COMMERCIAL FUMGIATION OF STORED PRODUCTS WITH A PROPYLENE OXIDE, CARBON DIOXIDE, AND SULFURYL FLORIDE MIXTURE

Leonel J. Jimenez, Sandipa Gautam, and Spencer S. Walse

USDA-ARS San Joaquin Valley Agricultural Sciences Center, Parlier, California, USA, 93648-9757

Abstract. Each year, the central valley of California produces >2 million metric tons of dried fruit and nuts collectively valued at 5.5 billion dollars. The goal of this research was to provide this sector with a commercially viable postharvest methyl bromide alternative that is effective against insect and microbiological pests. Fumigations at 25 °C with mixtures of propylene oxide, carbon dioxide, and sulfuryl fluoride were conducted at normal atmospheric pressure for 24 hours as well as at a pressure of 100 mmHg for 2 hours. We discuss the progression of this research from initial toxicological investigations, through laboratory-scale optimization, to commercial-scale confirmatory testing. We report how to modulate the applied dose of a mixture to ensure control of key insect pests (e.g., dried fruit beetle, red flour beetle, and codling moth) across a variety of commodities, including: dates, figs, prunes, pistachios, almonds and walnuts. We also report on the concomitant reduction of key microbial species following the respective fumigations. Quantifying the residues from fumigation with the mixture was a critical step in assessing commercial viability, as any proposed use must result in residues compliant with domestic (United States) food tolerances as well as international maximum residue level (MRL) regulations. Detailed below is a novel analytical approach, involving solvent extraction with methyl *tert*-butyl ether (MTBE) followed by gas chromatography (GC), which was developed to quantify residues that result from the postharvest fumigation of almonds and walnuts with propylene oxide (PPO).

Keywords: food security, food safety, propylene oxide, sulfuryl fluoride, commercial fumigation