 53(1971))

Attachment 4: Heat resistance of various resins

1.2.16 Heat resistance temperature

(90) Usable temperature of various plastics

1) Long-term heat resistance temperature (90 days or more)

Material	Long-term heat resistance temperature (90 days or more) (°C)	Material	Long-term heat resistance temperature (90 days or more) (°C)
Phenolic resin (no filler)	120 to 130	Methacrylic resin	120 to 130
Unsaturated polyester resin (cast)	90	GP-polystyrene	100
Allyl resin (cast)	90	High pressure polyethylene film	80
Epoxy resin	95 to 100	Molded polyvinyl carbazole	120
Molded polyurethane	110	Polytetrafluoroethylene film	>250
Hard vinyl chloride resin	80 to 90	Poly trifluorochloroethylene	>200
Soft vinyl chloride resin	60 to 70	Acetyl cellulose	80
Vinyl chloride vinyl acetate copolymer	80	Ebonite (S = 20%, No filler)	100

Degradation of high molecular materials, p. 237, CORONA PUBLISHING CO., LTD. (1958))

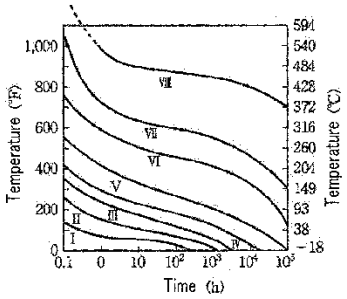
2) Useful temperature (Unit: °C)

Material	Filler	Replicated use	Continuous use	Material	Filler	Replicated use	Continuous use
Polyester	Glass fiber	135	105	Polytetrafluoroethylene		260	230 to −268
Epoxy resin	Glass fiber	150	120	Poly trifluorochloroethylene		230	200 to −196
ABS resin		80	70 to −20	Polyvinylidene fluoride			150 to −184
High density polyethylene		120	105 to −20	Chlorinated polyether		150	120
Polyvinyl chloride I		75	65 to −40	Polypropylene		150	120

(Gackenbach : Chem. Eng. Progr., **59** (10), 96 (1963))

3) Heat resistance classification

Time-temperature relationship diagram for 50% retention of mechanical properties under air heating



Region	Polymer	Region	Polymer
I	Methacrylic resin Acetyl cellulose Nitrocellulose Polyethylene (low density) Polystyrene Vinyl acetate resin Polyvinyl alcohol Vinyl chloride resin AS resin (SAN) SBR Urea resin	III	Polychlorotrifluoroethylene Vinylidene fluoride resin (PVF)
II	Polyacetal ABS resin Chlorinated polyether Ethylene vinyl acetate resin Furan resin Polyamide (nylon) Polycarbonate Polyethylene (high density) Polyethylene terephthalate Polypropylene Vinylidene chloride resin Polyurethane	IV	Alkyd resin Melamine resin Furfural resin Polyphenylene oxide (PPO) Polysulfone
		V	Thermosetting alkyl resin Diallyl dilate resin (DAP) Epoxy resin Phenolic resin Polyester Fluorine resin (PTFE)
		IV	Polybenzimidazole (PBI) Polyphenylene Silicone
		VII	Polyamideimide Polyimide
		VIII	Plastics made of future rigid linear polymer

(Oishi: plastics, **24** (2), 50 (1973))

Attachment 5: Purity of fluororesin

Elution test example of fluororesin

Eluate: concentrated nitric acid Elution temperature: room temperature

Elution time: 1+6+7 (days)

Processing method: PIFE paste extrusion method

PFA-screw extrusion method

Analytical method: ICP-MS method or flameless atomic absorption spectrometry Unit: ppb

	PTFE						PFA					
	No.1			No.2			No.1			No.2		
Element	1 day	6 days	7 days	1 day	6 days	7 days	1 day	6 days	7 days	1 day	6 days	7 days
Li	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Be	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Na	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Al	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ti	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
V	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cr	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mn	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ni	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Co	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cu	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zn	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ga	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ge	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sr	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zr	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nb	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mo	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ag	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cd	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
In	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sn	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sb	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ba	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ta	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tl	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pb	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bi	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fe	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ca	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	0.1
K	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1