

Dry ice sublimation performance as affected by binding agent, density, and age

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Abstract

Dry ice is one of the world's most in-demand commodities for cold chain distribution of temperature sensitive products in insulated shippers. A rule of thumb for packaging dry ice has been that it sublimates about 2.3 to 4.5 kg every 24 hours, without any consideration for specific dry ice type, size or geometry [(CISA, 2020)](#ref-0004). This study explored sublimation rates of dry ice composition (binding agent and density), age, and geometry (size and shape). Dry ice block manufacturing often involves dosing propylene glycol-water “binder” solution to liquid carbon dioxide. Tests performed in this study revealed that the binding agent did not influence the dry ice sublimation rate. Dry ice density was found to impact sublimation rate. Fresh and aged blocks of similar dimensions and weight were found to have similar performance outcomes. Weight loss curves for pellets and various sized dry ice blocks showed a dependence on surface area and volume. Chunked blocks and pellets with and without binding agent sublimated at similar rates of 2.84 % h⁻¹ and 2.53 % h⁻¹ (w/w), respectively, whereas block varieties with significantly lower surface area to volume ratios had lower sublimation rates of 0.98-1.60 % h⁻¹.

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