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Practicality of Large Mylar Bags to Store Corn and Beans in Kenya

BYU Food Quality Assurance Laboratory

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May-August 2000

Introduction

The purpose of this study is to determine the practicality of using extra large zip-lock mylar bags with oxygen absorber packets to store corn and beans in Chyulu, Kenya. Weevil usually gets in the food after about 5 months, so if the oxygen can be maintained at a low level, the corn and beans could be stored for longer than that. The goal is to be able to store the food for 18 months.

In order to determine the practicality of using the mylar bags to store corn and beans, the following questions will need to be answered:

- Are the bags strong enough and thick enough to provide a good oxygen barrier?
- Does the corn or beans cause the foil lining and other parts of the laminate to fail?
- Will this material be a sufficient barrier to insects (ie. cockroaches, saw-toothed grain beetles)? We already know they are not rodent proof.

NOTE: An alternative method for storing the corn and beans is to use a rigid steel container with CO_2 or another fumigant, but that is an entirely different project.

Methods

1. Four mylar bags were filled with either beans or wheat—2 bags had zip-lock closures and 2 required heat sealing.
2. Ten Ageless oxygen absorber packets (1 packet is used in a No. 10 can, and the amount of product filling the bags was ten times the amount used in a No. 10 can) were placed in each and the bags were closed and stored at ambient conditions.
3. A needle was inserted into the top part of the bag and sealed around the insertion point with silicone cement.

Measurements of oxygen headspace were taken every day until the oxygen level inside the bag began to increase toward atmospheric level. All measurements were made using the Illinois Instruments 3500 Headspace Oxygen Analyzer calibrated to ambient air (20.9% oxygen) and a syringe fitted with a gas-tight valve. See pictures below:

Zip-Lock Mylar Bag

Heat Sealed Mylar Bags

Needle With Gas-Tight Valve; Silicone Cement

Needle Inserted into Bag and Sealed with Silicone Cement

Hole in Bag Caused by Folding

View of Hole Looking Inside Bag

View of Hole in Dark Room with Light Behind

Pinholes in Mylar

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More Pinholes in Mylar

Very Tiny Pinholes in Mylar (barely visible)

Oxygen Analyzer

Obtaining Sample

Measuring Oxygen Level

Close-up of Sample Injection

Results

Figure 1: Oxygen level in large zip-lock mylar bag containing great northern beans and oxygen absorber packets

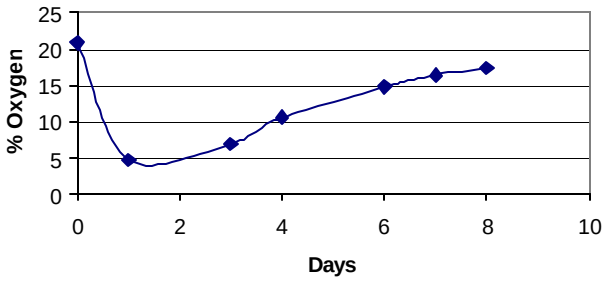


Figure 2: Oxygen level in second large zip-lock mylar bag containing wheat and oxygen absorber packets

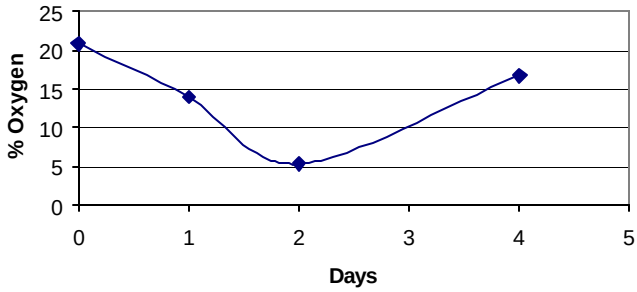


Figure 3: Oxygen level in large heat sealed mylar bag containing wheat and oxygen absorber packets

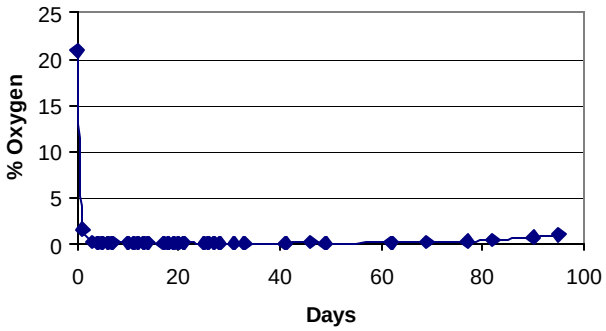
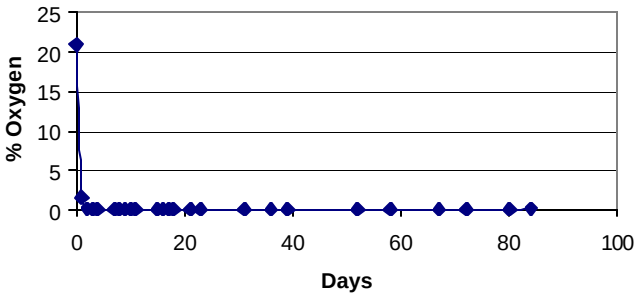


Figure 4: Oxygen level in second large heat sealed mylar bag containing great northern beans and oxygen absorber packets



Conclusions

The **zip-lock mylar bags** could not keep the oxygen levels low enough to prevent insect infestation. This is most likely do to pinholes in the aluminum barrier as well as imperfections in the packaging around the seal, which allowed oxygen to enter the bag. Defects in the aluminum barrier were present at the beginning of the experiment, and more tiny holes were produced from the stress of the beans and wheat on the packaging.

The **heat sealed mylar bags** kept the O_2 level below 0.2% for at least 9 weeks, so they appear to be highly impermeable to oxygen. Prediction of oxygen level after 18 months of storage is not possible, but from the results of this study, these bags may work to store corn and beans in Kenya.

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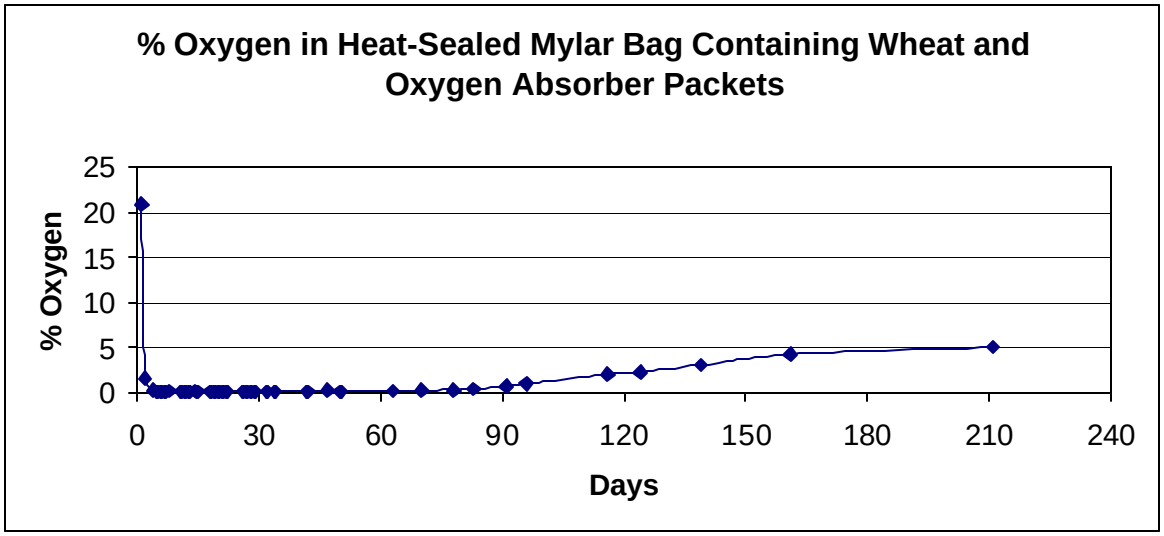
Follow-Up Report on Large Mylar Bags

27 November 2000

The oxygen level rose up to 5% in the 1st heat sealed bag over a period of 6 months. This increase in oxygen level could be due to imperfections in the seal around the gas tight syringe. The gas-tight valve used in this bag was needed for another study, so this study was ended.



The oxygen level inside the 2nd heat-sealed bag remains quite low (around 0.07%)after 6 1/2 months. Measurements will continue.