

# Fishermen and the Risk of Toxic Fumes from the Fish Storage Tanks

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**Keywords:** Fishermen, Hydrogen sulfide, Methane, Storage tanks, Toxic fumes.  
*Indian Journal of Critical Care Medicine* (2024); 10.5005/jp-journals-10071-24638

## Dear Editor,

Wet fish in the storage tank could get spoilt and emit toxic gases.<sup>1</sup> These toxic gases on inhalation could cause immediate loss of consciousness and death.<sup>2</sup> Fishermen who venture into the fish storage tank could be at risk of inhaling the toxic gases and may fall unconscious and it could be fatal if not rescued in time. The fellow fishermen who go down into the storage tank to rescue the victim, could be caught unaware and fall prey to the toxic gases as well.

We would like to draw the attention of the readers to a similar instance which happened recently at Malpe Bunder, Udupi, a coastal district of Karnataka. Four fishermen were found unconscious in the fish storage tank and the good Samaritan who went to save these victims also fell ill. Fortunately, there were no casualties and the victims recovered following hospitalization.<sup>3</sup>

## DISCUSSION

When wet fish are stored, they release harmful gases and deteriorate. The spoilage of fish is associated with the presence of substances, such as hydrogen sulfide, methane, cyanide, carbon dioxide, sulfur dioxide, and ammonia. These substances can be extremely harmful to fishermen exposed to them.<sup>1</sup> Fish in decomposition due to microbial actions or enzymatic reactions produce nitrogen compounds and volatile substances containing sulfur. After being caught, fish rapidly deteriorates due to postmortem changes triggered by chemical reactions, enzymatic processes, and bacterial activity. These reactions occur more quickly in warm and humid conditions. To extend the shelf life and maintain the freshness of fish, fishing vessels often use a preservation method called refrigerated seawater (RSW). Refrigerated seawater involves rapidly chilling the fish by submerging it in liquid seawater with a salt content of 3–4%. The RSW tanks on these vessels ensure that the fish is cooled from all sides, promoting efficient heat transfer. Harmful gases can be generated in the refrigerated sea water system when contaminated seawater, containing fish residue, is present. The RSW systems typically circulate seawater through a pipe network, a cooler, and into the fish tank. If these systems are not used for long periods of time, toxic gases may gradually accumulate in the pipes. When the systems are flushed out before use, the contaminated seawater can release toxic gases into the fish tank.<sup>4</sup>

Common gases found on sea-going vessels include hydrogen sulfide, carbon monoxide, natural gas, etc. High levels of methane can decrease oxygen levels in the air, leading to symptoms, such as slurred speech, impaired vision, headaches, nausea, vomiting, and mood swings. Inhaling acetylene may cause headaches, light-headedness, frostbite, and unconsciousness. The risk of toxic gas exposure is increased in confined spaces.

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**How to cite this article:** Haroon H, Naik SB. Fishermen and the Risk of Toxic Fumes from the Fish Storage Tanks. *Indian J Crit Care Med* 2024;28(3):307–308.

**Source of support:** Nil

**Conflict of interest:** None

## Examples of Potential Confined Spaces on Fishing Vessels

- Tanks such as RSW tanks, fuel tanks, freshwater tanks, and sea or fresh water ballast tanks.
- Fish holds containing fish, fish waste.
- Void spaces.
- Storage areas containing chemicals.<sup>5</sup>

Fish spoilage is caused by enzymatic autolysis, oxidation, and microbial growth. When fish is stored in wet conditions without proper ventilation, it can quickly spoil and release harmful gases. This becomes a significant concern in industrial fishing settings where large quantities of fish are stored in enclosed spaces. *Pseudomonas putrefaciens* and *Proteus* bacteria are commonly found on fish and contribute to the production of hydrogen sulfide. In warmer climates, different types of flora, such as *Bacillus* species, micrococcus, and coryneforms dominate the bacterial population on fish surfaces. Hydrogen sulfide produced by these bacteria poses a potential risk for hypoxic brain damage and also cause pulmonary edema.<sup>1</sup> H<sub>2</sub>S is similar to cyanide in binding to cytochromes, leading to suffocation. Its lethal effects have a steep dose–response relationship, indicating that even brief exposure at high levels can be deadly. H<sub>2</sub>S-induced acute central toxicity results in reversible unconsciousness known as a “knockdown.” The paralysis of the olfactory nerve caused by H<sub>2</sub>S prevents detection of its typically potent odor and hence eliminating a crucial alert.<sup>5</sup> Blood sulfide can indicate overexposure to hydrogen sulfide but must be collected promptly (within 2 hours) and analyzed without delay.<sup>1</sup> Initial treatment focuses on removing the individual from the source of exposure and ensuring rescuer

safety. Provide necessary resuscitation, including administering 100% oxygen through a mask or artificial ventilation. Consider hyperbaric oxygen therapy for severe cases. Address metabolic acidosis and monitor for pulmonary edema within 24 hours. Nitrite administration is commonly used but may cause hypotension and complicate anoxia with hypoperfusion. Limited evidence supports thiosulfate and as treatments. Supportive care and close patient monitoring are recommended.<sup>5</sup> Lethal incidents have occurred when damaged refrigeration units on fishing vessels leaked Freon, a halogenated hydrocarbon that can induce fatal cardiac arrhythmias. The displacement of oxygen by inert toxic gases is a well-known issue in fishing vessels due to the anaerobic decay of poorly refrigerated fish in unventilated storage areas or from decaying organic material in the bilge. The gases involved in these incidents include methane, ammonia, hydrogen sulfide, carbon monoxide, and carbon dioxide.<sup>6</sup> A similar news was in "THE JOURNAL" in 2016 on September which reported death of two fishermen from the toxic fumes arising from the decaying fish.<sup>7</sup> All enclosed spaces must be approached with caution before opening or entering. Safe work systems must be in place, which may involve atmospheric testing, the use of respiratory equipment, safety harnesses and lines, proper training, emergency response procedures, and rescue arrangements. Fishermen have to be educated to never enter an enclosed space to assist someone in distress without wearing the necessary safety equipment and without backup from other crew members.<sup>5</sup>

## CONCLUSION

There is a pressing need to educate the fishermen community about the hazards of the toxic gases that are formed in the fish storage

tanks. Every boat which harbors these storage tanks should be equipped with First Aid kits to handle this kind of mishaps while on fishing operation.

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