ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 11,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

UDK: 54.54.05
ORCID: 0009-003-2505-3985

CARBON MONOXIDE POISONING AND EMERGENCY MEDICAL ASSISTANCE TO PATIENTS

ОТРАВЛЕНИЕ УГАРНЫМ ГАЗОМ И ОКАЗАНИЕ ПОМОЩИ ПОСТРАДАВШИМ

Isaboyev Bahodir
Specialist Lecturer,
Chortoq Abu Ali Ibn Sino Public Health Technical College
Vahabova Dilnoza
Specialist Lecturer,
Chortoq Abu Ali Ibn Sino Public Health Technical College

Abstract: This article discusses the causes, symptoms, and pathophysiology of carbon monoxide (CO) poisoning, as well as methods of providing first medical aid to patients. Carbon monoxide is a colorless and odorless gas with strong toxic effects on the human body, mainly produced during incomplete combustion of organic substances. The article provides scientific information on the interaction of CO with hemoglobin, the mechanism of oxygen transport disruption, emergency care algorithms, preventive measures, and modern treatment methods such as hyperbaric oxygen therapy. The findings highlight the importance of increasing public awareness to prevent carbon monoxide poisoning incidents.
Key words: carbon monoxide, poisoning, first aid
Аннотация: В данной статье рассматриваются причины, симптомы и патофизиология отравления угарным газом (CO), а также методы оказания первой медицинской помощи пострадавшим. Угарный газ — это бесцветный и без запаха газ, оказывающий сильное токсическое воздействие на организм человека. Он образуется при неполном сгорании органических веществ. В статье приводятся научные данные о влиянии CO на гемоглобин, механизме нарушения транспорта кислорода, алгоритмах неотложной помощи, профилактических мерах и современных методах лечения, таких как гипербарическая оксигенация. Результаты исследования показывают необходимость повышения информированности населения для предотвращения случаев отравления угарным газом.
Ключевые слова: угарный газ, отравление, первая помощь

INTRODUCTION: Carbon monoxide (CO) poisoning is one of the most widespread acute toxicological conditions worldwide. According to the World Health Organization (WHO), millions of people are poisoned by CO each year, with thousands of cases resulting in death. This condition occurs more frequently during cold seasons when heating systems, automobile engines, or poorly ventilated spaces are used.

The danger of CO gas lies in the fact that it is colorless, odorless, and tasteless — making it undetectable by human senses. As a result, poisoning often progresses silently, and the victim may not realize the danger until they lose consciousness.

This article analyzes the physiological mechanisms, clinical symptoms, and first aid procedures for CO poisoning. The purpose is to deliver scientifically grounded and practically useful information to the public.

ORIGINAL ARTICLE
INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE
ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 11,2025
Journal: https://www.academicpublishers.org/journals/index.php/ijai

LITERATURE REVIEW: Physical and Chemical Properties of Carbon Monoxide. Carbon monoxide (CO) is a colorless, odorless gas produced during fires or as a result of incomplete combustion of fuel. Chemical formula: CO. It is slightly lighter than air, allowing it to accumulate quickly in enclosed spaces. CO is released during low-temperature combustion processes such as in stoves, automobile exhausts, cigarette smoke, and wood burning.
Mechanism of CO Poisoning:
CO binds strongly to hemoglobin in the blood, forming carboxyhemoglobin (HbCO). This bond is 200–250 times stronger than that of oxygen. Consequently, the delivery of oxygen to tissues through the bloodstream sharply decreases. Anaerobic metabolism intensifies, lactic acid levels rise, and hypoxia (oxygen deficiency) develops. CO also has direct toxic effects on the central nervous system, cardiac muscles, and liver cells.
Degrees of Poisoning and Clinical Signs: Degree| Clinical Signs| HbCO (%)
Mild| Headache, nausea, fatigue, dizziness| 10–20
Moderate| Shortness of breath, tachycardia, skin redness, pupil dilation| 30–40
Severe| Loss of consciousness, convulsions, respiratory and cardiac failure| >50
In cases of severe CO poisoning, the patient's skin and lips often appear "cherry red," indicating hemoglobin saturation with CO.
Primary Medical Assistance Algorithm:
1. Remove the patient from the hazardous environment. Immediately take the victim to fresh air. The rescuer should also protect themselves using a respirator or a damp cloth mask.
2. Open the airway and administer oxygen. Lay the patient down and provide 100% oxygen as soon as possible.
3. Artificial respiration and cardiac massage. If breathing has stopped, perform cardiopulmonary resuscitation (CPR).
4. Seek medical assistance. Transport the patient to a healthcare facility as quickly as possible.
5. Hyperbaric oxygen therapy (HBOT). In severe cases, the patient is treated in a special pressure chamber with oxygen, which accelerates the dissociation of HbCO.
Preventive Measures:
- Regularly inspect heating furnaces;
- Do not run vehicles in enclosed spaces;
- Monitor ventilation systems in gas stoves and heaters;
- Install CO detectors at home;
- Increase public awareness about CO poisoning risks.
Modern Treatment and Rehabilitation:
After CO poisoning, long-term complications in the nervous system and cardiac function (such as brain hypoxia, memory impairment, and cardiac arrhythmias) may occur. Therefore, patients should remain under medical observation for 2–3 weeks. Modern medical treatments include hyperbaric oxygen therapy, antioxidants, neuroprotectors, and detoxification infusions.
[2] Before starting the research, I reviewed literature sources to determine which plants contain the highest amounts of phytoncide substances and their chemical compositions.
METHODS USED: Based on the collected data, I found that coniferous plants contain abundant antibacterial substances such as phytoncides [2]. Coniferous plants, particularly Juniperus (juniper), are a natural source of phytoncides in nature. These biologically active substances exhibit antibacterial, antifungal, and antiviral properties. Juniper berries have been extensively studied in traditional medicine and scientific research, and the extracted phytoncides are widely used in the pharmaceutical and food industries, as well as for improving environmental quality.

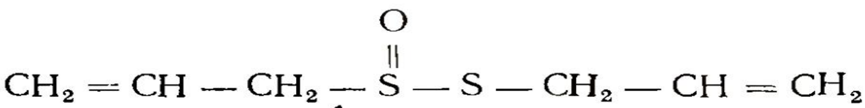
ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 11,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai



Аллицин

RESULTS AND DISCUSSION: During the conducted experiments, it was determined that carbon monoxide (CO) is mainly produced as a result of incomplete combustion of fuels such as coal, gas, wood, gasoline, and others. This phenomenon is observed under the following conditions:

- When heating systems operate without adequate ventilation;
- When automobile engines run in enclosed spaces;
- When burning coal or wood does not reach full combustion;
- During fires or explosions.

Studies have shown that when the CO concentration in enclosed spaces exceeds 0.1% (1000 ppm), human life becomes endangered (Source: Agency for Toxic Substances and Disease Registry, 2022).

CO has a strong affinity for hemoglobin in the blood, forming carboxyhemoglobin (HbCO). This compound sharply reduces hemoglobin's ability to transport oxygen. Additionally, CO increases hemoglobin's affinity for oxygen, making it harder for oxygen to be released into tissues.

As a result, hypoxia (oxygen deficiency) develops. Organs with high energy demands — such as the central nervous system, cardiac muscles, and liver — are the first to be affected. Moreover, CO blocks the cytochrome oxidase enzyme, disrupting oxidative phosphorylation at the cellular level. This leads to an increase in lactic acid concentration and results in metabolic acidosis.

(Source: Hall J.E., Guyton Textbook of Medical Physiology, 2021).

Symptoms of CO Poisoning Develop Gradually:

- Mild stage: headache, weakness, dizziness, nausea.
- Moderate stage: increased heart rate, shortness of breath, flushed skin.
- Severe stage: loss of consciousness, convulsions, possible respiratory and cardiac arrest.

Laboratory diagnosis of CO poisoning is based on the determination of HbCO levels:

- Healthy individuals: 1–3%
- Smokers: 5–10%
- Mild poisoning: 10–20%
- Moderate poisoning: 20–40%
- Severe poisoning: >50%

Pulse oximetry results may be unreliable since it detects HbCO as oxyhemoglobin (HbO_2). Therefore, the co-oximetry method (blood gas analysis) is preferred.

The main goal of treatment is to rapidly eliminate CO from the body and correct hypoxia.

1. Move to fresh air — remove the victim from the source of exposure.
2. 100% oxygen therapy — via a simple face mask or assisted ventilation.
3. Hyperbaric oxygen therapy (HBOT) — the most effective method, performed in special pressure chambers. This reduces the half-life of HbCO from 320 minutes to 20 minutes.
4. Infusion therapy and symptomatic treatment — to stabilize circulation, correct acidosis, and reduce cerebral edema. Patients with severe CO poisoning may develop neurological complications during the rehabilitation period, such as:

ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 11,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

- Memory impairment, dementia;
- Coordination disorders;
- Cardiac arrhythmias;
- Neuronal death due to cerebral hypoxia.

In such cases, antioxidant therapy (vitamins E, C, N-acetylcysteine) and neuroprotectors (piracetam, mexidol) are used.

To prevent such cases:

- Perform annual technical inspections of heating systems;
- Install gas detectors;
- Avoid running vehicles in closed areas;
- Follow fire and smoke safety rules;
- Conduct public awareness campaigns about CO poisoning risks.

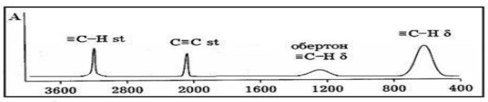
Carbon monoxide is a highly toxic substance that disrupts cellular oxygen exchange in the human body. Its harmful effects occur not only through binding to hemoglobin but also by blocking the mitochondrial respiratory chain. Therefore, CO poisoning represents an acute form of systemic hypoxia. Thanks to modern diagnostic technologies and HBOT treatment, mortality rates have significantly decreased — however, prevention remains the most effective measure.

In addition, conducting infrared (IR) spectral analyses in different regions to determine local CO exposure levels is advisable. The results can help monitor air pollution by CO and facilitate the implementation of preventive measures.

The conclusions obtained from my scientific research are analyzed below.

From the data presented in the table, it becomes evident that at the wavelength range of 3310–3320 cm^{-1}, vibrations corresponding specifically to the alkyne radical (-C≡C–H) are observed.

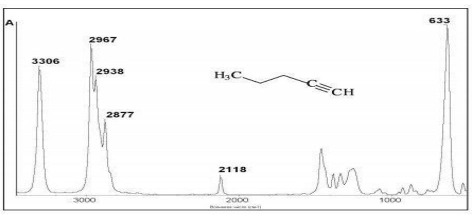
Based on the results of my research, I compared the obtained infrared (IR) spectral analysis data of the synthesized compound with standard reference wavelengths. Through this comparison, I was able to accurately determine the presence of specific functional groups within the compound.



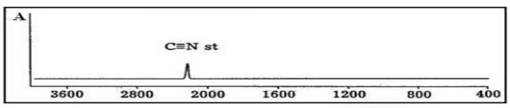
Поглощение в алкинах.

Тарасевич Б.Н., МГУ имени М.В.Ломоносова, химический факультет, кафедра органической химии 1

≡C-H (алкины) R-C≡C-H R-C≡C-R'	3310-3200 (3,02-3,12) 700-600 (14,29-16,67) 2140-2100 (4,67-4,76) 2260-2190 (4,42-4,57)	ν_{C-H} (ср. узкая) δ_{C-H} (широкая) $\nu_{C≡C}$ (ср.) $\nu_{C≡C}$ (оч.сл.)	Интенсивность $n_{C≡C}$ увеличивается при сопряжении с C=O. В симметричных соединениях отсутствует при R = R'.
R-CN (нитрилы)	2260-2240 (4,42-4,46) 2230-2220 (4,48-4,50) 2240-2200 (4,46-4,50)	ν_{CN} (ср.) ν_{CN} (с.) ν_{CN} (ср.)	Предельные нитрилы. α,β-непредельные ациклические нитрилы. Арилнитрилы.
$R-N^{+}≡C^{-}$ (изонитрилы)	2185-2120 (4,58-4,72)	ν_{CN} (с.)	
R-S-C≡N (тиоцианаты)	2140 (4,90) 2175-2160 (4,60-4,63)	ν_{CN} (с.) ν_{CN} (с.)	Алифатические. Ароматические.
$-N^{+}_{2}$ (соли диазония)	2300-2230 (4,35-4,49)	ν (с.)	От типа аниона не зависит.



Пример. ИК спектр пентина-1.



Нитрилы.

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 11,2025
Journal: https://www.academicpublishers.org/journals/index.php/ijai

Figure 1. Standard samples of the infrared (IR) spectrum.

CONCLUSION: In conclusion, it can be stated that carbon monoxide (CO) poisoning is one of the most dangerous yet preventable toxic conditions. Its primary danger lies in its silent progression and delayed manifestation of clinical symptoms. Therefore, public awareness, adherence to safety protocols, installation of CO detectors, and having basic first aid skills are the most effective ways to save human lives. For medical professionals, a deep understanding of the clinical mechanisms of CO poisoning, along with the ability to provide rapid diagnosis and treatment, remains a key requirement in modern emergency medicine.

REFERENCES:1

1. M. Yuldosheva, M. Isroilova. Perspectives for the Integration of Natural Sciences. Republican Scientific and Practical Conference Journal, November 22, 2024, p.151.
2. 2. A. Karimov, K. Kuchkarov, S. Teshaboyev. Biochemistry: A Manual for Chemistry-Biology Faculty Students of Pedagogical Institutes. Tashkent, “O‘qituvchi” Publishing, 1985, pp.132–134.
3. 3. Kao, L.W., Nanagas, K.A. Carbon Monoxide Poisoning. Emergency Medicine Clinics of North America, 22(4), 985–1018 (2004).
4. 4. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Carbon Monoxide. U.S. Department of Health, 2022.
5. 5. World Health Organization (WHO). Carbon Monoxide: Public Health and Environment. Geneva, 2023.