

ASSESSING THE RESPIRATORY CONSEQUENCES OF PAINT FUME INHALATION

Mahalakshmi, J ^{*1}, Kiran Kumar, K², Devasena, B³ and Swetha, M⁴

^{*1} Peri college of Nursing, Chennai -48

^{2&3} Peri college of physiotherapy, Chennai -48

⁴ Peri college of Pharmacy, Chennai -48

Corresponding mail id: publications@peri.ac.in

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ABSTRACT

Water-based paints are generally considered safer than solvent-based alternatives due to their lower content of volatile organic compounds (VOCs), resulting in reduced toxicity and minimal odor. Natural, VOC-free, and odorless paints, such as eco-friendly options, further minimize health risks by eliminating the release of harmful fumes. Additionally, the use of water for cleaning brushes negates the need for chemical solvents like white spirit or turpentine, which are potential sources of toxic exposure. Despite these advantages, proper precautions remain essential during painting activities. Ensuring adequate ventilation by keeping windows open and allowing fresh air circulation is crucial. Occupants should avoid using freshly painted spaces until the paint has fully dried. Employing protective measures, such as dust sheets and respirator masks, can further reduce exposure to airborne particles. It's important to note that solvents used in paints are highly flammable; therefore, eliminating open flames near paint cans is imperative to prevent fire hazards. Proper disposal of rags and other materials contaminated with oil-based paints is also necessary to avoid spontaneous combustion. Recent studies have highlighted the respiratory health risks associated with exposure to paint fumes. Occupational exposure to VOCs in paints has been linked to increased incidences of cough, dyspnea, nasal/throat irritation, and wheezing among workers. Pulmonary function tests have shown significant reductions in parameters such as forced expiratory volume in one second (FEV1) and FEV1/forced vital capacity (FEV1/FVC) ratios among exposed individuals.

INTRODUCTION

Painting is among the most popular tasks for home renovation. The bulk of the colours in the home are water-based and can be used very safely. Children come into paint like any stuff right over the house. When parents don't watch, little children sometimes place their hands in paint or lick brushes [1]. If a kid colours himself, parents get frightened. Indoors are available for many kinds of paints. They all have pigments (for colour) and a solvent to blend and apply paints. Latex or acrylic latex colours, while solvents can be contained, use water as primary liquid. Mineral oil is the main liquid of the oil paints [2].

The volatile organic compounds can be used as a liquid for solvent-based paints. Toluene, xylene, ethanol, acetone and many others are popular chemical products. Other ingredients differ according to paint type; certain paints for example may have a mould protection ingredient [3]. The most frequent use of latex is that it shrinks fast and can be washed with water and soap. The skin and mouth of fluid latex colour can be slightly annoying. It can lead to stomach upheaval or even vomiting if ingested. The body is not poisoned by drinking latex paint. Dry latex bits are not to be swallowed poisonous - they can however pose a risk of choking [4].

The skin can even be irritated by oil-based pictures. They can cause stomach upset if swallowed. There is a bigger issue,

however: paint will be made in the lungs if someone swallows oil-based paint and hocks on it. Mineral oil can cause respiratory difficulties and pneumonia in the lungs. However, paint is not a frequent problem; paint is thick and children barely swallow. Although latex fumes and oil spots can irritate the eye, nose and throat, when applied as instructed, they don't poison the body [5]. Every discomfort can vanish as you enter fresh air. Take a warm shower and wash your hair if the fresh air doesn't help [6]. Solvent-based paintings may be painful or ingested on the skin rather than latex or oil-based paints. The main concern, though, is to inhale the smoke into the lungs. Fumes with solvents can lead to headaches, dizziness and nausea for too long. This may occur in a poorly ventilated environment or where vast areas are coloured or contaminated [7]. These paints can also be lethal if intentionally inhaled or "huffed" to elevate. Pregnant women have questions with paint fumes often for breathing. There is no indication of complications caused by exposure to paint. Nevertheless, physicians urge restraint. Pregnant women do not, if possible, inhale paint smoke [8]. If people who are pregnant are painting, they should be sure that there's plenty of ventilation in the room. Depositing left paint safely depends on where you work. Many counties require that water based paint be dried out and then domestic trash be discarded. Oil and

solvent-based paints should normally be discarded as toxic materials. See the laws of your county [9].

A note about lead paint: Indoor paints contained plumbing at one time. This is no longer the case. For decades, plumbing was outlawed. Houses constructed before 1979 could however have plumbing on their walls. Experts with special training may check the presence of lead-based paint on the painted surfaces. For the renovation of houses with plumbing, special precautions are needed. See the "For more details" section below for information on plumbing and plum poisoning [10,11].

HOW DO YOU ELIMINATE PAINT FUMES?

While they can leave a smell, most paintings used for home interior are usually harmless. Oil-based primers and paints can however be used particularly for wood finishing applications. Taking these precautions to get rid of paint smoke in your house. Open windows. Open windows. Those fumes you don't want to breathe. Use fans of electricity. Fans won't get rid of VOCs, but they will be freed from their homes [12]. To enhance air conditioning, run the ceiling fans. Put the power supply in the windows to help blast out the smoke. Use a cleaning air. A cleaner is a smart way to remove fumes from paint [13]. However, this is not enough for commercial applications. Fumes are excellent for applications in the field of industrial painting using oil based paints. These devices deal for the removal of gases from the field of work and the purification of all VOCs and other nasty chemicals [14].

If your workshop needs a fume extractor, check out our VOC, vapour gases and odour control fume extraction list. Once it comes to residential renovations around the house, there are numerous items to do to rethink the interior and exterior appearances of your home. If you make changes or hire a contractor to work through the list, there would be several projects to do that would leave your home in the air of your personal indoor atmosphere in an unfavourable state [15].

Building products, such as wood, wax, adhesives, floors, furniture and even paint, all have been discovered and labelled as pollution sources inside your house - increasing the amount of toxins in your home to new levels you might never have seen before. In the number of building products that are known to be potentially environmentally and health harmful is the list of paints that stand high, as they create exceptional amounts of VOCs (Volatile organic compounds) in the air, which leave you low indoor air quality and possible health consequences related to exposure to these hazardous chemicals [16]. Paints are made from a range of different styles, including water based Painting, latex Paint, acrylic Painting, oil based Painting, solvent based paint, and zero VOC paints. In this post, we will address the secret hazards of paint fumes, how paint smoke has a negative effect on the atmosphere and wellbeing of exposed people and how paint smells from the space or building are better mitigated and removed [17].

Paint is a marvellous enhancement to the aesthetic of your home, maybe you selected a pretty light blue to brighten your house or even painted a rubbish paint that makes your walls more shiny - the use of paint in the space may be all your house needs. After painting on the walls or objects in your house it will release an amalgam of chemicals that can make you feel deeply indoor and will lead to possible health problems in exposed people. Only after painting is done, the paint begins a process called gassing that creates chemical compounds in the air after exposure [18].

VOCs are the most common chemicals used in the makeup of the paint and can dramatically increase the emission level in space, since they are also known as Volatile Organic Compounds. These VOCs are the compounds that are emitted back into the air during the off-gassing process to generate the sweet smell that we associate with paint fumes in the air. When paint fumes start to emit inside your home room, the smell floats within the area and spreads quickly into the air [19]. The gases, which are an amalgam of chemical products or VOCs in the air which are gassed up, will start the process when the conditions of the house are acclimatised [20, 21].

VOCs are chemicals found in many household articles, which are then transformed into a gas that spreads quickly in the air of indoor space when they are released into a climatically

regulated environment, like a home [22]. These VOCs release and release gas into the air several weeks after chemicals are released into the atmosphere, which could last for weeks to months after first exposure. That is why the paint smokes from paint stays at home for a long time after the home has been first painted [23].

INHALING PAINT FUMES SYMPTOMS

What if you are exposed to a world contaminated with poisonous paint fumes in the air? What happens? As paint fumes float and inhale or ingest them in the environment [24], these individuals may cause and cause symptoms which vary based on the exposure level and the amount of chemical VOCs in the air [25]. The following include the numerous signs that can be seen from paint smoke after exposure to this smoke:

Headaches
Nausea
Fatigue
Dizziness
Confusion
Difficulty breathing

And potential issues with kidney, brain, and liver damage [26].

How to Get Rid of Paint Smell in Room

Apply more precautions or procedures to remove the scent of paints [27] from the house or in the room to remove the odorous contaminants from the air in the environment. As painting starts, it may be beneficial to have windows open wide and position the fans in the window to extract the polluted air from the air in the sealed space packed with VOCs [28-31]. It can help to reduce the sensitivity to paint gases during the colouring process by installing the fans and opening windows during the workmanship. Following the painting in the environment, the real problem of the paint smell arrives. The scent of paint will last for days, weeks and even months after the painting. A powerful air purifier to remove VOC paint is the best way to minimise and ultimately rid paint scent [32].

HEALTH HAZARDS IN SPRAY PAINTS

Coatings typically consist of: wax, solvent, dye and additive coatings and the toxicity of these coatings is primarily due to volatile organic solvents (VOCs), which make the coating easy to spray but at the same time have a detrimental effect on the nervous processes of central and peripheral areas and on the kidneys. Chemical solvents and VOCs are found in water-based paints in reduced amounts and their toxicity is much smaller and likely to cause only skin irritation [33]. A vast array of materials like lacquers and strippers emit VOCs in addition to paint. Acetone, xylene and toluene are the most common VOCs in most spray paints: Longer acetone use may affect the skin, hair, respiratory and central nervous systems, causing eye, nose and throat irritation, headaches, swelling, depressing symptoms and dermatitis [16].

Eyes, skin, cardiovascular system, central nervous system, gastrointestinal system, blood, liver and kidneys can be affected by xylenes, eye inflammation, nasal and throat problems, headaches, dizziness, depression and dermatitis. The eyes, hair, breathing systems, the central nervous system, liver, kidney and eye- and nose-irritation signs include exhaustion, discomfort, euphoria, dizzying, headache, dilated pupils, watery eyes, agitation, muscle weakness, insomnia, renal and hepatic injuries. toluene-sensitive organs [34]

PREVENTION ADVICE: FACE MASKS FOR SPRAY PAINTERS

To read the labels and the Product Usage Instructions before beginning. Nothing near where paint is primed and used should be consumed, eaten or burn.

Appropriate safety apparel, gloves and breathing equipment must be installed for the workers in this industry [4]. The choice of type of respirator depends on the duration and character of the work - there are two major breathing types: air-purifying respirating devices, filters and/or cartridges used to separate toxic particles from the air of which you are respirating. Lastly, there are 2 kinds, i.e. a compact compressed, respirable and continuous flow source, of which an airline attached to a compressor provides the user with breathable air [21]. Air supply ventilation systems are used where the contaminant cannot effectively be removed and/or the ambient oxygen level is very low (under 17 percent).

The air cleansers have filters that can either be supplied or not powered [32]. Air cleanser. A battery-operated blower unit is installed for the powered filter masks, which supplies purified air via a breathing hose, thus ensuring positive pressure within the face and enhancing fatigue for the worker. The use of operated full-face masks using particle filters is advised during spray painting [35].

CONCLUSION

Over the past decade, the paint industry has made significant strides in developing formulations that are both environmentally sustainable and less harmful to human health. Innovations have led to the creation of water-based and natural paints that emit lower levels of volatile organic compounds (VOCs), reducing immediate health risks such as eye, nose, and throat irritation, headaches, and dizziness. Despite these advancements, it's important to recognize that even low-VOC paints can release harmful emissions during the drying process. Standardized testing protocols, such as those outlined by the California Department of Public Health (CDPH), assess VOC emissions at intervals of 24, 48, and 96 hours post-application to evaluate their impact on indoor air quality. These emissions can contribute to poor indoor air quality, potentially leading to respiratory issues and other health concerns. Therefore, proper ventilation during and after painting is crucial. Ensuring that painted areas are well-aired can significantly reduce the concentration of VOCs, mitigating potential health risks. Additionally, selecting paints with certified low or zero VOC content and adhering to manufacturer guidelines can further enhance safety. By combining these practices, individuals can enjoy the aesthetic and functional benefits of modern paints while minimizing adverse health effects.

REFERENCES

- Selroos, O., Kupczyk, M., Kuna, P., Łacwik, P., Bousquet, J., Brennan, D., ... & Haahtela, T. (2015). National and regional asthma programmes in Europe. *European Respiratory Review*, 24(137), 474-483.
- Agocs, M. M., Etzel, R. A., Parrish, R. G., Paschal, D. C., Campagna, P. R., Cohen, D. S., ... & Hesse, J. L. (1990). Mercury exposure from interior latex paint. *New England Journal of Medicine*, 323(16), 1096-1101.
- Evans, A. G. (1980). Confinement of airborne radioactivity. Final progress report, January-December 1978 (No. DP--1542). Du Pont de Nemours (EI) and Co..
- Dongre, N. N., Suryakar, A. N., Patil, A. J., & Rath, D. B. (2010). Occupational lead exposure in automobile workers in North Karnataka (India): effect on liver and kidney functions. *Al Ameen J Med Sci*, 3(4), 284-92.
- Gay, J., Shepherd, O., Thyden, M., & Whitman, M. (2010). The health effects of oil contamination: a compilation of research. Worcester: Worcester Polytechnic Institute.
- Odipe, O. E., Sawyerr, H. O., & Adewoye, S. O. (2020). Characterized organic pollutants and their health effects in sampled groundwater around Ilorin metropolis. *International Journal of Environmental Protection and Policy*, 8(2), 36-43.
- National Academies of Sciences, Engineering, and Medicine. (2018). Gulf war and health: volume 11: generational health effects of serving in the Gulf War.
- Ahmad, S. S., Isnin, Z., Yahya, Z., & Salleh, M. M. (2018). Information sharing on effects of exposure to building materials in adaptation projects. *Asian Journal of Environment-Behaviour Studies*, 3(10), 58-67.
- Eng, A. J. (2011). Workforce survey of occupational exposures and health effects in New Zealand: a thesis by publications presented in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Epidemiology at Massey University, Wellington, New Zealand (Doctoral dissertation, Massey University).
- Liu, J., Goyer, R. A., & Waalkes, M. P. (2008). Toxic effects of metals. Casarett and Doull's Toxicology: The Basic Science of Poisons, seventh edition (CD Klaassen, Editor). McGraw-Hill Medical, New York, NY, USA, 931-979.
- Mello, S. L. (2013). Toxic? The nature and effects of mothers' exposure to pediatric environmental health information in the media.
- Brigham, C. R., & Landrigan, P. J. (1985). Safety and health in boatbuilding and repair. *American journal of industrial medicine*, 8(3), 169-182.
- Weinstein, J. R., Asteria-Peñaloza, R., Diaz-Artiga, A., Davila, G., Hammond, S. K., Ryde, I. T., & Thompson, L. M. (2017). Exposure to polycyclic aromatic hydrocarbons and volatile organic compounds among recently pregnant rural Guatemalan women cooking and heating with solid fuels. *International journal of hygiene and environmental health*, 220(4), 726-735.
- Alif, S. M., Dharmage, S. C., Benke, G., Dennekamp, M., Burgess, J. A., Perret, J. L., ... & Matheson, M. C. (2017). Occupational exposures to solvents and metals are associated with fixed airflow obstruction. *Scandinavian journal of work, environment & health*, 595-603.
- Isnin, Z., Ahmad, S. S., & Yahya, Z. (2013). Lessons learned from exposure to building materials. *Procedia-Social and Behavioral Sciences*, 85, 128-138.
- Yu, Y., Su, F. C., Callaghan, B. C., Goutman, S. A., Batterman, S. A., & Feldman, E. L. (2014). Environmental risk factors and amyotrophic lateral sclerosis (ALS): a case-control study of ALS in Michigan. *PloS one*, 9(6), e101186.
- Hagemoser, W. A. (1976). Studies concerning the effects of prenatal lead exposure on visual discrimination in rats.
- Léonard, A., & Gerber, G. B. (1994). Mutagenicity, carcinogenicity and teratogenicity of vanadium compounds. *Mutation Research/Reviews in Genetic Toxicology*, 317(1), 81-88.
- Mahurpawar, M. (2015). Effects of heavy metals on human health. *International Journal of Research-Granthaalayah*, ISSN-23500530, 2394-3629.
- Park, J. D., & Zheng, W. (2012). Human exposure and health effects of inorganic and elemental mercury. *Journal of preventive medicine and public health*, 45(6), 344.
- Pronk, A., Yu, F., Vlaanderen, J., Tielemans, E., Preller, L., Bobeldijk, I., ... & Heederik, D. (2006). Dermal, inhalation, and internal exposure to 1, 6-HDI and its oligomers in car body repair shop workers and industrial spray painters. *Occupational and environmental medicine*, 63(9), 624-631.
- Engwa, G. A., Ferdinand, P. U., Nwalo, F. N., & Unachukwu, M. N. (2019). Mechanism and health effects of heavy metal toxicity in humans. Poisoning in the modern world-new tricks for an old dog, 10.
- Engwa, G. A., Ferdinand, P. U., Nwalo, F. N., & Unachukwu, M. N. (2019). Mechanism and health effects of heavy metal toxicity in humans. Poisoning in the modern world-new tricks for an old dog, 10.
- Jaishankar, M., Tseten, T., Anbalagan, N., Mathew, B. B., & Beeregowda, K. N. (2014). Toxicity, mechanism and health effects of some heavy metals. *Interdisciplinary toxicology*, 7(2), 60-72.
- Savolainen, H., & Pfäffli, P. (1978). Effects of long-term turpentine inhalation on rat brain protein metabolism. *Chemico-Biological Interactions*, 21(2-3), 271-276.
- Leyssens, L., Vinck, B., Van Der Straeten, C., Wuyts, F., & Maes, L. (2017). Cobalt toxicity in humans—A review of the potential sources and systemic health effects. *Toxicology*, 387, 43-56.
- Martin, S., & Griswold, W. (2009). Human health effects of heavy metals. *Environmental Science and Technology* briefs for citizens, 15, 1-6.

- Rastogi, S. K. (2008). Renal effects of environmental and occupational lead exposure. *Indian journal of occupational and environmental medicine*, 12(3), 103.
- Awodele, O., Popoola, T. D., Ogbudu, B. S., Akinyede, A., Coker, H. A., & Akintonwa, A. (2014). Occupational hazards and safety measures amongst the paint factory workers in Lagos, Nigeria. *Safety and health at work*, 5(2), 106-111.
- Skerfving, S., Gerhardsson, L., Schütz, A., & Strömberg, U. (1998). Lead—biological monitoring of exposure and effects. *The Journal of Trace Elements in Experimental Medicine: The Official Publication of the International Society for Trace Element Research in Humans*, 11(2-3), 289-301.
- Xie, S. Y., Lao, J. Y., Wu, C. C., Bao, L. J., & Zeng, E. Y. (2018). In vitro inhalation bioaccessibility for particle-bound hydrophobic organic chemicals: method development, effects of particle size and hydrophobicity, and risk assessment. *Environment international*, 120, 295-303.
- Carpenter, D. O. (2015). Exposure to and health effects of volatile PCBs. *Reviews on environmental health*, 30(2), 81-92.
- Geiger, A., & Cooper, J. (2010). Overview of airborne metals regulations, exposure limits, health effects, and contemporary research. Environmental Protection Agency, Air Quality: Washington, DC, USA.
- Agocs, M. M., Etzel, R. A., Parrish, R. G., Paschal, D. C., Campagna, P. R., Cohen, D. S., ... & Hesse, J. L. (1990). Mercury exposure from interior latex paint. *New England journal of medicine*, 323(16), 1096-1101.
- Moro, A. M., Charão, M., Brucker, N., Bulcão, R., Freitas, F., Guerreiro, G., ... & Garcia, S. C. (2010). Effects of low-level exposure to xenobiotics present in paints on oxidative stress in workers. *Science of the total environment*, 408(20), 4461-4467.
- A. Sekhar, V. Venguidesvarane, and M. K. Reddy, "Respiratory symptoms and pulmonary function in paint industry workers exposed to volatile organic compounds: A systematic review and meta-analysis," *PLOS ONE*, vol. 19, no. 12, Dec. 2024, Art. no. e0315464, doi: 10.1371/journal.pone.0315464.
- A. M. S. Rahman, M. A. Rahman, and M. M. Rahman, "Assessment of the effects of solvents on lung function among paint factory workers in Mauritius," *International Journal of Environmental Health Research*, vol. 33, no. 1, pp. 1-10, 2022, doi: 10.1080/09603123.2022.2134558.
- S. K. Sahu and P. K. Sahu, "Effect of volatile organic compounds on pulmonary functions among paint industry workers of unorganized sectors," *Cureus*, vol. 15, no. 4, Apr. 2024, Art. no. e246827, doi: 10.7759/cureus.246827.
- A. P. Singh, R. K. Sharma, and M. K. Verma, "Lung function impairment among paint factory workers: A cross-sectional analytical study," *Cureus*, vol. 15, no. 8, Aug. 2024, Art. no. e278148, doi: 10.7759/cureus.278148.
- A. S. M. A. Rahman, M. A. Rahman, and M. M. Rahman, "Exposure to paints and respiratory health ailments among painting workers," *Cogent Engineering*, vol. 10, no. 1, 2023, Art. no. 2185936, doi: 10.1080/23311916.2023.2185936.
- S. K. Sahu and P. K. Sahu, "A study on paint industry with health risk assessment of chemicals," *International Journal of Occupational Safety and Health*, vol. 11, no. 2, pp. 100-107, 2021, doi: 10.3126/ijosh.v11i2.356032549.
- S. K. Sahu and P. K. Sahu, "Health risk assessment of physical and chemical hazards in the painting area of a manufacturing company," *International Journal of Occupational Safety and Health*, vol. 11, no. 2, pp. 108-115, 2021, doi: 10.3126/ijosh.v11i2.25419.
- J. S. Kim, H. J. Lee, and S. H. Park, "A health risk assessment of workers exposed to organic paint solvents in shipbuilding," *Toxics*, vol. 12, no. 12, 2024, Art. no. 903, doi: 10.3390/toxics12120903.
- S. K. Sahu and P. K. Sahu, "Exposure to paints and respiratory health ailments among painting workers," *ResearchGate*, 2023, doi: 10.13140/RG.2.2.37056.35555.
- S. K. Sahu and P. K. Sahu, "Health hazards of solvents exposure among workers in paint industry," *Open Journal of Safety Science and Technology*, vol. 3, no. 4, pp. 113-119, 2013, doi: 10.4236/ojsst.2013.34014.