What helps make paint flow and inks dry? What keeps bridges from rusting? What cleans your home and even makes microchips possible?

The answer is solvents -- a group of chemicals that have dramatically changed modern day living in the United States and around the world. Solvents have many diverse uses -- from paints and coatings, personal care products and pharmaceuticals to pesticides, cleaners and inks.

Thousands of producers and manufacturers, and millions of workers, rely on solvents every day to provide solutions to new manufacturing needs and to sustain excellence in functional performance. In fact, without solvents, many of the products we rely on -- from pharmaceuticals to industrial coatings -- would not perform as well.

**What is a Solvent?**

A solvent is a liquid that has the ability to dissolve, suspend or extract other materials without causing a chemical change to the material or solvent. Solvents make it possible to process, apply, clean or separate materials. Solvents operate on the principle of “like dissolves like.” Therefore, for a solvent to work it needs to have similar chemical characteristics to the substance it is trying to dissolve.

**Different Types of Solvents**

This brochure deals with a subset of organic (i.e., carbon containing) solvents, specifically hydrocarbon and oxygenated solvents. For example, water is a solvent, but is inorganic (does not contain carbon), so is not discussed here. Even in so-called “water based” technologies, oxygenated and hydrocarbon solvents work in conjunction with water to dissolve or suspend other materials. Organic solvents can be classified by chemical structure. There are three main groups:

<table>
<thead>
<tr>
<th>Oxygenated Solvents</th>
<th>Alcohols, glycol ethers, ketones, esters, and glycol ether esters</th>
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<tbody>
<tr>
<td>Hydrocarbon Solvents</td>
<td>Aliphatic and aromatic hydrocarbons</td>
</tr>
<tr>
<td>Halogenated Solvents</td>
<td>Chlorinated, fluorinated and brominated hydrocarbons</td>
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The Solvents Industry Group represents producers of oxygenated and hydrocarbon solvents. Oxygenated and hydrocarbon solvents represent most of the total organic solvents used each year in the United States.
Solvents in Action
The largest demand for solvents comes from the paint and coatings industry. The mix of solvents used in this and other industries continually changes to satisfy increasing demands for high performance.

Generally, once solvents are used they evaporate (for example when paint dries). Remaining solvents are incinerated and their energy recovered; or recycled by recovering and reusing in the process many times. In many applications, solvent emissions from evaporation are virtually eliminated with techniques such as thermal oxidation, where heat is used to destroy the volatile solvent component. There are many kinds of solvents with different physical and chemical properties.

Combinations of solvents often are used to make products with optimal performance, including spray paints that dry quickly and don’t clog the nozzle; inks that don’t smudge; paints that brighten our world and last a long time; and cleaners that tackle tough jobs.

Solution Providers
Solvents are very versatile. They can be produced or blended to meet very specific requirements and so, in a way, can be “tailor-made” for distinct purposes. When choosing or blending a solvent performance, health and safety, cost and environmental factors are all considered. A range of other factors that should be taken into account are dissolving power, viscosity, evaporation rates, color, odor, toxicity, flammability, and conservation of resources.

SOME OF THE MAJOR USES OF SOLVENTS

Paints and Coatings
Making paint “paintable” and fast drying...
In paints, solvents dissolve or disperse different compounds used in the paint formulation (such as pigment and resin), making paint the desired consistency for application. Once paint is applied, the solvent evaporated, allowing the resin and pigment to produce a film of paint (a coat) and to dry rapidly. The use of solvents in paints provides a variety of effective choices like durable and decorative coatings and glossy paints designed for effectiveness, indoors and outdoors.

Fast drying saves energy...
Solvents evaporate readily, thus reducing energy consumption and minimizing costs. Solvent-based systems can dry up to 10 times faster at room temperature than low solvent alternatives, keeping production rates up and costs down, while minimizing energy consumption.

Standing up to Harsh Environments...
A manufacturer can use different solvents to produce coatings with very diverse characteristics. For example, modern high-solids paints used for metal protection on bridges and pipelines give a film (coating) thickness that would require at least two applications of other coating systems.

Increasing Functional and Environmental performance...
The flexibility that solvents provide means that the whole system can be formulated to optimize product perfor-

To minimize total consumption of solvents, high-solids paints with lower levels of solvents have been developed. These are popular where high quality and durable finishes are required. Even for water-based coatings, a solvent content of up to 15 percent is indispensable for high durability and performance. In recent years, some attention has been focused on waterborne, powder and high energy cure coatings. All of these technologies offer different technical and performance attributes, depending on application needs. For many applications, however, solvent based coatings have clear performance advantages or are the only effective option.

Printing Inks
Promoting vivid color and sharper images...
Printing inks are used to print everything from magazines to food packaging and labels. Solvents help these inks to be applied, stay put, and stay bold and bright. In printing inks, solvents are used to control viscosity (thickness) and to allow ink to flow without damaging printing rollers or sprayers. Solvents assist in optimal drying for today’s high speed printers.

Adhesives
From Soles on Shoes to Tires on Cars...
Solvents provide the beneficial properties necessary to make adhesives work properly. From soles on shoes to tires on cars, solvents are used in household and industrial adhesives and are particularly valuable where high performance is required, like metal-to-metal bonding.
Pharmaceuticals

Creating Purity...
Solvents set the stage for the production of pharmaceuticals by providing the medium in which the reaction takes place. They are also used to separate the desired chemical products from unwanted ones, maximizing the purity of the drug. In the synthesis of pharmaceuticals the solvents are removed from the product before it is sold. Solvents are used in many cases in pharmaceutical formulations to enable the drug to be conveniently applied, injected or ingested. Solvents are also used to apply tablet coatings and in inks used to print on pharmaceutical tablets and capsules. Solvents are critical to the manufacture of numerous drugs and in the continued development of new, life-saving, life-enhancing ones.

Agriculture

Capturing natural flavors...
Solvents are used in food processing to extract the required substances from a natural product more efficiently than by using mechanical methods, for example in the extraction of oils and flavorings. Solvents are also used to extract fats, oils and flavorings from nuts, seeds and other raw materials. They are often used in the liquid formulations of those flavorings and essences. Inks and adhesives for food packaging use appropriate solvents as well.

Personal Care Products

Cleaning and Beautifying...
Solvents are an important part of many beauty and cosmetic products. Many consumer products rely on solvents to dissolve ingredients and allow them to work properly. Several examples of personal care products that rely on solvents include nail polish, nail polish remover, hairspray, hair color, and antiseptics.

At Home or in your Car

Solvents keeping us clean...and safe...
Solvents are used effectively in a variety of home cleaning products to help improve cleaning efficiency and make homes both easier to clean and hygienic. Different types of cleaners are designed for counters, appliances, windows, floors, automobiles and numerous other surfaces. Because of the effectiveness of solvents in these cleaning applications, people have more time to do the things that they enjoy. Solvents are also an essential part of the make up of vital car-care safety products such as windshield de-icer and brake fluid.

The Solvents Industry in the United States

More than six thousand people across the U.S. are directly employed in the production of solvents. However it is estimated that 1.4 million people are employed in industries that depend on solvents. The size and structure of the solvents industry is constantly evolving to meet new needs. There is increasing awareness of health, safety and environmental issues surrounding the use of all chemicals, and solvents are no exception. For solvents, particular areas of focus are toxicity levels and atmospheric emissions.

Product innovation has led to the development of new solvents to meet the more demanding requirements of current and next generation products.

Our Health and Safety

Hydrocarbon and oxygenated solvents have been in widespread use for many years and have been the subject of extensive health and environmental studies. Many studies have been carried out in the United States and Europe to examine the effects of exposure to solvents. Many commonly used solvents are recognized as having relatively low toxicity. These solvents are not expected to pose significant hazards when used properly. Products with specific toxic effects should be subject to appropriate controls and/or restrictions on use. Solvents are being used safely in a wide variety of everyday applications. In order to promote the continuing safe use of solvents the Solvents Industry Group members are committed to product stewardship; compliance with health, safety and environmental regulations; expanding understanding through scientific research; improving products; and providing health, safety and environment information on an ongoing basis. Solvents Industry Group members support Responsible Care and its product stewardship principles.

Our Environment

Current issues affecting both producers and consumers of solvents are being addressed. Information bulletins on volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) are available from the Solvents Industry Group to help improve the...
Understanding of these issues. Information bulletins on other important solvent topics are published periodically.

**Solvents – Providing Solutions Now and into the Future**

Solvents provide solutions for many aspects of modern business and home life. The ongoing commitment of the Solvents Industry Group to enhancing solvents’ functional and environmental performance means that all of us will continue to benefit from their use.

**Legal Notice**

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Please visit www.americanchemistry.com/solvents for more information about other solvent topics.