Toxic Gas from Fermentation

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ABSTRACT

The today situation of global warming may increase risk of toxic gases from fermentation. These toxic gases are divided into three groups: simple asphyxiates, chemical asphyxiates and irritant gases. Simple asphyxiates are gases that can displace oxygen from ambient air leading to oxygen fraction of lower than 21%. Common simple asphyxiates are methane, carbon dioxide, nitrogen gas. Asphyxia is manifested primarily by central nervous system and cardiovascular system dysfunction. CNS effects from asphyxia are nausea, vomiting, dizziness, agitation, and loss of consciousness. Moreover, cardiovascular manifestations are dysrhythmias, hypotension, heart failure and myocardial infarction. Management is removing from source place and oxygen therapy.

Decay of sulfur containing protein in some industry such as fish sauce or fish fermentation, can produce hydrogen sulfide (H$_2$S). H$_2$S is cellular toxic gas as it inhibits cytochrome oxidase, thereby interrupt oxidative phosphorylation. This mechanism is similar to cyanide poisoning but its toxicity is more potent than cyanide. As a result, H$_2$S cause cellular hypoxia and anaerobic metabolism. The main clinical manifestation of H$_2$S is rapid conscious loss after inhalation of rotten egg odor. The initial treatment is to remove the patient to fresh air environment and oxygen therapy. 3% sodium nitrite is administered to induce methemoglobin. H$_2$S has higher affinity to methemoglobin than cytochrome oxidase and then forming sulfhemoglobin. Unlike cyanide poisoning, sodium thiosulfate is not useful in the treatment of H$_2$S intoxication.

Silo filler disease is pulmonary injury from nitrogen dioxide and its polymers. Nitrogen dioxide (NO$_2$) is produced from agricultural silo. NO$_2$ is transformed to nitric acid which causes lung injury. Because of its low water solubility, nitric acid usually affect lower airway. However, if high concentration is inhaled, it may cause acute bronchitis and pulmonary edema. Management is supportive to correct hypoxia, ventilation failure and secondary infection.