

OS-10. Explosive concentration of hydrogen gas and safety of hydrogen gas inhaler

[Background & Objectives]

Many reports have been published on the effectiveness of hydrogen gas inhalation. Hydrogen gas is flammable and may explode depending on its concentration. However, no report has been reported to verify the safety of hydrogen gas inhaler. Hydrogen gas explodes at 4-75% when mixed with air. Therefore, to ensure safety, the concentration of hydrogen gas generated from a hydrogen gas inhaler should be controlled below the concentration. The explosive concentration of hydrogen gas was investigated experimentally and examined in literature. In addition, the safety of commercially available hydrogen gas inhalers was examined.

[Materials & Methods]

Hydrogen gas was collected at various concentrations in a polyethylene bag to experimentally determine the explosive concentration under fire environment. In addition, literature survey was conducted to examine the upper and lower limits of explosive concentration. Furthermore, the concentrations of commercially available hydrogen gas inhalers were surveyed, and their explosiveness was investigated experimentally by bringing the gases generated from the inhalers close to a flame.

[Results]

The lower limit of explosive concentration of hydrogen gas was 10% under ordinary circumstances. This result was also supported by the literature survey. In commercially available hydrogen gas inhalers, the mixture of oxygen and hydrogen gases explodes when brought close to a flame. This phenomenon was also observed for static electricity. In devices that produce only hydrogen gas, a flame was ignited under fire environment. The flame was transparent, and, therefore, could not be visually confirmed under

ordinary circumstances. Some inhalers were adjusted to lower gas production below the explosive concentration. However, they posed a risk of explosion if gas ignited during piping, because the gas was produced at the explosive concentration before dilution. One of the devices under investigation generated no hydrogen gas.

[Discussion]

The lower limit of explosive concentration of hydrogen gas is 4% in a mixture with air. However, there seems to be no risk of explosion below 10% under normal circumstances. Most of the commercially available hydrogen gas inhalers pose a risk of explosion and flammability. Currently, these products are not legally regulated. Therefore, caution should be exercised for them, because even a single accident may hamper the activities of hydrogen-related societies and companies. In addition, hydrogen gas cannot be measured by ordinary users, because it is colorless, transparent, tasteless, and odorless. Thus, products with unknown hydrogen concentrations may be distributed.