EFFECT OF SOLVENTS ON ENVIRONMENTAL POLLUTION

***T.Raja Rajeswari, Talari Kalpana**
Department of Chemistry, Govt.College for Women, Guntur.
***Corresponding author: Email:** impactPOPS@gmail.com

ABSTRACT

Globally, it is evident from the researches that usage of solvents has become the part and parcel of human life today. Scientific and technological innovations in solvents have a great impact on the health of the individuals. Even though the solvents are used as invaluable solution for industries as diverse as pharmaceuticals and microelectronics to domestic cleaning and printing Etc. Their toxicity is hazardous to human health physically as well as mentally. The motto behind this paper presentation is to highlight the uses of the solvents and enlightening the toxic effects on the human health and environment leading to the pollution. Hence, we are badly in need to reduce the toxicity of solvents with the application of Green chemistry.

Key words: solvents, global

INTRODUCTION

A solvent can be defined as a substance that dissolves another substance to form a liquid. Most of the solvents are combustible, often highly volatile and extremely flammable and they should always be handled with care. Some solvents produce vapours which are heavier than air. These may move on the floor or ground to a distant ignition source, such as a spark from welding or caused by static electricity. The vapours may also explode from smoking. Vapours of solvents can also accumulate in confined places and stay there for a long time, presenting risks for health and property. Solvents can be broadly classified as either aqueous (water based) or organic (hydrocarbon-based) and within each classification, further classifications are necessary to account for differences in structure and physical properties. Given below the widespread industrial and domestic use of solvents and their impacts on human health and environment.

SOLVENT CLASSIFICATION:

Most organic solvents can be classified into chemical groups based on the configuration of the hydrogen and carbon atoms and the presence of different functional groups.

Chemical groups that are commonly used are:

- Straight or branched chains of carbon and hydrogen (e.g. Hexane, Heptane),
- Cyclic hydrocarbons (e.g. CycloHexane, Turpentine),
- Esters (e.g.Ethylacetate, Isopropylacetate) ,
- Aromatic hydrocarbons (e.g. Benzene, Toluene, Xylene),
- Alcohols (e.g. Ethanol, Isopropanol),
- Ketones (e.g. Acetone, Methyl ethyl ketone),
- Halogenated hydrocarbons (e.g. Carbon tetrachloride, Chloroform),
- Aldehydes (e.g. Acetaldehyde, Formaldehyde),
- Ethers(e.g. Diethyl ether, Isopropyl ether),
- Glycols (e.g. Ethylene glycol, Hexylene glycol)
- Nitro-hydrocarbons (e.g. Nitroethane, Nitromethane).

SOLVENT PROPERTIES:

Solvents from different chemical groups can differ markedly in their characteristics; however, within each group, chemical and solvent properties change only slightly as the molecular weight of the solvent increases.

The main factors which influence the properties of organic solvents are:

- The number of carbon atoms present;
- The presence of only single bonds(saturated molecules) or double or triple bonds (unsaturated molecules) between adjacent carbon atoms,
- The configuration of the solvent molecule i.e. Straight chain(aliphatic), branched chain or ring(i.e. Cyclic and Aromatic);The presence of functional groups, e.g. Nh_2

The solvent properties of organic solvents tend to increase with fewer numbers of carbon atoms in the molecule. Unsaturated molecules tend to be more reactive than their saturated counterparts.

SOLVENT CHARACTERISTICS:

The following characteristics of organic solvents determine the type of hazards they present:

Volatility:

As organic solvents are volatile (i.e. Tend to evaporate), inhalational exposure is an important exposure pathway to be considered when assessing the health hazards that solvents may present. The greater the volatility of a solvent the greater the vapour concentration in the air. Two measures of volatility are the vapour pressure and evaporation rate. Both measures are temperature dependent and increase as the temperature increases.

The density of the solvent vapour may also need to be considered in emergency situations. As the density increases the rate at which the solvent dissipates will decrease. As a general rule, a vapour that is heavier than air (vapour density>1) will tend to pool and spread near ground level in confined spaces, whereas a vapour which is lighter than air (vapour density <1) will tend to rise and dissipate.

Water and lipid solubility:

The water and lipid solubility of a solvent will determine how readily it will be absorbed through the skin. Given that the skin can be described as a lipid-water bilayer, solvents such as dimethylsulfoxide and glycol ethers which are readily dissolved in both are well absorbed through the skin.

Chemical structure:

The chemical structure of a solvent including any attached functional groups will determine its toxicological properties. Toxicological properties tend to be similar within chemical groupings.

Flammability and explosiveness:

The flammability and explosiveness of a solvent are clearly important determinants of hazard. Measures frequently used to give an indication of the flammability and explosiveness of solvents include the flash and fire points, and the autoignition temperature. Explosive ranges or flammability limits have been determined for different solvents and refer to the concentrations over or above which a particular vapour will burn when ignited. Many organic solvents have low flash points and will burn if ignited. Chlorinated solvents have quite high flash points and are not usually flammable under conditions of normal use.

The following classification is used to qualify the flammability hazard associated with a solvent:

- HIGHLYFLAMMABLE - flash point < 23°C
- FLAMMABLE - flash point 23-61°C
- COMBUSTIBLE - flash point 61-150°C

Some solvents may also be explosive, e.g. Nitrocellulose. There may also be a risk of exothermic reactions of some solvents with other materials, which may lead to fire or explosion.

OCCUPATIONAL EXPOSURE:

Given the tendency for most organic solvents to evaporate at ambient temperatures and to be absorbed through the skin, the two most important exposure pathways for organic solvents in the workplace are through the lungs and skin.

The Worksafe Australia Standard - lists exposure standards(e.g. TWA, STEL) for solvents (among other chemicals) in workplace air. In some circumstances engineering controls and protective equipment/clothing may be required to ensure that worker safety is not compromised. Such requirements are generally detailed in the Material Safety Data Sheet (MSDS) for the solvent.

Some of the occupational related exposure of organic solvents are as follows:

- Adhesive and glue manufacturing.
- Production of coating and degreasing or cleaning agents.
- Paint and pigment manufacturing.
- Electronic workers.
- Production of printing inks.
- Manufacturing of agricultural products.
- Manufacturing of pharmaceutical products.
- Manufacturing of phone industries.
- Polymer and plastic production.

DANGEROUS BEHAVIOUR OF ORGANIC SOLVENTS:

Solvents have various effects on human health, whether the exposure is by vapour, mist, or liquid form. They can enter the body by inhalation (breathing in), by swallowing, and through the skin. The way that solvents may enter the body depends on the volatility and fat-solubility of the solvent, and the resulting ill health effects are specific to each solvent. These can include:

- A narcotic effect, causing fatigue and dizziness. High doses may to unconsciousness and death. Exposure to large doses of solvents may slow reaction time and affect rational judgement. This may increase the risk of accidents both at work and outside, such as in the traffic on the way back home.
- Irritation of the eyes and the respiratory tract.
- Dermatitis and other skin disorders. Solvents clean and de-fat, not only the product in the process, but also the skin.
- Damage to the liver, kidneys, heart, blood vessels, bone marrow and the nervous system (e.g. Chronic Toxic Encephalopathy). Solvents can penetrate the skin and enter into the blood circulation.

The health risk of exposure to solvents depends on the specific solvent and on the level of exposure to the solvent. Solvent differ in their potency to harm health.

For example:

- Ethanol often consumed in beverages, is an example of an organic solvent that is only moderately toxic, and hence, can be drunk in relatively large portions without acute intoxication. In addition, swallowing is by far the only relevant exposure route as the air concentration must be uncommonly high to cause any observable effects in human.
- Methanol has a rather similar chemical structure as ethanol, but the intake rate, potency to cause adverse health effects and the type health effects differ significantly.

Solvents also can pose a safety risk. Most of the solvents are volatile and flammable and they should always be handled with care. Some solvents produce vapours, which are heavier than air. These vapours may flow to flow, or in worst cases to spaces where ignition by a spark from welding or static electricity may light them. The vapours may also flash from smoking. Vapours of solvents can also accumulate in confined places and stay there for a long time, presenting risks for health and property.

TOXICITY AND **EFFECTS OF SOLVENTS:**

There are many organic solvents which are using directly or indirectly in our daily life which are badly causing harmful effects on human health and environment. Here we discuss about some of the toxic organic solvents which are causing hazardous effects. They are as follows;

BENZENE:

Benzene is a colourless, flammable liquid with a pleasant odour. It is used as a solvent in many areas of industries, such as rubber and shoe manufacturing, and in the production of other important substances such as styrene, phenol and cyclohexane. It is essential in the manufacture of detergents, pesticides and paint removers. It is present in fuels such as in gasoline upto the level of 5%. Benzene reacts violently with oxidizing agents, such as permanganates, nitrates, peroxides, chlorates and perchlorates.

HEALTH EFFECTS:

- Benzene is a cancer causing substance which is known as carcinogen.
- There is sufficient evidence that benzene causes leukaemia in exposed workers. Many scientists say that there is no safe level of exposure to a carcinogen.
- Benzene enters the body through inhalation and it may pass through the skin.
- Exposure to low concentrations of benzene vapour or the liquid which has penetrated the skin may cause dizziness, lightheadedness, headache, loss of appetite and stomach upset.
- Exposure can also irritate the nose and throat.
- High exposure to benzene may cause irregularities in the heart beat which can lead to death.
- Repeated exposure can damage the bone marrow, which is the blood-forming organ, causing a condition called "aplastic anaemia". This also lead to death.
- Benzene may cause birth defects in animals. Until further testing has been done it should be handled very carefully as a possible agent causing birth defects in human as well.
- By inhaled high levels of benzene for many months, it decreases the size of ovaries in women.
- If men exposed to benzene are more likely to have an abnormal amount of chromosomes in their sperm, which impacts fertility and fetal development.
- In several countries there are severe restrictions for using and selling benzene.

HANDLING AND STORAGE:

Benzene vapour is heavier than air and may move along the floor to a distant ignition source. Smoking and open flames are prohibited where benzene is handled, used or stored. It should be stored in tightly closed containers in a cool well-ventilated area away from heat.

Metal containers need to be grounded to avoid ignition from sparks caused by static electricity. Attention should be paid to electrical equipment, this should be explosion –proof.

PRECAUTIONS:

If benzene is accidentally spilled, the following steps should be taken:

- Ventilate the area of spill or leak.
- Restrict persons from the area of spill unless they water protective equipment.
- Remove all ignition sources.
- Do not wash benzene into the sewage system. It may cause an explosion. Benzene is a hazardous waste.
- Absorb the liquid in inert material, such as vermiculite, dry sand, earth and deposit in sealed containers.
- Large spills should be cleaned by experts from the fire department.

FORMALDEHYDE:

Formaldehyde is a colourless, flammable gas or liquid that has pungent, suffocating odour. It is a volatile organic compound, which is an organic compound that easily becomes a vapour or gas. It is also naturally produced in small, harmless amounts in the human body. It is used mainly to produce resins used in particleboard products and as an intermediate in the synthesis of other chemicals. Exposure to formaldehyde may occur by breathing contaminated indoor air, tobacco smoke, or ambient urban air. Acute (short-term) and chronic (long-term) inhalation exposure to formaldehyde in humans can result in respiratory symptoms, eye, nose, and throat irritation.

Limited human studies have reported an association between formaldehyde exposure and lung nasopharyngeal cancer. Animal inhalation studies have reported an increased incidence of nasal squamous cell cancer. EPA considers formaldehyde a probabale human carcinogen.

USES:

- One of the most common uses of formaldehyde in the U.S is manufacturing urea-formaldehyde resins, used in particleboard products.
- Formaldehyde is used predominantly as a chemical intermediate.
- It also has minor uses in agriculture, as an analytical reagent, in concrete and plaster additives, cosmetics, disinfectants, fumigants, photography and in wood preservation.
- Formaldehyde as urea formaldehyde foam was extensively used as an insulating material until 1982 when it was banned by the U.S. consumer product safety commission.

SOURCE AND POTENTIAL EXPOSURE:

- The highest levels of airborne formaldehyde have been detected in indoor air, where it is released from various consumer products such as building material and home furnishings.
- One survey reported formaldehyde levels ranging from 0.10 to 3.68 parts per million (ppm) in homes.
- Higher levels of formaldehyde have been found in new manufactured or mobile homes than in older conventional homes.
- The major sources appear to be power plants, manufacturing facilities, incinerators, and automobile exhaust emissions.
- Smoking is another important source of formaldehyde.
- Formaldehyde may also be present in food, either naturally or as a result of contamination.

HEALTH EFFECTS:

ACUTE EFFECTS:

- The major toxic effects caused by acute formaldehyde exposure via inhalation are eye, nose, throat irritation and effects on the nasal cavity.
- Other effects seen from exposure to high levels of formaldehyde in humans are coughing, wheezing, chest pains and bronchitis.
- Ingestion exposure to formaldehyde in humans has resulted in corrosion of the gastrointestinal tract and inflammation and ulceration of the mouth, esophagus and stomach.
- Acute animal tests in rats and rabbits have shown formaldehyde to have high acute toxicity from inhalation, oral and dermal exposure.

CHRONIC EFFECTS:

- Chronic exposure to formaldehyde by inhalation in human has been associated with respiratory symptoms and eye, nose and throat irritation.
- Repeated contact with liquid solutions of formaldehyde has resulted in skin irritation and allergic contact dermatitis in humans.
- Animal studies have reported effects on the nasal respiratory epithelium and lesions in the respiratory system from chronic inhalation exposure to formaldehyde.

ACETONE:

Acetone is a colourless and highly flammable manufactured liquid. It has a distinctive fruity or mint-like odour and a pungent taste. It is also found naturally in plants, trees, volcanic gases and as a by-product of the breakdown of body fat. It is found in vehicle exhaust, tobacco smoke and landfill sites.

It is a good solvent for many plastics and some synthetic fibers. It is used for thinning polyester resin, cleaning tools used with it, and dissolving two-part epoxies and superglue before they harden. It is used as one of the volatile components of some paints and varnishes. As a heavy-duty degreaser, it is useful in the preparation of metal prior to painting. It is also useful for high reliability soldering applications to remove rosin flux after soldering is complete: this helps to prevent the Rusty bolt effect.

Acetone is used as a solvent by the pharmaceutical industry and as a denaturant in denatured alcohol. Acetone is also present as as excipient in some pharmaceutical drugs. Although itself flammable, acetone is used extensively as a solvent for he safe transporting and storing of acetylene, which cannot be safely pressurized as a pure compound. Vessels containing a porous material are first filled with acetone followed by acetylene, which dissolve into the acetone. One liter of acetone can dissolve around 250 liters of acetylene.

EXPOSURE OF ACETONE:

Acetone is exposed by breathing it, ingesting it, or absorbing it through your skin. Exposure can occur through smoking cigarettes, or breathe second-hand cigarette smoke. At home, we can be expose to acetone by using nail polish remover, household cleaners, paints, adhesives, rubber cement, particle board or other products that can acetone.

Exposure can occur if people who are living near a landfill site that contain acetone, near busy roads or near other facilities such as incinerators that release acetone emissions. At work, it is exposed to them who are working in the manufacturing of paints, plastics, chemicals, artificial fibers, commercial cleaning products and shoes.

FLAMMABILITY:

The most hazardous property of acetone is its extreme flammability. At temperatures greater than acetone's flash point of -20 ^{0}C, air mixtures of between 2.5% and 12.8% acetone, by volume, may explode or cause a flash fire. Vapours can flow along surfaces to distant ignition sources and flash back. Even pouring or spraying acetone over red-glowing coal will not ignite it, due to the high concentration of vapour and the cooling effect of evaporation of the liquid. Auto-ignition temperature

is also dependent upon the exposure time, thus at some tests it is quoted as 525 ^{0}C. Also industrial acetone is likely to contain a small amount of water which also inhibits ignition.

HEALTH EFFECTS:

- Exposure to high levels of acetone can death, coma, unconsciousness, seizures and respiratory distress.
- It can damage human kidneys and the skin in mouth.
- Breathing moderate to high levels of acetone for short periods of time can cause nose, throat, lungs and eye irritation.
- It can also cause intoxication, headaches, fatigue, stupor, light headache, dizziness, confusion, increased pulse rate, nausea, vomiting and shortening of the menstrual cycle in women.
- Breathing highly concentrated acetone vapours can irritate the respiratory tract and burn your eyes. Skin contact with acetone can irritate or damage your skin.
- It can also cause low blood pressure, bronchial irritation, difficulty breathing, shortness of breath, abdominal pain and an increased need to urinate.

ENVIRNOMENTAL EFFECTS:

Although acetone occurs naturally in the environment in plants, trees, volcanic gases, forest fires and as a product of the breakdown of body fat, the majority of the acetone released into the environment is of industrial origin. Acetone evaporates rapidly, even from water and soil. Once in the atmosphere, it has a 22 days half-life and is degraded by UV light via photolysis. Consumption by micro organisms contributes to the dissipation of acetone in soil, animal or waterways. Acetone may pose a significant risk of oxygen depletion in aquatic system due to the microbial consumption.

CHLOROFLUOROCABONS (CFC):

CFC is an organic compound which are produced as volatile derivatives of methane, ethane and propane. They are also commonly known by the DuPont brand name Freon. Many CFCs have been widely used as refrigerants, propellants, air conditioners, to make plastic foams for furniture, insulation and also used for aerosol in spray cans. we all knew that CFCs are dangerous organic solvent which causes ozone depletion in the upper atmosphere.

ENVIRONMENTAL IMPACTS:

CFCs were phased out via the Montreal protocol due to their part in ozone depletion. However, the atmospheric impacts of CFCs are not limited to its role as an active ozone reducer. This anthropogenic compound is also a greenhouse gas, with a much higher potential to enhance the greenhouse effect than CO_2. Infrared absorption bands trap heat from escaping earth's atmosphere. In the case of CFCs, the strongest of these bands are located in the spectral region 7.8-15.3 μm referred to as an atmospheric window due to the relative transparency of the atmosphere within this region. The strength of CFC bands and the unique susceptibility of the atmosphere at which the compound absorbs and emits radiation, are two factors that contribute to CFCs "super" greenhouse effect. Another such factor is the low concentration of the compound. Because CO_2 is close to saturation with high concentrations, it takes more of the substance to enhance the greenhouse effect. Conversely, the low concentration of CFCs allows their effects to increase linearly with mass.

OZONE DEPLETION:

For over 50 years. CFCs were thought of as miracle substance. They are stable, non flammable, low in toxicity and inexpensive to produce. Over time, CFCs found uses as refrigerants, solvents, foam blowing agents and in other smaller applications. Other chlorine containing compounds include methyl chloroform, a solvent and carbon tetrachloride, an industrial chemical. All of these compounds have atmospheric lifetimes long enough to allow them to be transported by winds into the stratosphere. Because they release chlorine or bromine when they break down, they damage the protective ozone layer.

In the early 1970s, researchers began to investigate the effects of various chemicals on the ozone layer, particularly CFCs, which contain chlorine. They also examined the potential impacts of other chlorine sources. Chlorine from swimming pools, industrial plants, sea salt and volcanoes does not reach the stratosphere. Chlorine compounds from these sources readily combine with water and repeated measurements show that they rain out of the troposphere very quickly. In contrast, CFCs are very stable and do not dissolve in rain. Thus, there are no natural processes that remove the CFCs from the lower atmosphere. Over time, winds drive the CFCs into the stratosphere.

The CFCs are so stable that only exposure to strong UV radiation breaks them down. When that happens, the CFC molecule releases atomic chlorine. One chlorine atom can destroy over 1,00,000 ozone molecules. The net effects are to destroy ozone faster than it is naturally created. To return to the analogy comparing ozone levels to a stream's depth, CFCs act as a siphon, removing water faster than normal and reducing the depth of the stream.

One example of ozone depletion is the annual ozone hole over Antarctic that has occurred during the Antarctic Spring since the early 1980s. Rather than being a literal hole through the layer, the ozone hole is a large area of the stratosphere with extremely low amounts of ozone. Ozone levels fall by over 60% during the worst years.

HEALTH EFFECTS:

- Direct exposure to some types of CFCs can cause unconsciousness, shortness of breath and irregular heartbeat.
- It can also cause confusion, drowsiness, coughing, sore throat, difficulty breathing and eye redness and pain.
- Direct skin contact with some types of CFCs can cause frostbite or dry skin.
- When CFCs destroy the ozone layer, harmful ultraviolet rays reach the earth. Exposure to increased ultraviolent rays can cause skin cancer, cataracts and weakened immune systems.

METHANOL:

Methanol is the simplest alcohol and is a light, volatile, colourless, flammable liquid with a distinctive odour very similar to that of ethanol. It is a highly toxic colourless liquid that may explode when exposed to flames.

USES:

- Methanol is used in antifreeze products and is an ingredient of gasoline.
- It is used as an ingredient of some paint strippers.
- It is used in wall and spray paints, paint thinner, shellac, varnish, carburetor cleaners, inks, resins, adhesives, dyes, plastics, car windshield washer compounds and in some pesticides.
- In some vehicles they are used as an alternative fuel and are used as a fuel for picnic stoves.
- It is also used in semi-conductor manufacturing.
- Used in the production of some pharmaceuticals such as vitamins and hormones.
- It is used in the treatment against Dutch elm disease and fungi on timbers, wood fence posts and poles and lumber.

METHANOL EXPOSURE:

Methanol is exposed by the using consumer products such as wall and spray paints, paint strippers, adhesives, cleaners, insulation products, pesticides and car windshield washer fluid or antifreeze. Exposure can occur from breathing air that contains methanol from natural sources or vehicle exhaust and from drinking or eating contaminated water or food.

At work, it is exposed which as using wall and spray paints, paint strippers, adhesives, inks, wood fungi treatments or industrial cleaners. It is exposed to them who are working at a pharmaceutical or semi conducting manufacturing facility, mortuary or oil recovery facility.

HEALTH EFFECTS:

- Swallowing, breathing or absorbing large quantities of methanol through the skin, as in an industrial setting, can cause death.
- Exposure to methanol can cause visual problems and lead to blindness.
- It can cause convulsions, coma, loss of consciousness, kidney failure, liver damage, low blood pressure, respiratory arrest and damage to the central nervous system.
- Chronic exposure to methanol can result in methanol poisoning, which may cause inflammation of the eye, recurrent headaches, insomnia, stomach problem, visual failure and dermatitis.
- Short-term exposure to methanol can cause difficulty breathing, lack of coordination, blurred vision, dermatitis, headache, dizziness, insomnia, confusion, nausea, vomiting, diarrhea, inflammation of the pancreas, conjunctivitis, stomach problems and pain, weakness, leg cramps and excessive sweating.
- It causes damage to liver, kidney and eye disorder.

REDUCING TOXIC NATURE OF SOLVENTS BY GREENER SOLVENTS:

Solvents define a major part of the environmental performance of processes in chemical industry and also impact on cost, safety and health issues. The idea of "green" solvents expresses the goal to minimize the environmental impacts resulting from use of solvents in chemical production. The replacement of toxic and noxious solvents by more environmentally-benign ones is an important area for the 'green' chemist. Over recent years the use of harmful solvents, such as benzene, carbon tetrachloride and chloroform, have been phased out by industry and have gradually become less commonly used in academic research. Many solvents, which can be harmful to workers if not adequately protected and to the environment if releases occur, are still used however. With the exception of solvents such as supercritical fluids and ionic liquids, solvent replacement is not seen, so most of the research in this area is done by industrial process development chemists. And because of increasingly strict legislation on the release of volatile organic compounds and on trace solvents in water, industry is focusing on the usage of greener solvent.

SAFER SOLVENTS:

Reactions that occur in the gas phase are preferable as they avoid the use of solvents to bring the reactants together. Examples include the manufacture of ammonia, the manufacture of methanol and the manufacture of ethane.

Some reactions use water as a solvent, for example in the manufacture of inorganic compounds such as hydrogen peroxide, phosphoric acid, sodium carbonate and organic compounds such as ethane-1,2-diol and ethanol. Water is not a harmful solvent but it is a precious resource and it is important to ensure that it is not washed.

In the manufacture of ethanoic acid, the product itself is used as the solvent. However, other reactions use organic solvents which readily evaporate into the atmosphere unless great care is used to contain them. Wherever possible alternative solvents are used which are not harmful, one example being the development of water-borne paints, which are replacing paints that use volatile organic compounds such as the hydrocarbons which are harmful to the atmosphere. Supercritical (liquid) carbon dioxide is widely used as a solvent in the extraction of caffeine from coffee beans and in the latest dry cleaning equipment it replaces chlorinated solvents such as perchloroethene, C_2Cl_4.

CONTROL METHODS AND MANAGEMENT OF EXPOSURE:

- Replace the harmful compounds by less hazardous form.
- e.g. substitution of benzene by Cylcohexane or toluene.
- Ceasing to use the chemical.

- Take into account both the desirable and undesirable property of solvent while in selection of substitution of solvent.
- Compare toxicity, volatility, flammability, explosiveness and stability.
- e.g. substitute water-based paint for solvent-based paint.

CONCLUSION:

As solvents causing great harm to human and environment which has to be reduce the use of these toxic solvents by replacing them with greener solvents and also taking some preliminary precautions while using solvents. Diagnosis of chronic poisoning is not easy and toxicity has not yet been fully clarified. So, it is difficult to treat and prevention of exposure is easier. By taking some precautions we can reduce some of the toxic effects on human and environment.

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