Preventing Oxidation of Dairy Powders Using Oxygen Removal Packaging

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Abstract:

Three types of dried milk (whole, nonfat, and buttermilk) were packaged in a modified atmosphere with a novel palladium-based oxygen removing catalyst and stored for eight weeks at 50°C. Powders stored in air with no catalyst and powders stored with the catalyst in an atmosphere modified to contain 5.7% hydrogen in nitrogen were evaluated by instrumental, chemical, and sensory methods.

Hexanal concentrations were measured weekly using solid phase microextraction (SPME) and gas chromatography (GC) to compare the degrees of oxidation in the powders stored with the catalyst to those stored without it. Color changes were also monitored weekly using Hunter's L-, a-, and b-values. At the end of the eight-week period, a paired comparison sensory test was used to ascertain if the catalyst had an effect on odor. Anisidine values were also measured at this point to determine levels of oxidation in the powders.

No significant difference was found in levels of oxidation between samples packaged with and without the catalyst in the modified atmosphere. At the end of eight weeks, the average hexanal concentration in the whole milk powder stored with the oxygen scavenger was 1.19 ± 0.20 ppm, while the average hexanal concentration in the air-packed whole milk powder was 1.06 ± 0.08 ppm. The average hexanal concentrations for the buttermilk stored with the catalyst and without were 0.84 ± 0.18 and 0.79 ± 0.15 ppm, respectively. In the nonfat milk powder, the sample stored with the catalyst had an average hexanal concentration of 0.91 ± 0.14 ppm and the sample stored in air without the catalyst had an average hexanal concentration of 0.83 ±0.20 ppm. Difference testing by volunteer sensory panelists also revealed no significant differences.

It was expected that the milk powders stored with the catalyst in the modified atmosphere would have lower levels of oxidation and off-odors at the end of the eight weeks. However, the treatment ultimately resulted in no chemical or sensory differences. Thus, the catalyst proved

ineffective in the given conditions. This could be due to a loss of the hydrogen required for the catalyst to function as time progressed or a lack of significant oxidation under the conditions employed.

Key words: lipid oxidation; powdered milk; oxygen catalyst; modified atmosphere packaging

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Attribution:

It is important to recognize the colleagues who assisted in both the research and writing involved in this thesis.

Chapter II: Preventing Oxidation of Dairy Powders Using Oxygen Removal Packaging

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