

Hazard Identification and Risk Assessment at Biogas Plants using Proton Exchange Membrane Fuel Cells

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ABSTRACT

Objective: The objective of this study to minimise accidents occurring at biogas-fed proton exchange membrane fuel cells (PEMFCs) plants through several methods, such as Dow's fire and explosion index (FEI), Dow's chemical exposure index (CEI), Hazard and Operability Study (HAZOP), safety index and hazard modelling via ALOHA[®] software. Several mitigation controls were proposed via the hierarchy control concept.

Method: This work analysed the main factors of toxic gas dispersion, fire and explosion accidents resulting from flammable gases at biogas plants and the parameters used in the biogas production process. **Findings:** Through FEI and CEI analyses, the anaerobic digester and biogas storage tank were found to have the highest hazards and risks amongst the equipment. Hence, safety index analysis was conducted to distinguish between these two units, and HAZOP analysis was conducted by referring to the process flow of the plant. **Conclusion:** This study aimed to improve safety in biogas plants to enhance green energy production.

Keywords: Hazard identification, Risk assessment, Biogas, PEM fuel cell, Sewage treatment plant
