DOI: https://doi.org/10.5281/zenodo.21801562

Accidental Industrial Fatalities Resulting from the Hazardous Effects of Carbon Monoxide in the Absence of Combustion: A Case Series

Bajrang K. Singh[1*] 0000-0001-9120-1569, Ankit P. Jain[2], Osheen Jain[3], Jai P verma[3]

Abstract:

Carbon monoxide gas, because of its properties of being odourless and non-irritating, is known as 'the silent killer'. Carbon monoxide intoxication is a commonly reported as cause of death during fires, faulty heating system and car exhaust leakage where it is produced due to incomplete combustion. This case report is unique because 03 workers died from carbon monoxide gas produced without combustion. All 03 deceased entered the processing tank of a lubricating factory to clean it one by one but became unconscious rapidly, and all workers were declared brought dead on arrival at the hospital. In literature no such fatality due to carbon monoxide without combustion has been reported, so we have searched for mechanisms of carbon monoxide production without combustion, and we found mechanisms like autooxidation and pyrolysis may produce carbon monoxide if a hydrocarbon material is heated in an oxygen-deficient confined space. We concluded carbon monoxide intoxication as the cause of death in all 03 cases on the basis of autopsy findings and laboratory reports. This case series also underscores the importance of safety measures to prevent such fatalities in the industry.

Keywords: Carbon monoxide; accidental; industrial; forensic pathology.

Introduction:

Carbon monoxideis usually produced by incomplete combustion of compounds having carbon during fire, unsafe heating systems, car exhaust leakage, etc.[1] Carbon monoxide is a non-irritating gas without any odour or taste. This makes it difficult for those who are exposed to detect it.[2] Because of it, this gas is also known as the "Silent Killer". Carbon monoxide fatalities due to such incomplete combustion have been reported in literature, but in this case series, 03 people died due to carbon monoxideproduction without combustion.

[1]Professor, [2]Assistant Professor, [3]Postgraduate Student, Department of Forensic Medicine & Toxicology, MGM Medical College, Indore, Madhya Pradesh, India,
Correspondence: **Dr. Bajrang K. Singh**
Email ID: drbajrangforensic@gmail.com
Contact No. +91 9713167594

Received on 02.02.2026 | Accepted on 01.03.2026

Scientific and industrial literature identifies several non-combustive pathways for carbon monoxide (CO) production in lubricant storage and processing. Usual mechanisms for non-combustive carbon monoxide (CO) production are autoxidation during storage and thermal cracking & pyrolysis [3,4].

Carbon monoxide in blood forms carboxyhaemoglobin in combination withh aemoglobin. The affinity of carbon monoxide is 200 to 250 times greater than the affinity of oxygen to haemoglobin;thus, less haemoglobin is available for carrying oxygen.[5] Carboxyhaemoglobin in blood causes cherry-red discolouration of hypostasis and viscera. Hypoxia of tissues and organs causes tissue oedema, and in severe hypoxia, A series of pathophysiological changes will follow, which can cause death at last.[6] This case is unique, as no

such case has been reported of industrial fatalities due to carbon monoxide produced without combustion.

Case History:

Three deceased males of ages 22, 29 and 41 years were brought for autopsy with an alleged history of getting unconscious when they entered one by one into the processing tank (Fig-01) of a lubricant oil factory for the purpose of cleaning it. All three were declared dead on arrival at the hospital. This company is manufacturing automobile and industrial lubricant oils. This incident got newspaper coverage mentioning 03 employees die after inhaling toxic fumes.[7]

During autopsy, blackish greasy material (Fig-02) emitting a hydrocarbon-like smell was found over clothing and body surface at places in all 03 deceased. Hypostasis was found over back of the body and of pinkish red colour in all deceased(Fig-03). Nail beds were found to be of reddish colour (Fig-04). On dissection, in all cases, organs were found congested and oedematous. The liver and kidneys were found to be of pinkish red colour (Fig. 05). No foul odour was found emitting from the stomach or viscera during autopsy. Blood was kept for toxicological examination, which showed the presence of carboxyhaemoglobin in all 03 deceased. Histopathological reports of the brain and other visceral organs showed oedema in all cases.

Figure -1: Crime scene photograph; green arrow showing alleged processing tank

Figure 2:Blackish greasy material found adherent over body at places.

Figure -3: pinkish red hypostasis over back of the body

Figure 4: reddish nailbeds and palms showing blackish greasy material adherent to it.

Discussion:

Carbon monoxide is a silent killer and responsible for many deaths, but in all such reported cases carbon monoxide has been produced due to an incomplete combustion process. In the cases of this case series, all three workers entered the processing tank covered by a lid to clean hydrocarbon residue left out in it. This tank has beenutilised for heatingand

processing

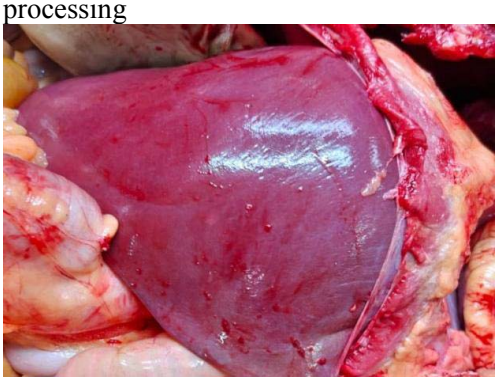

Figure -5: pinkish red liver,

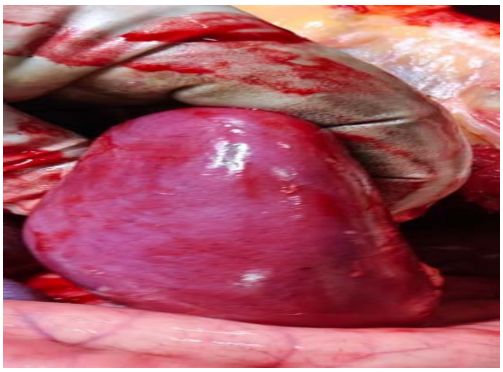

Figure 6: pinkish red kidney.

of hydrocarbon materials to produce lubricants. During the heating process no combustion has been done inside the tank. Based on these facts, we suspected toxic gases like methane which usually produced from hydrocarbon materials may be reason for death but as history of combustion was lacking carbon monoxide poisoning was not suspected. During autopsy reddish hypostasis, pinkish red visceral organ and reddish nail beds raises suspicion of carbon monoxide poisoning and no unpleasant smell from stomach and lung also favour carbon monoxide as it is gas without odour. Gross and microscopic findings of congestion and oedema in viscera were found consistent with asphyxial death. The presence of carboxyhaemoglobin in the blood of all cases confirms exposure to it and also the reason for these fatalities. We have gone through extensive literature searches for such case reports in which carbon monoxide fatalities occur without any combustion, but such reporting was found lacking in the literature. We have gone through literature about the production of carbon monoxide in an industrial setup without combustion, and we found that various mechanisms like autoxidation during storage and thermal cracking & pyrolysis can produce it. Autoxidation during Storage: Hydrocarbons in petroleum-based lubricants can react with atmospheric oxygen over time. This free radical chain mechanism (often referred to as autoxidation) produces peroxides and oxyacids. Research on the Autoxidation of Fuels During Storage details how these radical reactions lead to the chemical degradation of the oil.[3] Thermal Cracking & Pyrolysis: When lubricants are exposed to high temperatures without sufficient oxygen (pyrolysis), large molecules break down into smaller gaseous byproducts. Studies on the Thermal Decomposition of Lubricating Oil indicate that heating oil in an inert atmosphere generates a "soup" of lower molecular weight molecules, including significant CO.[4] In this case the tank was being used for heating hydrocarbon materials, and such heating in a closed space where there is a deficiency of oxygen may cause carbon monoxide production. The tank was closed with a lid before cleaning, so the toxic gas formed and collected during processing in the tank, even without combustion, was responsible for the rapid unconsciousness of all 03 deceased who entered the tank one by one. Heating of the tank just before cleaning to loosen the hydrocarbon residue attached to the wall of tank for facilitating cleaning also contributed to the fatal carbon monoxide level inside the tank. Carbon monoxide is a silent killer because it is without odour and non-irritating; hence, whoever enters the tank to clean it gets unconscious and non-responsive without sensing any alarming sign. Severe hypoxia due to less availability of haemoglobin for oxygen transport causes

rapid death in these cases, so all three were declared dead on arrival at the hospital.

Conclusion:

This case highlights the importance of recognising that fatalities may occur in industries doing heating of hydrocarbon materials during processing. Heating will cause non-combustive production of carbon monoxide, and in a tank, a fatal level will build up in the closed space. Usually, fatalities will occur if a person enters a processing tank with a closed lid without protective measures. Because this case series demonstrated that even in the absence of fire, heating hydrocarbons can result in lethal levels of carbon monoxide in a closed tank, protective measures will be necessary even if there is no smell coming from the tank and the person entering does not feel irritating gases inside. Industry should employ carbon monoxide alarm detectors to detect carbon monoxide collection. Before entering such a tank, workers should leave the lid open for a while and, if possible, vent the tank with fresh air.

Only those wearing safety gear and using the appropriate breathing apparatus should enter the tank. One person from outside the tank should closely monitor the person entering the tank because this gas quickly rendered a person unconscious.

Abbreviations- Not applicable

Declarations:

Ethical approval and consent to participate: Not applicable as Medico-legal autopsy does not require consent.

Consent for publication: Authors declare consent for publication.

Funding: Authors received no financial support for research, authorship, and/or publication of this article from anywhere in any form.

References:

1. Kinoshita H, Türkan H, Vucinic S, Naqvi S, Bedair R, et al. Carbon monoxide poisoning. Toxicol Rep 7;2020: 169-173
2. Henn SA, Bell J, Sussell A, Konda S. Occupational carbon monoxide fatalities in the US from unintentional non-fire related exposures, 1992-2008. ***Am J Ind Med***. 2013;56(11):1280-9.
3. Czarnocka J, Matuszewska A, Odziemkowska M. Autoxidation of Fuels During Storage [Internet]. Storage Stability of Fuels. InTech; 2015. Available from: http://dx.doi.org/10.5772/59807)
4. Nejjar K, Zeriouh A.Zakarya EM, Belkbir L, Hamad M.Thermal Decomposition of Lubricating Oil Under an Inert Atmosphere.*Asian Journal of Chemistry. 2011; 23(6): 2478-82.*
5. Rose JJ, Wang L, Xu Q, McTiernan CF, Shiva S, et al. Carbon monoxide poisoning: Pathogenesis, management, and future directions of therapy. Am J Respir Crit Care Med 2017; 195(5): 596-606.
6. Nañagas KA, Penfound SJ, Kao LW. Carbon Monoxide Toxicity. Emerg Med Clin North Am 2022; 40(2):283-312.
7. https://www.bhaskarenglish.in/local/mp/indore/news/gas-leak-at-pithampur-oil-company-plant-3-employees-lost-their-lives-after-inhaling-toxic-fumes-during-routine-work-accident-triggering-panic-and-police-investigation-135863674.html (accessed on 19.01.2026)