

Guidebook for Choosing Low-VOC Products in Everyday Life



- Aiming for a clean sky without photochemical smog -



1. Photochemical Smog and VOCs

Photochemical smog is caused by high concentrations of harmful photochemical oxidants. One of the causative agents of the photochemical oxidants is a group of compounds known as VOCs or Volatile Organic Compounds.

The sky over Tokyo is said to be cleaner than it used to be, but it can still be **covered with photochemical smog** depending on the weather conditions. Photochemical smog advisories may be issued especially in summer.

However, what is perhaps less known is that the causative agents are **also generated from things we use on a daily basis**.

This guidebook introduces **ideas that you can use in your daily lives** to make the sky of Tokyo even cleaner.

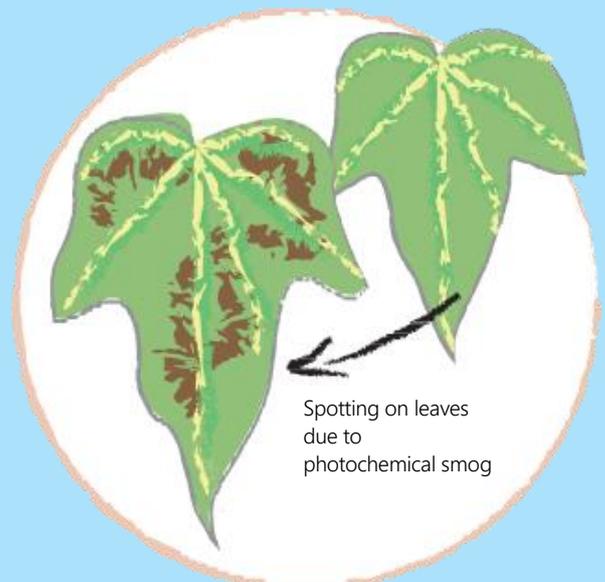
(1) Photochemical smog and photochemical oxidants

Once released into the air, some chemical substances react to sunlight to produce **new air pollutants collectively called photochemical oxidants**.

Starting in spring and going through to autumn, particularly on sunny days when there is little wind, these photochemical oxidants become highly concentrated, **causing a phenomenon called photochemical smog** in which the distance appears hazy.

Photochemical smog can **affect human health**, causing eye pain, shortness of breath, and headaches, **as well as agriculture**, causing surface spots on leaves and crop withering.

If there are high concentrations of photochemical oxidants over a sustained period, a photochemical smog advisory may be issued to **restrict outdoor activities at schools and other places**.



Spotting on leaves
due to
photochemical smog

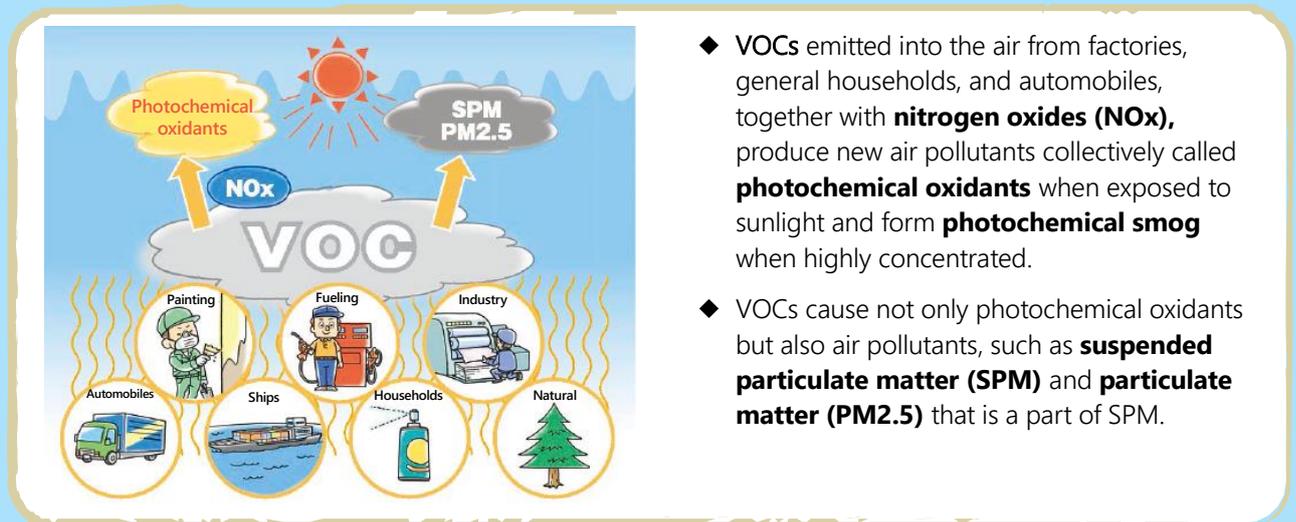
Photos: View from the Tokyo Metropolitan Government Building (sunny day on the left, photochemical smog day on the right)



(2) VOCs: Causative agents of photochemical oxidants

Volatile Organic Compounds (VOCs) are among the substances that produce photochemical oxidants. VOC is a generic term for organic compounds that have the property of easily evaporating^{*1}.

VOCs are widely used in a variety of products for **daily home use** as well as industrial purposes, because of their excellent capacity as solvents and drying agents, and because they are economical^{*2}.



- ◆ VOCs emitted into the air from factories, general households, and automobiles, together with **nitrogen oxides (NOx)**, produce new air pollutants collectively called **photochemical oxidants** when exposed to sunlight and form **photochemical smog** when highly concentrated.
- ◆ VOCs cause not only photochemical oxidants but also air pollutants, such as **suspended particulate matter (SPM)** and **particulate matter (PM2.5)** that is a part of SPM.

*1 Organic compounds are a collective term for compounds that contain carbon with some exceptions, such as carbon dioxide. They have a carbon skeleton as a basic structure and are also essential elements in the composition of living organisms, including sugars, proteins, and lipids.

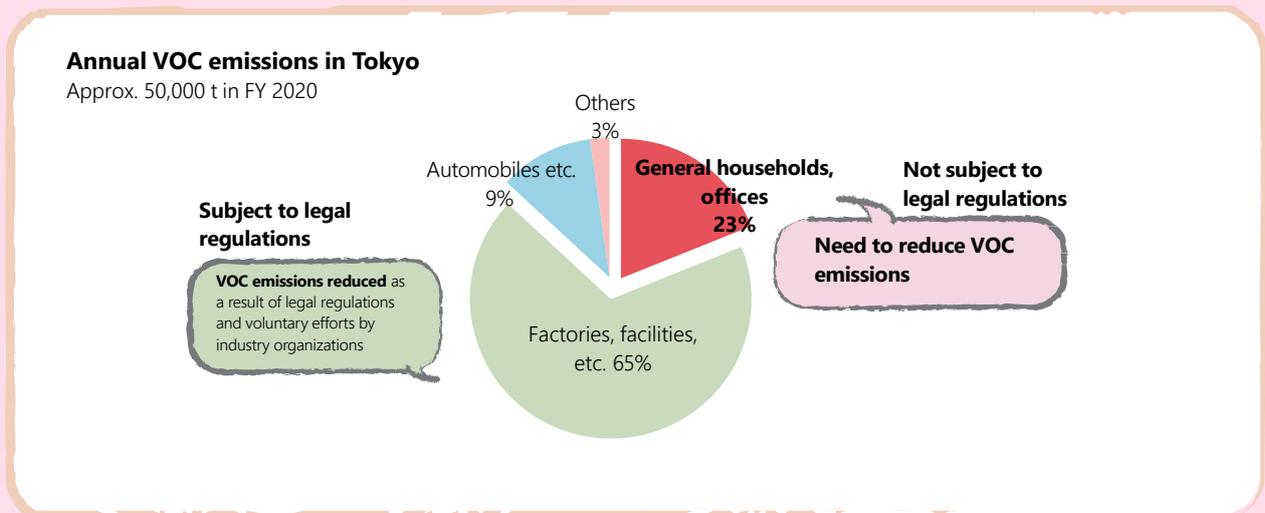
*2 Such VOCs include organic solvents (thinners etc.), volatile oils (gasoline etc.), and alcohol, which are all around us. It is said that about as many as 200 types among them are in common use.

2. VOCs in Everyday Life

VOC emissions from general households and offices account for a large proportion of the annual emissions in Tokyo. What kind of everyday products use VOCs?

(1) Measures required for general households and offices

Of the approximately 50,000 tonnes of VOCs annually emitted in Tokyo, it is estimated that about 12,000 tonnes (23%) come from general households and offices, accounting for a large proportion of the total.



VOC emissions from factories, facilities, etc. have been reduced due to legal regulations and voluntary efforts by businesses. **A further reduction in VOC emissions requires measures taken at general households and offices, which are currently not subject to legal regulations.**

What kind of everyday products use VOCs? Here, we will take a look at typical examples of VOC use, in (1) sprays, (2) paint, and (3) adhesives, then consider **VOC emissions associated with the use of these products.**



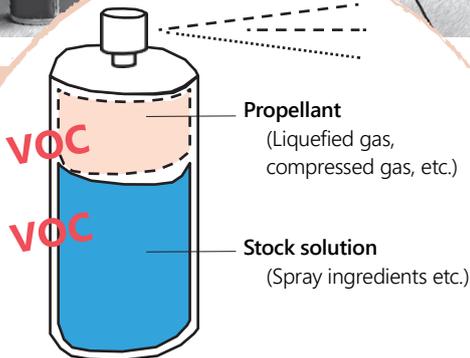
(2) Typical examples of VOC use

(1) Spray products - See pages 9 to 10 for choosing low-VOC products

Spray products include (1) **aerosol** products that enclose **propellant** and **stock solution** in a container with a nozzle and release them in the form of mist or mousse by **gas pressure**, and (2) sprayer/pump products that are manually pumped to **pressurize air and generate mist**.

(1) Aerosol

- ◆ Uses propellant containing VOCs



- ◆ Advantage of **providing the required amount hygienically** by sealing and pressurizing the **contents for protection**.

Gas used as **propellant** and stock solution or spray ingredient in **aerosol** products may contain **VOCs**^{*3}.

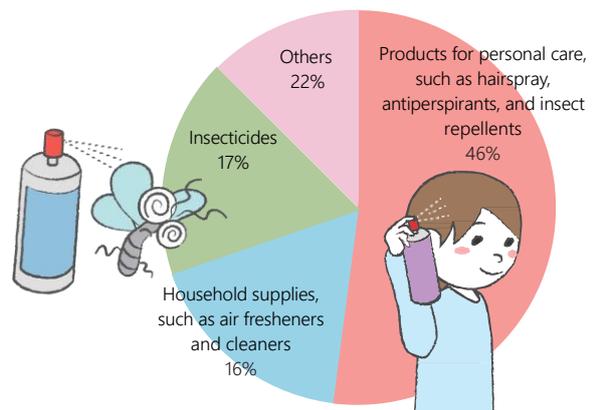
(2) Sprayer/pump

- ◆ Uses no propellant



Due to their high level of convenience, aerosol products are used for a wide range of product groups, including hairspray and insecticides. **The products we use frequently in our daily lives account for approximately 80% of the total production volume.**

Production ratio of aerosol products in 2020

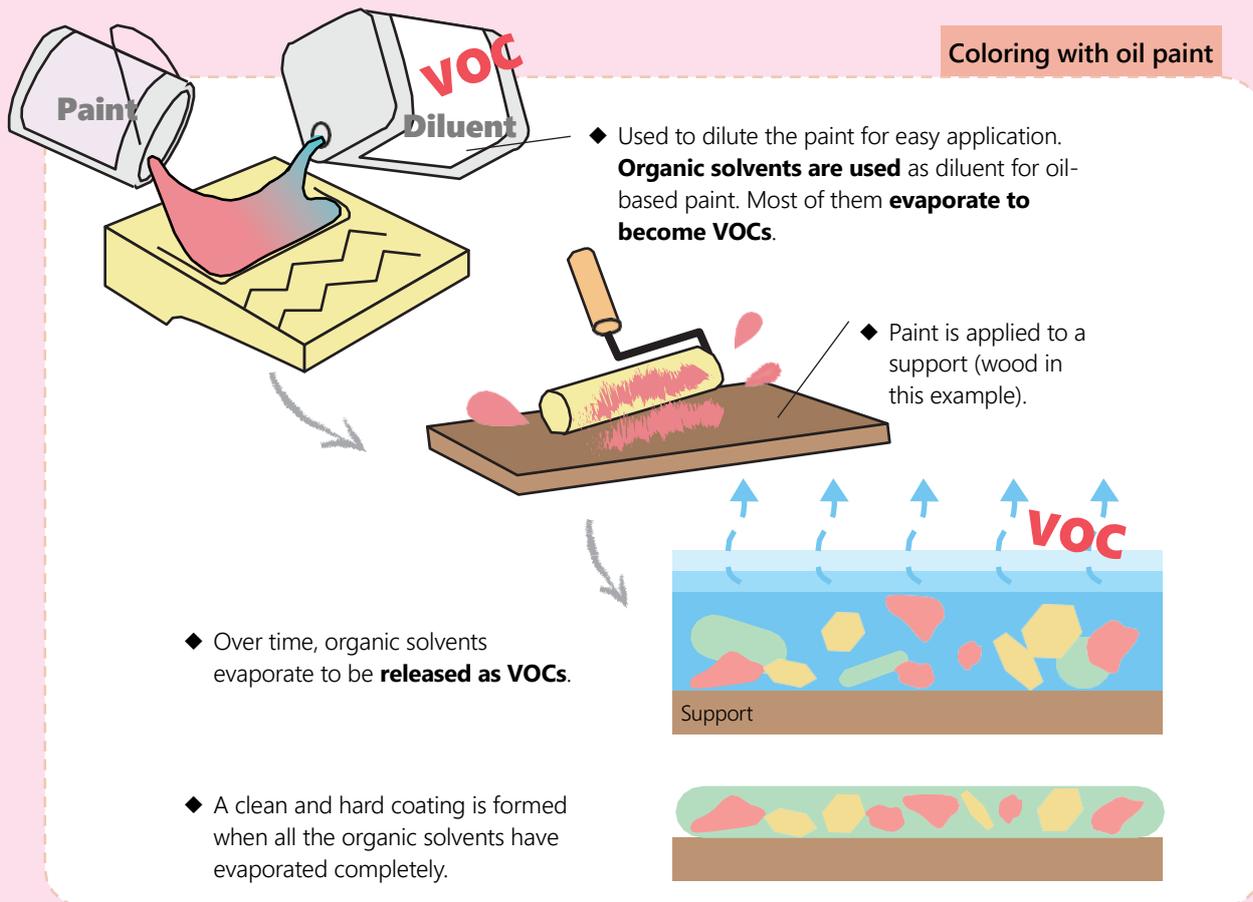
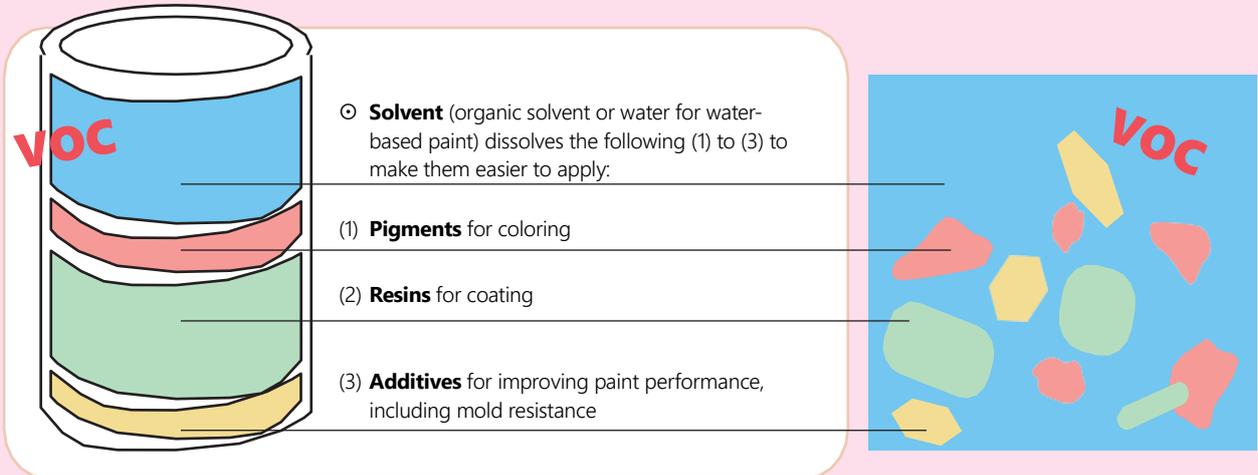


*3 The percentages of VOCs contained in general aerosol products are approximately 90% for products for personal care, 15 to 80% for household supplies, and 40 to 50% for insecticides, relative to the volume of a container.

(2) Paint - See pages 11 to 12 for choosing low-VOC products

In addition to being used in general households, **paint** is used on a variety of products around us, such as buildings, automobiles, furniture, and home appliances.

Familiar oil-based paint contains not only resins and pigments that form a coating but also the **organic solvents** to dissolve them. After being applied, paint dries to form a coating, and the **organic solvents** in the paint are **released into the air as VOCs**.



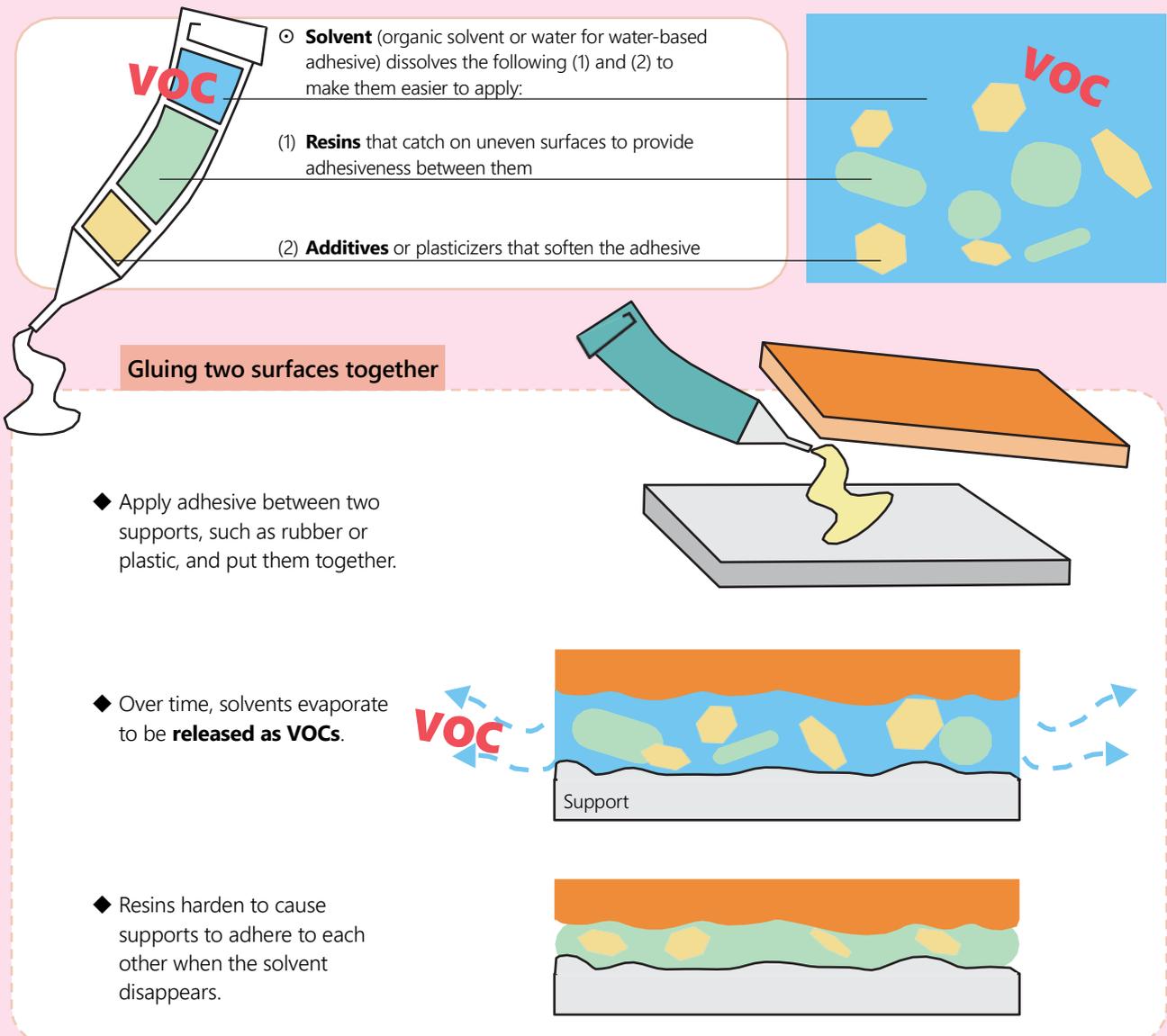
- VOCs released from paint include toluene, xylene, ethyl acetate, and formaldehyde.
- Paints diluted with organic solvents include lacquer and acrylic paints in addition to oil-based paints.

(3) Adhesive - See pages 13 to 14 for choosing low-VOC products

Adhesive is widely used in building materials, such as plywood, and automobiles as well as everyday products like glue and adhesive tape.

Some adhesives contain not only resins that provide adhesiveness but also **organic solvents** to dissolve them.

When adhesive dries to harden after application, **organic solvents are released into the air as VOCs.**



◆ VOCs contained in adhesive include toluene, xylene, ethyl acetate, and formaldehyde.

3. Risks Associated with the Use of VOC Products

Used in a variety of products, VOCs can not only cause photochemical smog, but also have an impact on health and the environment.

As we have seen so far, a wide range of products that make our lives easier also contain **VOCs** due to their excellent performance, such as **dissolving properties** and **drying characteristics**.

On the other hand, if these products are used without fully observing the precautions listed on them, there is a **risk of health hazards or accidents**, such as fire.

(1) Odor problems, sick building syndrome

VOCs contained in **paint** and **adhesive** are perceived as **odors**.

They may **produce noxious odors** when used in large quantities indoors, and cause **acute poisoning** when inhaled in large amounts.



In addition, these VOCs may contain substances that cause **sick building syndrome**^{*4}. They are known to **cause eye and nose irritation, headaches, and dizziness**.

^{*4} Toluene, xylene, ethyl benzene, formaldehyde, etc.

When paint or adhesive containing these substances is used for furniture, wallpaper, and other products for indoor use, you will be exposed to **these substances as they are gradually released over a period of time, long after their initial use**. Inhaling the causative agents, even in a small amount, for extended periods may cause the symptoms described above. **Adequate ventilation must be provided during and after the use** of paint and adhesive.

(2) Fire

VOCs used in the propellant or stock solution of **aerosol** products, and the resins and solvents of **paint** and **adhesive** are **combustible gases** and **flammable liquids**. They can **ignite** or **explode** in the vicinity of an **ignition source**, leading to an unexpected major accident^{*5}.



When using products containing VOCs, DO NOT:

- Throw them into fire.
- Use them in large amounts indoors - Ventilate well.
- Use them near fire or heating appliances or in the kitchen or bathroom.
- Store or leave them in a place subject to 40°C or higher temperatures.
- Store or leave them near a window exposed to direct sunlight.
- Put cloths used for wiping off paint or sheets used for curing in a container or plastic bag to leave them in that state.
- Throw away spray products with remaining contents.

*5 As some types of VOCs are odorless, accidents have occurred in which their presence goes undetected and they are inadvertently ignited by a lighter or stove, resulting in an explosion.



Odor problems, the development of sick building syndrome, and the risk of fire **can be easily reduced through the use of low-VOC products—those with low-VOC emissions and content.**

The use of low-VOC products also has the advantage of **protecting objects** (minimizing skin irritation for example) and **reducing environmental impact** (reducing air pollutants for example).

See pages 9 to 14 for choosing low-VOC products

4. Choosing Low-VOC Products

How can we choose products with low-VOC emissions and content?

Since there are many types of VOCs and their labeling on products is not mandatory, it is difficult to choose **low-VOC products** at present. Here are some **simple ways suggested for choosing low-VOC products**.

(1) Spray products

Among **spray** products, some of **aerosol products** described earlier **contain VOCs** in their propellant or stock solution. Choosing product types from (1) to (4) below will help **reduce VOCs**.

(1) Sprayer/pump type

A sprayer/pump type **does not scatter VOCs** during use as it **does not use propellant**^{*6}.



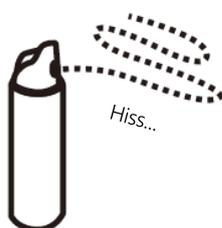
(2) Mousse type

A mousse type **only has a low concentration of VOCs** for the propellant, and **scatters a smaller amount of VOCs** as it generates foam.



(3) Fixed-amount, timer, and push types

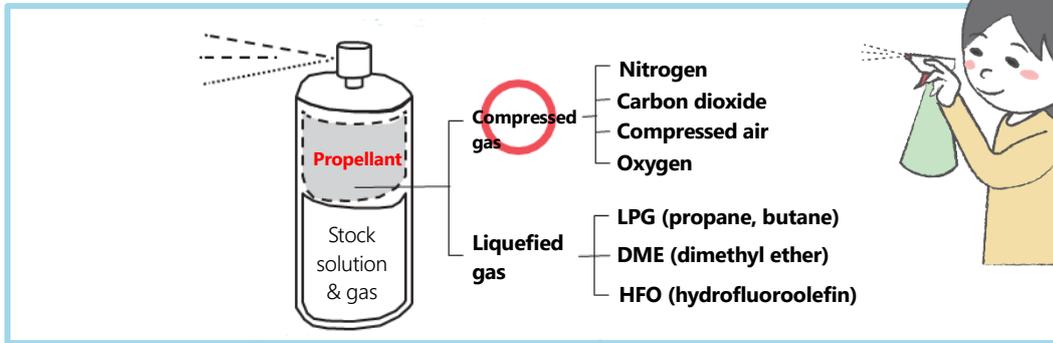
In the market, there are products that use a nozzle for fixed-amount spraying and timer/push-type small products. You **can limit the amount of VOCs scattered per use** as they spray only a fixed amount at one time.



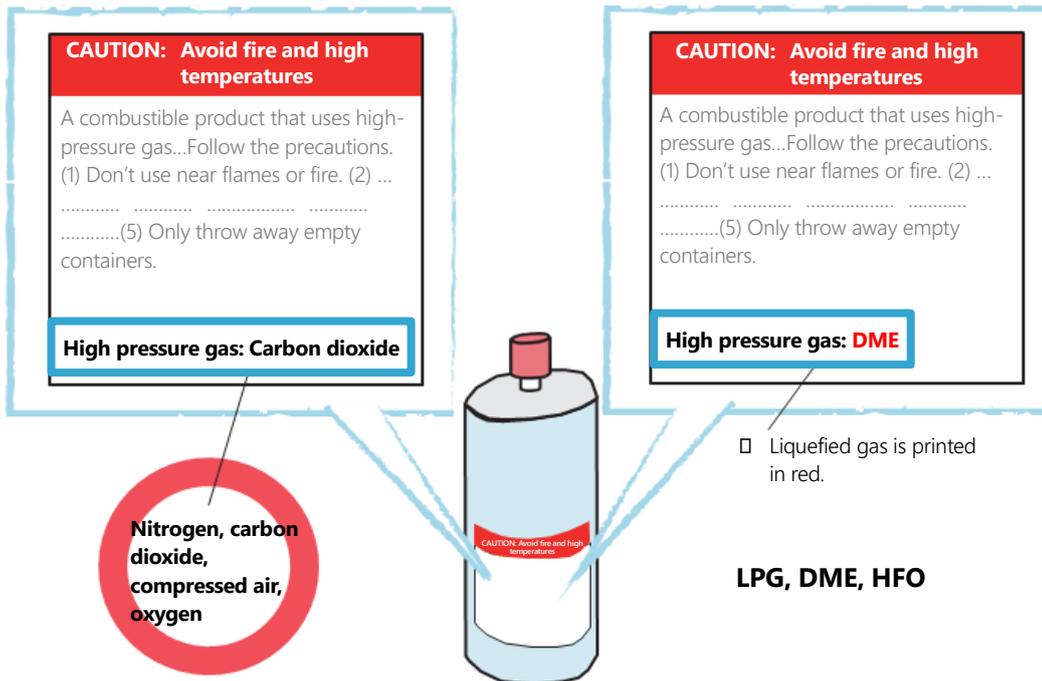
(4) Products using compressed gas

Check the **type of propellant** when choosing a low-VOC product from **aerosol products**.

Products using **compressed gas** do not scatter VOCs^{*7}. In contrast, **liquefied gas** contains VOCs.



The type of propellant is indicated on an **aerosol product**. Products using compressed gas without VOCs as propellant have the name of the gas used indicated in black on the caution area of the container label.



*6 Spray ingredients may contain VOCs.

*7 Products using compressed gas do not scatter VOCs contained in propellant, but they may contain VOCs in the spray ingredients.

(2) Paint

Some **paints** contain organic solvents (VOCs). Choosing products labeled as (1) to (4) below will help **reduce VOCs**.

(1) Low-VOC paint

VOCs contained in the paint are less than 30%.

Look for this (1)

"Low-VOC Paint" is indicated or marked on the container.

- ◆ Products conforming to the guidelines of the Japan Paint Manufacturers Association are labeled as "Low-VOC Paint (Solvent)."
- ◆ Manufacturers decide labeling on their products as there is no standardized mark. (Hereinafter referred to as "No standardized mark")

Low-VOC Paint
(Solvent)



Labeling example

(2) Non-toluene/xylene paint

The paint contains less than 0.1% toluene, xylene, or ethylbenzene.

Look for this (1)

"No Toluene or Xylene Used" is indicated or marked on the container.

- ◆ Other labeling may include "Non-," "Zero-," or "-Free"
- ◆ No standardized mark

No Toluene or
Xylene Used

Labeling example

(3) Paint taking into account formaldehyde emissions

The paint takes into account formaldehyde emissions regulated by law. Such paints are graded according to the emissions and limited in the coverage area of interiors based on these grades.

Look for this (1)

"No Formaldehyde Used" is indicated or marked on the container.

No Formaldehyde

Used

Labeling example

Look for this (2)

"F☆☆☆☆" is indicated for paints that emit less formaldehyde and can be used for interiors without restriction.

Registered with the Japan Paint Manufacturers Association	
Registration No.	
Formaldehyde emission grade	F☆☆☆☆
Contact	http://www.toryo.or.jp

F☆☆☆☆



- ◆ White stars or the JIS mark may also be indicated

(4) Water-based paint

The paint is soluble in water and can be diluted with water instead of thinner or other organic solvents.

- ◆ Organic solvents (VOCs) in the paint are either 5% or less or 1% or less
- No standardized mark

Look for this (1)

The product name includes "Water-Based" or "Waterborne."

Durable

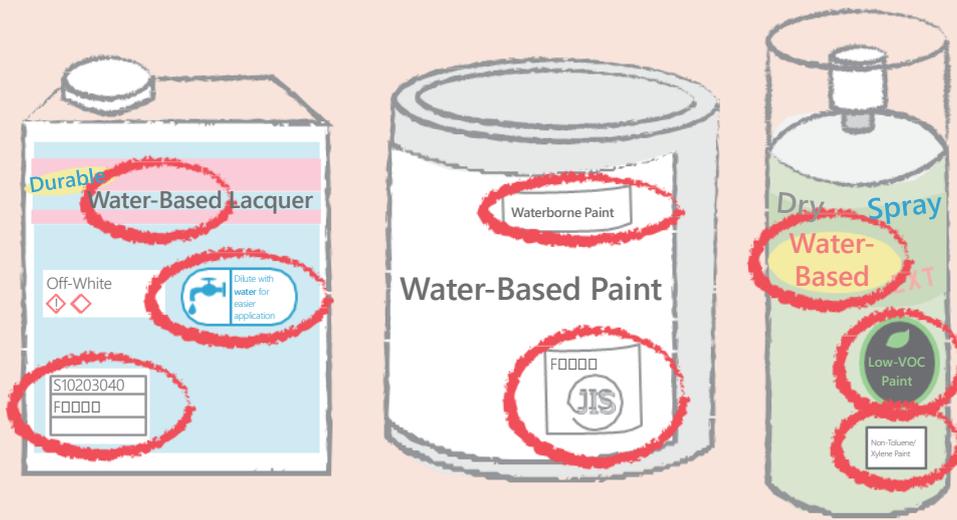
Water-Based Lacquer

Super Fast
Drying

Water-Based

Spray
EXTRA

Labeling example



Look for this (2)

“Non Toluene/Xylene Paint” is indicated on the container.

- ◆ Products registered according to the voluntary labeling guidelines of the Japan Paint Manufacturers Association for non-toluene/xylene paint are labeled as “Non Toluene/Xylene Paint.”

**Non-Toluene/
Xylene Paint**

Formaldehyde emission grading (F☆☆ to F☆☆☆☆)

Interior materials, such as wallpapers, paint, and adhesives, which emit formaldehyde, one of the causative agents of sick building syndrome, are graded according to the emissions.

Labeling of JIS or industry organization certification systems	Formaldehyde emissions	Restrictions on interior use
F☆☆☆☆	Low	Not restricted
F☆☆ F☆☆	High	Applicable coverage area is restricted

- Two to four stars indicate formaldehyde emissions.
- The grading is based on the Building Standards Act or the voluntary management rules of industry organizations.

Look for this (2)

“Water-Based,” “Water-Based Paint,” “Waterborne Paint,” etc. are marked on the container.



Look for this (3)

“Dilutable with Tap Water” etc. are indicated or marked on the container or description.



(3) Adhesive

Some **adhesives** contain organic solvents (VOCs). Choosing product types from (1) to (3) below will help **reduce VOCs**.

(1) Water-based adhesive

The adhesive has been dissolved in water.

Look for this (1)

"Water-Based" etc. is indicated on the container.



Labeling example

(2) Adhesive taking into account formaldehyde emissions

The adhesive takes into account formaldehyde emissions regulated by law. Such paints are graded according to the emissions and limited in the coverage area of interiors based on these grades.

Look for this (1)

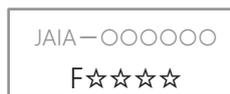
"No Formaldehyde Used" is indicated or marked on the container.



Labeling example

Look for this (2)

"F☆☆☆☆" is indicated for adhesives that emit less formaldehyde and can be used for interiors without restriction.



* "JAIA - F□□□□" is labeling for non-formaldehyde products registered with the Japan Adhesive Industry Association, not using any raw materials that emit formaldehyde.

(3) 4VOC standards compliant products

The products intentionally avoid using toluene, xylene, ethylbenzene, or styrene, and their content of these substances meets the specified values: Less than 0.1% by weight for toluene*, xylene, and ethylbenzene, and less than 0.015% by weight for styrene.

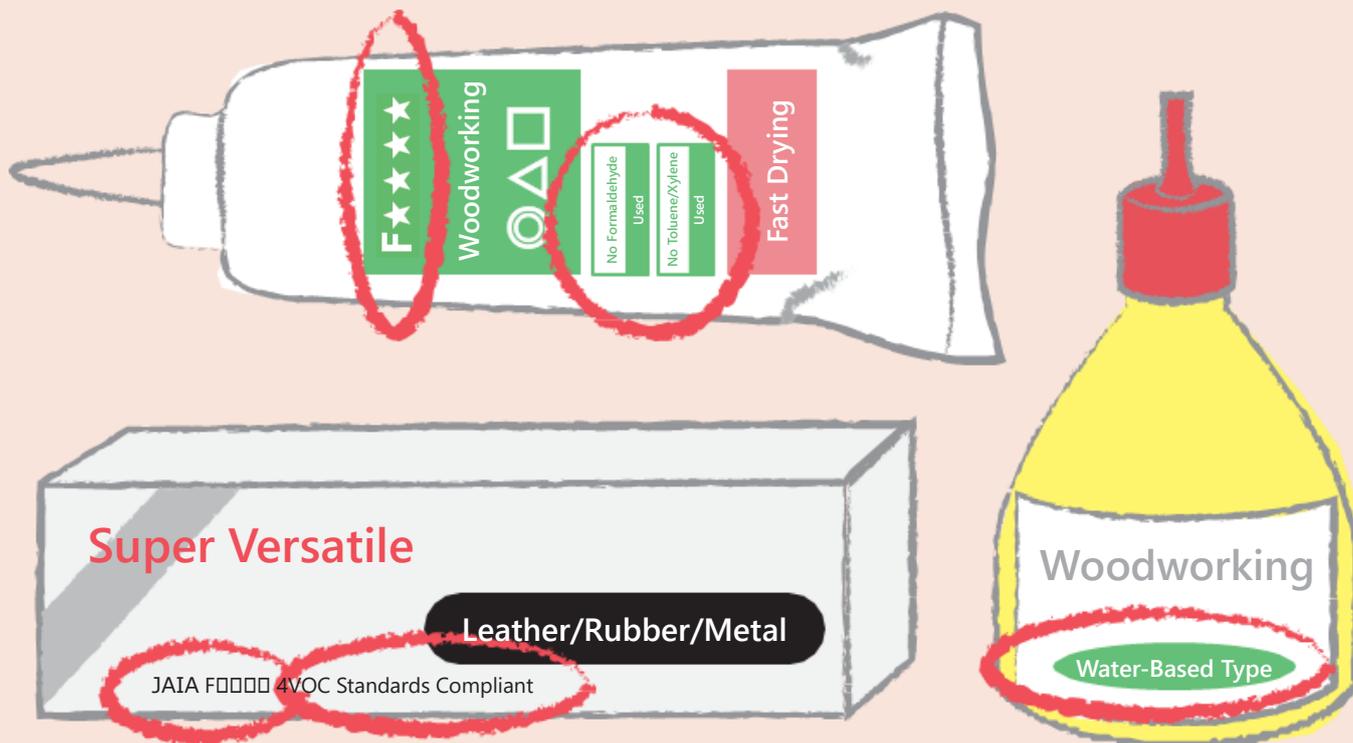
Look for this (1)

"JAIA 4VOC Standards Compliant" is indicated on the product.



Registered with the Japan Adhesive Industry Association
Registration No.: JAIA-○○○○○○
Emission category: 4VOC Standards Compliant
Manufacturer name: ○○○○ Co., Ltd.
Contact: http://www.jaia.gr.jp
Lot No.: ○○○○○

* For adhesive containing ethylene-vinyl acetate copolymer resin emulsion, the specified value is less than 0.05% by weight.



VOCs are contained in many of the everyday products we use at home or work. These products are indispensable and make life much easier. However, why not switch to low-VOC products, considering the impact on our health and the environment?

When choosing a product, refer to this leaflet and look carefully at labeling!



In collaboration with:

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Japan Adhesive Industry Association

Green Purchasing Network
Japan Paint Manufacturers Association

Bureau of Environment, Tokyo Metropolitan Government

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