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Oxygen Absorbers, Desiccants and Diatomaceous Earth

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Oxygen Absorbers

What is an Oxygen Absorber?

If all of this messing about with gasses sounds like too much trouble, you can try using oxygen absorption packets. I don't know exactly when they first showed up on the market for use by private individuals, but they are a relatively recent tool for long term food storage. The packets, one brand is Ageless Z300E from the Mitsubishi corporation, absorb free oxygen from the air around them and chemically bind it. This removes it from being available for other purposes such as oxidative rancidity and respiration by insects or bacteria. The practical upshot of all this is that by removing the free oxygen from your storage containers, you can greatly extend the storage life of the foods in the containers.

Finding any information about these absorbers has been difficult, but, thanks to Al Durtschi, I was able to find a study of their effectiveness from Brigham Young University.

The study tested the absorption capacity of the Ageless Z300E packets. It found they were even more effective than their rated absorption capacity of 300 milliliters of oxygen (O₂ at sea level pressure). A single packet sealed into an empty #10 can (80% of one gallon) reduced the oxygen in the canned air to less than 1/2%.

The following is the verbatim text of the conclusions section of the Brigham Young study. See V.B Pamphlets for the complete citation of this study.

Conclusions:

"Oxygen absorbing packets are effective in reducing oxygen contents in sealed cans. The ageless Z300 packet has a greater than claimed capacity for absorbing oxygen. Packets abused by 4 hour-exposure- to-air still exceed claimed capacity. It may be economical to use smaller packets based on the dead air volume instead of can volume. Smaller packets would have less tolerance for abuse and personnel would need to be more diligent in protecting the packets."

"The level of oxygen remaining in the presence of the absorber packets is sufficiently low to greatly retard development of rancidity. The biological consequences are not so easy to predict. Microorganisms range from aerobic to anaerobic, thus no unqualified statement can be made. The energy requirements of anaerobic bacteria are met by reactions between oxygen and more than one

other molecule. This makes bacterial energy a higher order of reaction than rancidity. Thus, the rate of bacterial aerobic reaction would be more seriously retarded than rancidity. These matters are not of practical importance because the products to be canned should be too dry to support microbial growth. Insects are aerobic and would like-wise suffer retardation of activity. No comprehensive statement can be made about irreversible inactivation or death of insects. As long as the oxygen level remains low, insect activity will be lower by at least the square root of oxygen content. In a practical sense, these packets are effective in stopping insect activity. USDA does not recognize any method except disintegration as effective for completely killing insect eggs."

Where Can I Find Oxygen Absorbers?

Because they are a relatively new tool on the food preservation and storage market, oxygen absorbers have not yet achieved a widespread dissemination amongst the various storage food dealers and suppliers. They are available, but you may have to do a bit of searching to find them.

The following short list are the suppliers I've located, thus far, who sell them:

- WALTON FEED
- RAINY DAY FOODS
- BEST PRICES STORABLE FOODS
- DOUBLE SPRINGS HOMEBREW SUPPLY
- LAKERIDGE FOOD STORAGE
- NITRO-PAK PREPAREDNESS CENTER

In addition to the above suppliers it may be possible to acquire oxygen absorbers through a LDS family cannery if you have one locally available. Please see [the section on these canneries](#) for information on how to explore this possibility.

How Are Oxygen Absorbers Used?

Even though they apparently will absorb a great deal more than the 300 ml of O₂ they are rated for, the following instructions for use are based on their listed rating. So, when using the Mitsubishi Ageless Z300E oxygen absorption packets, you should allow one packet for every quart and a half (1430 ml) of *remaining air volume* in your filled storage containers.

Now determining the volume of air remaining in a filled container is no easy thing. In the study, #10 cans filled with either elbow macaroni or powdered milk were used and their respective air volumes were determined. A can full of elbow macaroni was found to contain 22% remaining air volume and a can full of powdered milk was found to contain 10.5%. With these as guides, you should then be able to roughly figure the remaining air volume of the foods you have in your containers. You'll have to decide whether the food you are working is closer to the macaroni or the dry milk in its packing density. Obviously, this is a rather rough rule of thumb and this is why I kept my instructions to the listed ratings rather than on what they will apparently really do. The excess capacity will thus serve to cover the shortcomings of your reckonings. These absorption packets should be used only in dry foodstuffs and not with any product that will get them wet.

NOTE: If you do choose to use oxygen absorbers in packing your food storage containers you should give some consideration to the container you're using. The absorber is going to be removing the 20% of the atmosphere that oxygen constitutes. Since nothing is replacing it this will leave the interior of the storage container with a lower atmospheric pressure than the outside. If the container is sufficiently sturdy this pressure differential will be of little consequence. For containers with thinner walls or more flexible material the pressure drop could cause them to partially collapse or buckle, particularly if other containers are stacked upon them. This could make them more likely to lose seal integrity. The sturdier plastic buckets (Superpails, etc), or metal cans should have no problems. Other containers should probably be tested or first flushed with an inert gas (N₂, CO₂) before the absorber is sealed in.

If anyone out there knows of more precise instructions for the use of these O₂ absorbers, particularly if they're from the manufacturer, I'd appreciate it if you'll send them to me. To date, the study that AI pointed out to me is the only solid data I've found. It is from it that I derived the instructions I have given above.

Desiccants

What is a desiccant?

A desiccant is a substance with very hygroscopic (adsorbs moisture from the air) properties. There's any number of different substances that meet this description, but only some of them will serve our purposes.

The most commonly used desiccant is silica gel. This is an amorphous, highly

adsorbent form of silica. It is most easily found in a form called "indicating silica gel" which are small white crystals looking much like granulated sugar with small colored specks scattered throughout.

Those specks are how we determine whether the gel is dry or has adsorbed all of the moisture it will hold. If the specks are blue, the gel is dry and capable of carrying out its moisture adsorbing mission. If the specks have turned pink, then the gel has adsorbed all it will and is now saturated. Part of what makes silica gel so useful is that it can be refreshed by driving out the adsorbed moisture so it can be used again. This is as simple as pouring the saturated desiccant into shallow pans and placing in a 250 F oven for no more than five hours until the colored crystals have once again turned blue. You can also do the same thing in a microwave. Stir thoroughly and repeat until dry.

Although I've never found anything that mentions this, apparently it is possible for silica gel to break down over time, or at least the colored crystals can. I had a five pound can stored in an outside shed here in Florida for several years before I opened it again to use some of it. Nearly all of the colored indicator specks had broken down and disappeared. I don't know if the gel itself was still good and with no way to reliably determine whether it was saturated or not, I discarded it. The can the gel was in was just cardboard and it gets *very* humid here in Florida so it really was very poorly stored. Under decent conditions it may not break down at all. (I've never heard of this occurring, anyway.)

There are other desiccants, but I am not familiar with any that can be used with foodstuffs. I know that Kearny recommends using a piece of gypsum wallboard as a desiccant in his expedient radiation meter in Nuclear War Survival Skills, does anyone know if this can be used with dry foodstuffs? How about other desiccants?

From: Pyotr Filipivich

Simple trick is to dry a piece of wood in the oven - and once it is bone dry (more than usual) then put it in your container and seal it. The wood will suck up any available moisture.

Where do I Find Dessiccants?

I buy all of my silica gel at Wal Mart in their dry flower section where it is sold in one and five pound cans for flower drying. I've seen it sold the same way in crafts stores and other department type stores that carry flower-arranging supplies. You can also buy it from many other businesses already prepackaged in

one form or another to be used as an absorbent. All of the desiccant that I've found packaged this way has been rather expensive (to me) so shop carefully.

How do I Use Desiccants?

The key to storing many foodstuff for the long term is dry, dry, dry. Available oxygen and storage temperature also play roles, but it is moisture content that determines whether you get usable food out in five years or not.

Therefore, the idea here is to have the food you want to put into storage as dry as possible before it goes in and then take steps to deal with any moisture trapped, generated or leaked into your storage containers.

Ideally, the foodstuffs you have on hand will be no more than 10% moisture. If this is the case then you can go ahead and seal them into your storage containers using the packaging method of your choice and have a reasonable expectation of your food staying in good condition.

If your storage foods aren't sufficiently low in moisture content then you'll need to reduce the water they contain. Wheat has been found intact in Egyptian pyramids where it had lain for several thousand years. It was the bone dry desert air and the cool interior temperature of the pyramids which kept it from rotting away. We can approximate that Egyptian climate by several methods.

The least involved method is to wait until the driest time of year for your location. If this doesn't suit, then turn your air conditioning on a little high. Bring in your buckets, lids, and the storage food. Let everything sit in a well-ventilated place where it's going to get plenty of cool from the a/c. I'd avoid anywhere near the kitchen or bathroom areas, as they put out a lot of moisture. Stir the food frequently to maximize moisture loss. About three days of cool, constant air flow and low humidity ought to dry things out a bit. Due to its highly odor absorptive nature, I would not do this with any dried milk products or other powdered foods, flours or meals. This method works best with coarse particles such as grain, legumes and dried foods.

If this won't do, you can place a large quantity of desiccant in your storage containers. Fill the remaining space with your food product and seal on the lid. After about a week, unseal and check the desiccant. If it's saturated, change it out with dry desiccant and reseal. Continue to do this until the contents are sufficiently dry. If it doesn't become saturated the first time, change it anyway before sealing the bucket permanently. You'd hate to find later it saturated in storage.

I use silica gel for practically everything. My usual procedure is to save or scrounge clear plastic pill bottles such as 500ct aspirin bottles. Fill the bottle with the desiccant (remember to dry the gel first) and then use a double thickness of coffee filter paper carefully and securely tied around the neck of the bottle to keep any of it from leaking out. The paper is very permeable to moisture so the gel can do its adsorbing, but it's tight enough not to let the crystals out. This way whatever moisture does inadvertently get trapped inside can be safely absorbed. It won't dry out a *lot* of moisture -- you still need to take steps to get everything as dry as possible before you pack it -- but it will take care of what little is left.

IMPORTANT NOTE: The indicating form of silica gel (has small blue specks in it) is not edible so you want to use care when putting together your desiccant package to insure that it does not spill into your food.

I've never found any certain rule of how much silica gel to use to how much dry goods. For my purposes, I use about four ounces of gel to a five gallon bucket of dry grain and beans. If I think the moisture content is over 10% when I seal them, I'll go as high as a half pound. This might be ridiculous overkill, but in Florida everything is high in moisture because of our ever present humidity. For a one-liter bottle of dry milk I'll use about one ounce of silica gel rolled up in a paper cartridge made from a coffee filter. If you're familiar with them, it looks like a paper cartridge such as you'd use for black powder weapons. They fit nicely into the bottle and keep the gel in.

Diatomaceous Earth

What is Diatomaceous Earth?

Diatomaceous earth is a naturally occurring substance comprised of the fossilized remains of marine diatoms. These diatoms are microscopic in size and are covered in sharp spines that make them dangerous to exoskeletal insects, but not to animals with internal skeletons. The spines of the diatom skeletons pierce the soft body tissues of insects between their hard exoskeletal plates and it is through these numerous microscopic wounds that the insect loses bodily moisture to the point of desiccating and dying. Creatures with internal skeletons such as humans, cattle and pets have means of resisting such damage and are not harmed. Thus, it is possible to mix a small amount of DE into your stored grains and beans to control insects without having to remove the dust again before you consume them.

Where do I Find D.E. and What Type Should I Buy?

IMPORTANT NOTE: There are actually two kinds of diatomaceous earth to be found on the market and only one of them is suitable for use as an insecticide to use in your stored grains. The kind that you DO NOT WANT is the type sold by swimming pool suppliers as a filtering agent. It has been subjected to a heat treatment that dramatically increases it's silicate content and makes it unsuitable for use with your foodstuffs. The type that you want is sold by a number of suppliers as a garden insecticide. Many organic garden suppliers will carry it. Read the lable carefully to be certain no deleterious substances such as chemical pesticides have been added. An appendix with the names and addresses of some DE suppliers may be found in the food and equipment suppliers section.

From: higgins10@aol.com (Higgins10)
Originally posted in: rec.gardens

Good afternoon all. Diatomaceous earth is approved by the USDA as an animal feed additive, however I have found out that there are vast differences between various forms of diatomaceous earth. Some DE products may not be effective in controlling insects, while others may be harmful to humans and pets. The most important differences between individual forms of DE is the shape of the diatom, content of Crystalline Silica, and the purity of the Silica Dioxide.

The World Health Organization cautions that DE with a crystalline silica content of three percent or higher is dangerous to humans, (and probably pets and birds as well). Diatomaceous Earth used in swimming pool filters has close to a 60% crystalline silica content. I know of a product called Organic Solutions (insecticide) which is approved by both the EPA and USDA and has a crystalline silica content ranging between 0.36% to 1.12% according to its labels etc. It is classified as Amorphous fresh water Diatomaceous Earth (whatever that means). However, all literature I have read assures it is safe for both humans and animals and seems to be very effective at killing insects. I stumbled across all this info. while shopping in the mall. If you're interested in reading it too, go to the Organic Solutions website at <http://www.BuyOrgs.com>. Hope this helps answer the question and always use environmentally safe products!
Higgins10

From kahless@ns.waymark.net Sat Aug 24 14:08:48 1996

To: Dunross (A.T. Hagan) Private e-mail

[previous text deleted]

I have always purchased DE at the local feed store. It's cheaper there than at the garden and hardware stores. The feed store I buy at has DE available in bulk, but they'll package up a smaller amount if that's what you want. My package in the garage doesn't have a brand name but says Nitron Industries at the bottom. The label recommends 7 pounds of DE for each ton of grain. Ha! As if I had "tons" of grain in storage 8-D

I've been using DE for grain storage for about 15 years now but flea control only for the past 6 years. The only fleas we've seen in that period of time is the ones that hitch a ride in with friends pets. A very light dusting afterward takes care of that problem. Miracle stuff as far as I'm concerned since we'd had an awful time with fleas before we started using DE. Much much much cheaper and as far as I'm concerned the advantages FAR outweigh the risks.

Sam (hope that was helpful)

How do I Use D.E. in Food Storage?

To use, you must mix thoroughly one cup of DE to every forty pounds of grain, grain products or legumes. You need to make certain that every kernel is coated so it is better to do the mixing in small batches where you can insure more even coating.

WARNING: Since DE is essentially a kind of dust, you need to take steps to keep it out of your lungs and eyes. Even whole wheat flour dust can cause lung irritation if you breath enough of it.

DE does not kill the insect eggs or pupae, but it will kill adults and larvae and any eggs or pupae that hatch into adults will die after coming into contact with it.

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