



Technical Information



ORGATIX WATER SOLUBLE LINEUP

Crosslinking agent for polyvinyl alcohol (PVA)
Use as an adhesiveness improver for aqueous resin



Matsumoto Fine Chemical Co.,Ltd.

HEAD OFFICE 5-13-2, Minamiyawata, Ichikawa-shi, Chiba,
272-0023 JAPAN

TEL +81-47-393-6330
FAX +81-47-393-1063

OSAKA OFFICE Kawaramachi SF Bldg. 6F
3-4-15, Kawaramachi, Chuo-ku, Osaka, 541-0048 JAPAN
TEL +81-6-7654-6862
FAX +81-6-7655-2087

URL:<http://www.m-chem.co.jp/>

ORGATIX is a trademark for the titanium, zirconium, and other compounds created by our company. It is widely used in the paper, film, paint, ink, and adhesive industries as a highly reactive crosslinking agent with active hydrogens, such as OH and COOH groups.

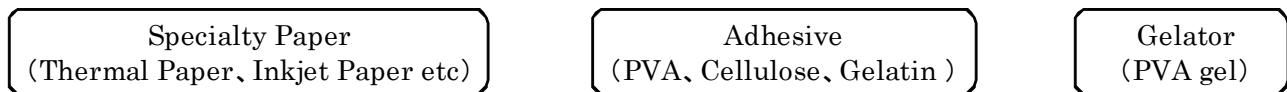
In particular, the aqueous series has recently been attracting attention as a water-resistant agent for polyvinyl alcohol (PVA) and an adhesiveness improver for aqueous resins (emulsions and dispersions).

I. As a water resistant and gelling agent for polyvinyl alcohol (PVA)

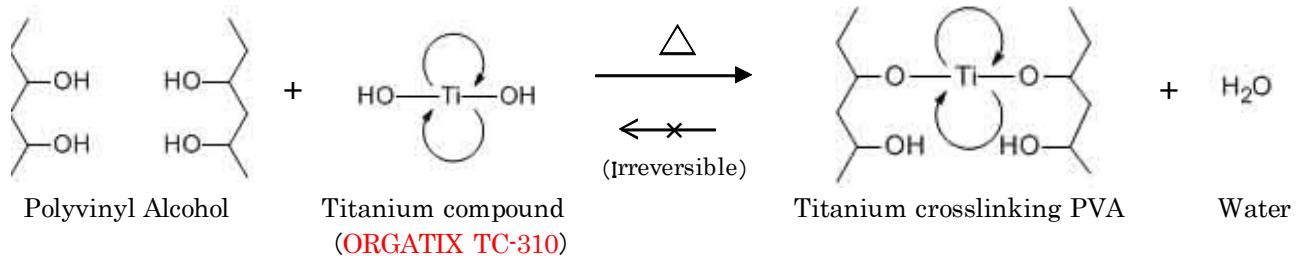
1. Characteristics:

- High reactivity: Irreversible Crosslinking reaction is possible in low temperature (40~120°C) to Hydroxyl group and Carboxyl group.
- High safety: Ames Test Negative (TC-310).

2. Major Industrial Use:



3. Chemical reaction model: (Example: ORGATIX TC-310)



4. Products list and Physical properties table

Trade name	ORGATIX TC-310	ORGATIX TC-300	ORGATIX TC-315	ORGATIX TC-335	ORGATIX TC-400	ORGATIX TC-510
Chemical Name	Titanium lactate	Titanium lactate diammonium salt	Titanium lactate (Nonflammable Type)	Titanium lactate diammonium salt (Nonflammable Type)	Titanium triethanol-amine	Titanium aminoethyl aminoethanolato
Appearance	pale yellow liquid	pale yellow liquid	pale yellow liquid	pale yellow liquid	Pale yellow to yellow clear liquid	Pale yellow to yellow liquid
Content	44%	41%	44%	35%	79%	70%
Solvent	IPA: 40% Water: 16%	IPA: 39% Water: 20%	Water: 55% IPA: 1%	Water: 50% Lactic acid: 15% IPA: less than 1%	IPA: 21%	IPA: 30%
Metal Content	8.2%	6.7%	8.2%	5.6%	8.2%	8.0%
pH	1	8.2	1	4.4	9 (10 fold dilution)	11 (10 fold dilution)
Flash Point	24.5°C	24.5°C	Not applicable	Not applicable	17°C	25.5°C
Crosslinking ability of PVA	Good	Good	Good	Medium	Very good	Good
stability in PVA	Good	Medium	Good	Good	Bad (Gelling occurs)	Medium
Inventory	✓	✓	✓	✓	✓	✓
	N/A	✓	N/A	✓	✓	✓
	✓	✓	✓	✓	✓	✓
	N/A	✓	N/A	✓	✓	✓
	✓	✓	✓	✓	✓	✓
Feature	Standard	Neutral pH	Water solvent	Mild acidity	Gelling agent	Basicity

5-1. Comparison of water resistance of PVA with various kinds of crosslinkers

Crosslinkers	Insolubility ratio(%)
ORGATIX TC-310(315)	64
ORGATIX TC-300	59
ORGATIX TC-335	35
ORGATIX TC-400	76*
ORGATIX TC-510	43
40% Glyoxal + 4wt% HCl	0
Borax	0
None	0

Additive amount : 17wt% (Crosslinker/5% aqueous PVA solution = 0.85/100 weight ratio)

PVA grade: PVA-117® (Fully Saponified PVA made by KURARAY CO., LTD. JAPAN, thereafter KURARAY)

Cure condition of PVA : 2hours×105°C

Water extraction : Immersed in boiling water for 30 minutes, filtered, and dried.

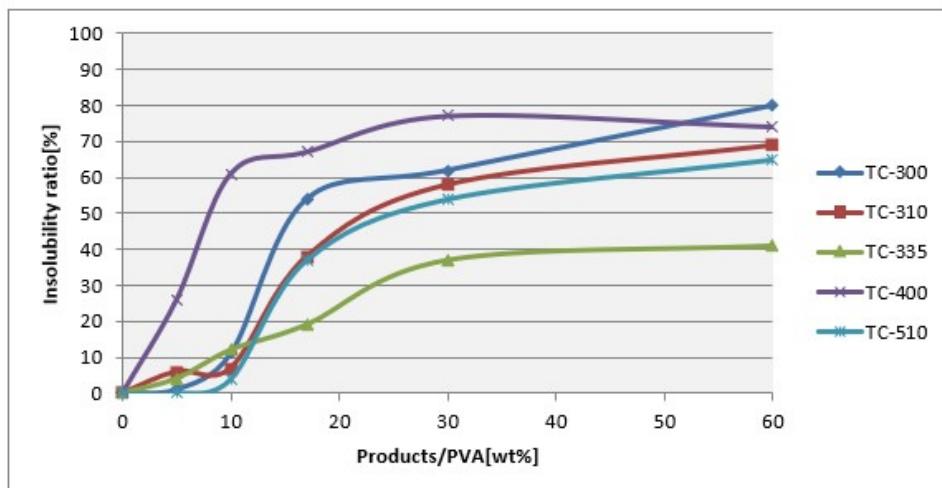
Insolubility ratio(%) : (Weight after boiling) ÷ (Weight before boiling) × 100

* Immediate gelation when added to PVA solution

5-2. Insolubility ratio vs. Additive amount (Products/PVA) of crosslinkers

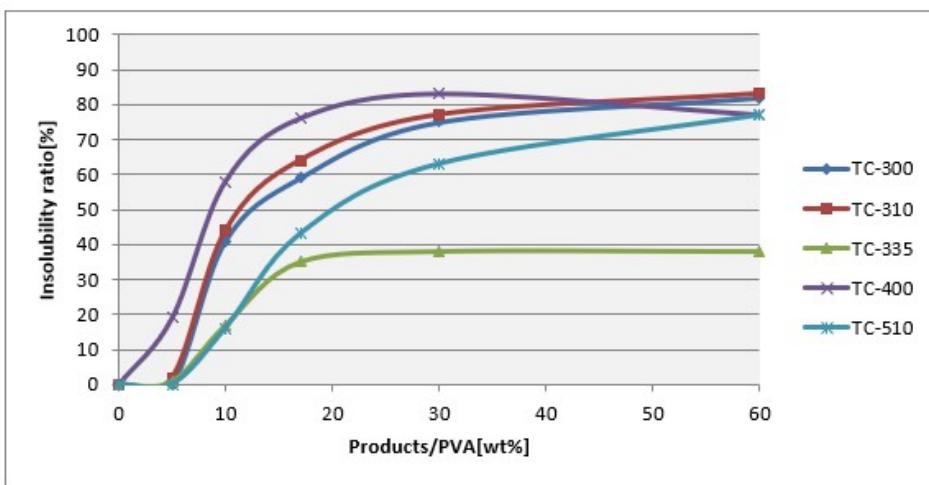
<Cure condition of PVA : 16 hours × 40°C>

Cure Condition of PVA:
16 hours × 40°C



<Cure condition of PVA : 2 hours × 105°C>

Cure Condition of PVA:
2 hours × 105°C

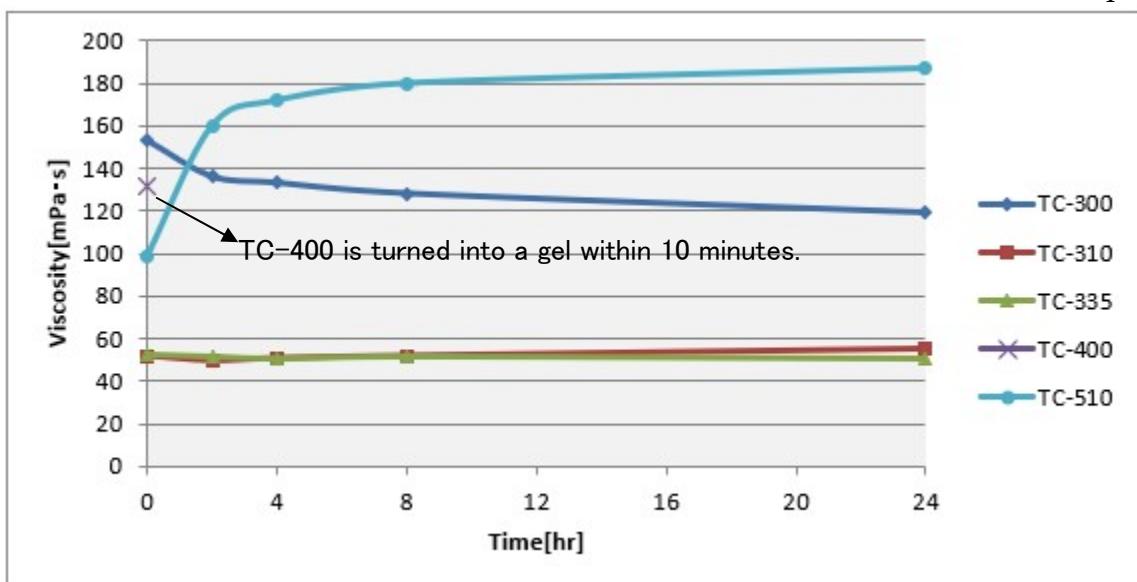


Recommendable Additive amount : You can add “10~30% of ORGATIX®”

5-3. Viscosity vs. Hour (after Orgatix® added in PVA)

Case①: Products/PVA = 17wt%

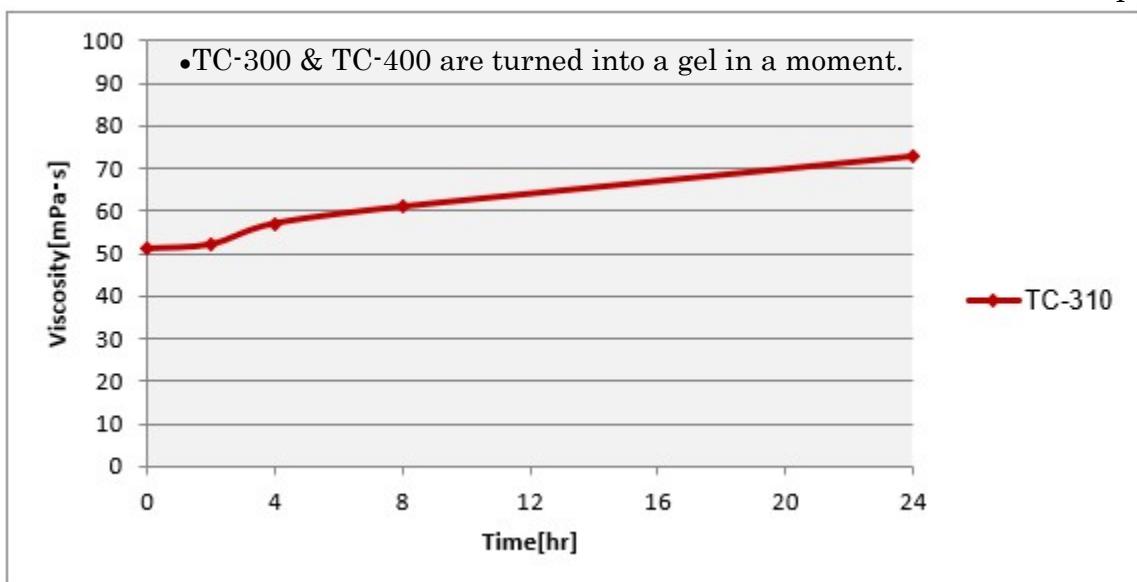
Room temperature



※ PVA grade = PVA117 (Fully Saponified PVA, made in KURARAY,JAPAN)

Case②: Products/PVA = 50wt%

Room temperature

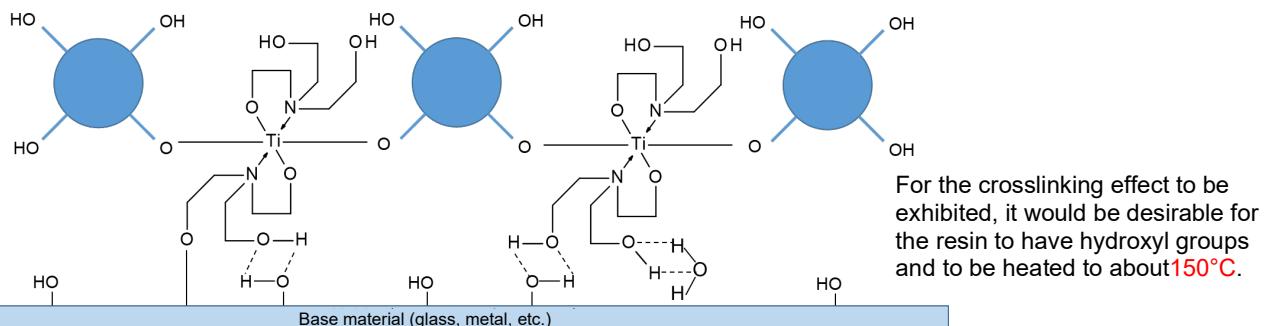


TC-310 : Viscosity may increase, depending upon additive amount (wt%).
 TC-300 : Even in low wt%, viscosity may be increased.

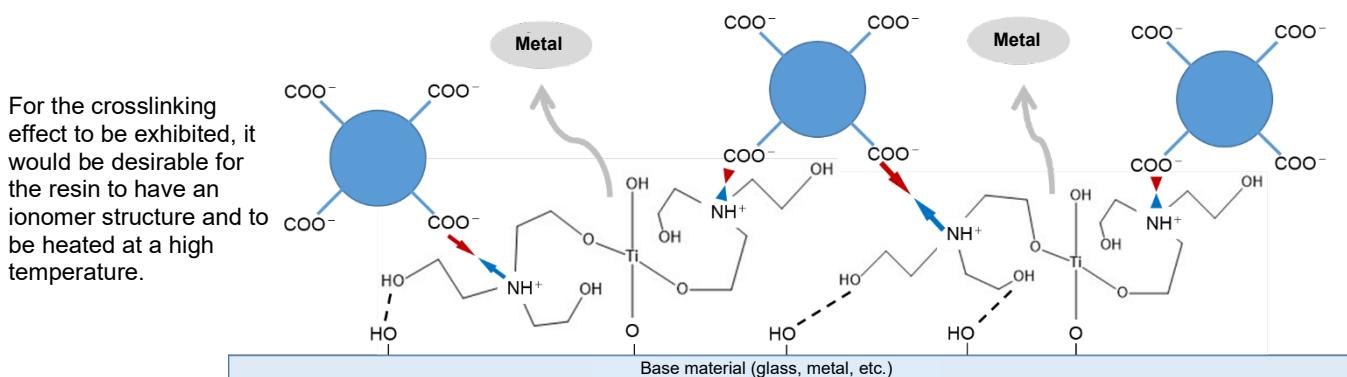
II. As an adhesiveness improver for emulsions and dispersions

ORGATIX also exhibits a crosslinking effect on aqueous resins (emulsions and dispersions) and remarkably improves adhesiveness to the base material. Employing various crosslinking agents facilitates the attainment of this effect.

○ Hydroxyl-containing aqueous resin (estimated crosslinking model diagram)



○ Ionomer-structure-containing resin (estimated crosslinking model diagram)



1. Recommended Grades

Trade name	ORGATIX TC-400	ORGATIX TC-500	ORGATIX TC-510	ORGATIX TC-750	Sample No. T-2794
Composition	Titanium triethanol-amine	Titanium diethanolamine	Titanium aminoethyl aminoethanolate	Titanium ethyl acetoacetate (Ethyl acetoacetate)	Titanium triethanolamine
Appearance	Pale yellow to yellow clear liquid	Pale yellow to yellow liquid	Pale yellow to yellow liquid	Pale yellow to reddish-orange liquid	Pale yellow to yellow liquid
Active ingredient concentration	79%	70%	70%	95% or more	77%
Solvent content	IPA: 21%	IPA: 30%	IPA: 30%	IPA: 5% or less	n-Butanol: 23%
Metal content	8.2%	8.0%	8.0%	11.0%	7.5%
pH	9 (10-fold dilution)	11 (10-fold dilution)	11 (10-fold dilution)	—	9 (10-fold dilution)
Applicable aqueous resin	General-purpose type	Ionomer structure	Fluorine emulsion	Acrylic emulsion	Ionomer structure
Remarks	General-purpose product	Made-to-order product	Made-to-order product	General-purpose product *See Notes	Product under development

Notes: TC-750 must be mixed with triethanolamine (TEA) before being used to make it water-soluble and then added. If used as is, it will hydrolyze and become inactive.

2. Evaluation of compatibility between ORGATIX and aqueous resins

Adding ORGATIX may cause gelation or thickening of the resin due to its crosslinking properties. The results of the compatibility evaluation after adding ORGATIX are shown below. However, its behavior may change depending on the presence of other additives, such as film-forming agents.

Resin	Acrylic emulsion	Acrylic styrene emulsion	Fluorine emulsion	Polyester dispersion	Polyolefin ionomer
Heating residue[%]	45	41	52	25	27
Hydroxyl value [mg-KOH/g]	77-88	60	10	6	-
pH	7.9	8.9	8	4.7	10
Results of compatibility evaluation					
TC-400	Good	Good	Good	Good	Good
TC-500	Bad	Bad	Neutral	Bad	Neutral
TC-510	Bad	Bad	Neutral	Bad	Neutral
TC-750 + TEA	Good	Bad	Good	Good	Good
T-2794	Good	Good	Good	Bad	Good
TC-300	Bad	Bad	Good	Bad	Bad
TC-310	Bad	Bad	Good	Bad	Bad

[Summary of results]

TC-400 showed high compatibility. TC-300 and TC-310, which do not have amine ligands, all showed low compatibility, and further tests were discontinued.

[Evaluation conditions]

ORGATIX additive amount: Add 5-20 wt% to the solid content of each resin.

Evaluation method: Visual check of the appearance of the sample after addition.

Good: No change;

Neutral: Showed a tendency to increase viscosity with an addition of 10% or more;

Bad: Gelling, precipitation, or aggregation occurred

3. Evaluation of adhesiveness of ORGATIX

The crosslinking performance of ORGATIX was evaluated for three types of resins, including acrylic emulsion, fluorine emulsion, and polyolefin ionomer resin, regarding its adhesiveness to glass base materials. Those that showed poor film formation were excluded from the evaluation.

3-1. For acrylic emulsion [Amount of hydroxyl group: Large]

Aqueous resin	Crosslinking agent	Additive amount [wt%]	Film-forming property	Adhesiveness
Acrylic emulsion	Not used	-	Good	Bad
	TC-400	5-20	Bad	-
	TC-750 + TEA	10	Bad	-
		20	Good	Good
	T-2794	5-20	Bad	-

[Summary of results] Adding 20% of the TC-750 + TEA mixture was found to improve adhesiveness.

3-2. For fluorine emulsion [Amount of hydroxyl group: Small]

Aqueous resin	Crosslinking agent	Additive amount [wt%]	Film-forming property	Adhesiveness
Fluorine emulsion	Not used	-	Good	Bad
	TC-400	5-20	Good	Bad
	TC-500	5	Good	Bad
	TC-510	5	Good	Good
	TC-750 + TEA	5-20	Good	Bad
	T-2794	5-20	Good	Bad

[Summary of results] Adding 5% of TC-510 was found to improve adhesiveness.

3-3. For polyolefin ionomer resin [Amount of hydroxyl group: Null]

Aqueous resin	Crosslinking agent	Additive amount [wt%]	Film-forming property	Adhesiveness
Polyolefin ionomer	Not used	-	Good	Bad
	TC-400	5	Good	Good
		10	Good	Neutral
		20	Good	Bad
	TC-500	5-20	Good	Good
	TC-510	5	Good	Good
	TC-750 + TEA	5	Good	Good
		10	Good	Neutral
		20	Good	Bad
	T-2794	5	Good	Good
		20	Good	Bad

[Summary of results] Adding 5% of each candidate agent was found to improve adhesiveness. Only in the case of TC-500 was the addition of both 5% and 10% found to have an effect of improved adhesiveness.

[Evaluation conditions]

Aqueous resin:	Product stock solution (not diluted)
ORGATIX additive amount:	5, 10, 20 wt% for the solids of each resin
Base material used:	Float glass
Conditions of film formation:	Bar Coater No. 10, 150°C × 30 minutes
Film-forming property:	After application and drying, the film was checked under a laser microscope. Good: Uniform film without air bubbles or cracks Bad: Faulty film formation or a film with whitening or cracks
Adhesiveness:	The cellophane tape was strongly pressed on the film cut in a grid (25 squares), and then pulled off to make the following judgment. Good: No peeling off (grid-like cut "Peeling off 0%") Neutral: Partial peeling off (grid-like cut "Peeling off 5-65%") Bad: Peeling off (grid-like cut "Peeling off 65% or more")

4. Evaluation of adhesiveness of ORGATIX due to differences in base materials

Using fluorine emulsion and ORGATIX TC-510 as a crosslinking agent, the difference in adhesiveness improvement effect was evaluated for glass, electrogalvanized steel sheet (SECC), aluminum (A-1100P), and stainless steel sheet (SUS304).

Base material	Aqueous resin	Crosslinking agent	Additive amount [wt%]	Film-forming property	Adhesiveness
Glass	Fluorine emulsion	TC-510	5	Good	Good
SECC				Good	Good
A-1100P				Good	Good
SUS304				Good	Good

[Summary of results] Adding 5% of an aqueous agent was found to improve adhesiveness, not only for glass but also for SECC, A-1100P, and SUS 304.

[Application conditions]

Aqueous resin: Product stock solution (not diluted)

ORGATIX additive amount: 5 wt% for the resin solids

Application conditions: Bar Coater No. 10, 150°C × 30 minutes

Film-forming property: After application and drying, the film was checked under a laser microscope.

Good: Uniform film without air bubbles or cracks

Bad: Faulty film formation or a film with whitening or cracks

Adhesiveness: The cellophane tape was strongly pressed on the film cut in a grid (25 squares), and then pulled off to make the following judgment.

Good: No peeling off (grid-like cut "Peeling off 0%")

Neutral: Partial peeling off (grid-like cut "Peeling off 5-65%")

Bad: Peeling off (grid-like cut "Peeling off 65% or more")

5. Cautions when using ORGATIX

Among several factors contributing to increased adhesiveness, the content of hydroxyl groups (existence of hydroxyl values) or ionomer structure in the aqueous resin used is effective.

In addition, while some of the resins evaluated this time have a low MFT (minimum film-forming temperature), high-temperature curing is effective for developing the crosslinking effect. If no improvement in adhesiveness is observed with room or low-temperature drying, consider drying at a higher temperature.

Due to the corrosive or flammable nature of some products, follow the instructions outlined in the SDS.

The contents of this document were created based on the data available to us at the time of creation, but do not constitute any guarantee.

Contact Us : Matsumoto Fine Chemical Co., Ltd.
5-13-2, Minamiyawata, Ichikawa-Shi
Chiba, 272-0023, Japan
Tel: +81-47-393-6330
Fax: +81-47-393-1063
<http://www.m-chem.co.jp/>