

College of Agriculture and Life Sciences  
Telephone: 607-255-2893

Department of Food Science  
Stocking Hall, Ithaca, NY 14853

## *Studies of Light Induced Defects in Fluid Milk: Vitamin A Loss & Light-Oxidized Off Flavors*

Fluorescent lighting in retail dairy display cases induces vitamin A degradation and “light-oxidized” flavor defects in milk products packaged in light-transmissible (i.e. high-density polyethylene - HDPE) containers. Summaries of two studies that evaluated this under conditions that are likely to exist in the market place are as follows:

**Vitamin A Loss:** While whole fat milks are considered to be a good source of vitamin A, the reduction of fat in non-fat, low-fat and reduced fat products also reduces their vitamin A content (a “fat-soluble” vitamin), thus it is required that vitamin A be added to these products to nutritional equivalence. In this study, whole fat, reduced fat (2%), and nonfat milk samples were

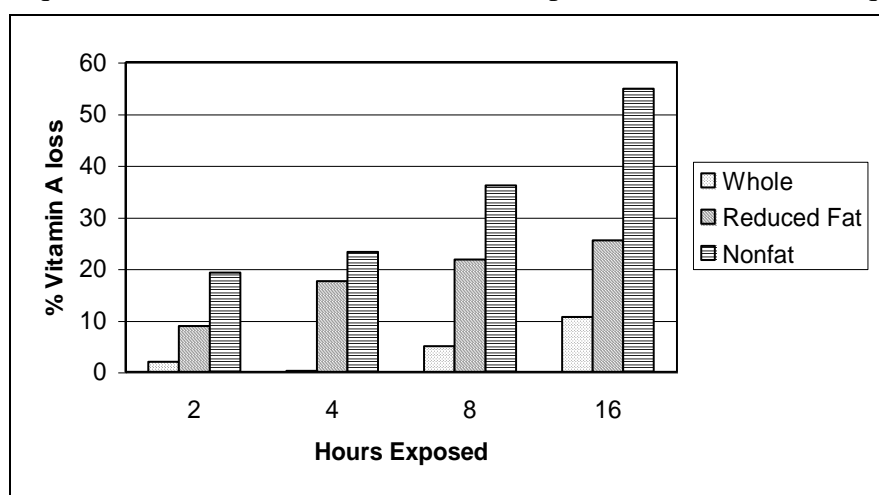


Figure 1. Percentage of Vitamin A lost in whole, 2% and nonfat milks after exposure to light (2000 lux) for 2, 4, 6 and 8 hours.

fat (2%), and nonfat milk samples were exposed to fluorescent light at 2000 lux (a typical light exposure in a moderately lit commercial dairy case) for time intervals of 2 hrs, 4 hrs, 8 hrs, and 16 hrs. The samples were then analyzed for vitamin A content to evaluate light induced vitamin loss. Nonfat milk exposed to 2000 lux of fluorescent light demonstrated vitamin loss after 2 hrs; reduced fat milk after 4 hrs; and whole milk after 16 hrs of exposure. This study clearly demonstrates the influence of light exposure times on vitamin A loss, especially with the fortified products.

**Light-Oxidized Flavor Threshold:** It is well known that exposure to fluorescent lighting in retail dairy cases can result in “light-oxidized” flavor defects though the minimum light-exposure time require for detection, or the “threshold,” has not been well documented. In this study, gallon plastic (HDPE) containers of 2% milk were exposed to fluorescent light (2000 lx) for periods ranging from 0 (not exposed) to 3.5 hours while stored at 43°F. Ten trained panelists and 94 consumers then evaluated the samples for the different exposure times. The minimum “threshold” times were determined statistically based on the exposure times where 50 % of the panelists or consumers detected light-oxidized off-flavors (plastic-like, burnt). Based on the results of this study, trained panelists were able to detect oxidized flavor after 15 to 30 minutes of light exposure while consumers required between 54 minutes and 2 hours. The consumer panel also expressed a lower level of acceptability of the light exposed milk. As milk in dairy cases may be stored under light for prolonged periods, this study indicates that a high level of market milk in translucent containers is likely to be “light-oxidized.”

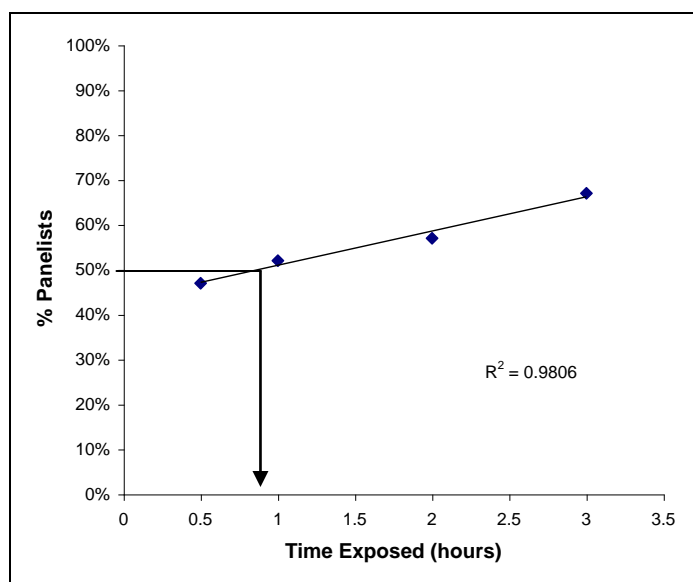


Figure 2. Percent detection of oxidized flavor after light exposure (0 – 3.5 hr at 2000lx) & with arrowed 50% cutoff indicating the minimum “threshold” exposure time for consumer detection.

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