



A Guide to Oxygen Absorbers

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1.0 Oxygen Absorbers Introduction

An oxygen absorber is a packet filled with iron particles (ferrous carbonate) or vitamin C (ascorbic acid salt; non-ferrous) that works by reacting with available oxygen.

In the case of iron based absorbers, moisture absorbed by the package (charcoal or other absorbent material) combines with iron (ferrous carbonate), salt (sodium chloride), and oxygen to change the ferrous carbonate to its ferric state. This traps the oxygen and usually lets off a small amount of heat.

By absorbing oxygen in an enclosed package of food, this product improves the shelf-life of the food. They are used in food packaging to prevent food color change, to stop oils in foods from becoming rancid (oxidizing of fats), and also inhibit the growth of oxygen-using aerobic microorganisms.



Oxygen supports the growth of microorganisms and causes changes in color and rancid odors in packaged foods. Plastic packaging is less able to exclude oxygen from packaged foods than are the older glass and metal containers. Oxygen absorbers collect oxygen that might diffuse into a food package.

1.1 Why write this document?

I have written, and published an academic, peer reviewed journal in 2014 entitled ‘Oxygen absorbers in food preservation: a review’, *Journal of Food Science and Technology*, 1-7. After some time manufacturing, distributing oxygen absorbers with consultancy in the Australia, China, Japanese food manufacturing industries, I seem to keep getting similar style questions. This publication has been abridged to the end of this document for you to read. Some people may want to cite this work, but due to copyright issues, they must request permission from the author and the publisher (Springer).

The most common questions asked to me are enclosed in this document. A common questions: **What is inside an oxygen-absorbing satchel or Oxygen Absorber?** Some people contact us stating that they need oxygen absorbers for their products, ‘they extend shelf life and keep my product fresh’.

No matter how many half truths you have, they never make the entire truth. What you need is the complete solution for your product’s shelf life. Oxygen absorbers are not magic pouches that keep mould away. When instituted with the correct packaging for your product (type of product, fat content, desired shelf life, and water content) they are one of many tools available, yet nothing beats the right advice. Wholesale Group International can assist you with product development, project management, product appraisal, or Quality Assurance issues.

Oxygen absorbers are manufactured to different compositions to match the water activity of the foods they are intended for. Some companies will state that the size varies and so does the oxygen absorbing capacity. I will present a simple fact; the ferrous carbonate



(FeCO₃) which reacts with water (H₂O) and ‘absorbs’ the oxygen, so the ratio of iron carbonate to other ingredients (charcoal, sodium chloride and water) will vary the capacity of the absorber to absorb oxygen. This will inturn vary the amount of FeCO₃ add the oxygen absorber.

Simply tell the consultant the water activity of your food, packaging specification i.e. oxygen transmission, dimensions, and we will match the right absorber for the application. A higher moisture product requires different types of ratio of these compounds mentioned as well as a water or oil replant packaging material.

Oxygen absorbers are made from FeCO₃, charcoal (activated carbon) and salt. When oxidized, FeCO₃ becomes Iron (II) oxide (FeO) should not be confused with ‘rust’, which usually consists of hydrated iron (III) oxide (ferric oxide).

Cheaper imitations of Wholesale Group International’s oxygen absorber exist, but as there exists gold and fool’s gold, a major concern in the industry is the existence of sub-standard oxygen absorbers that do not meet local food standards or national standards for packaging. All customers receive laboratory reports for every batch and also pro bono advice for their food packaging to make sure they are using the right packaging for their application, although it is the responsibility of the manufacturer to make sure that their food product, packaging and our oxygen absorber is expectable to for the intended purpose and desired outcome.

Like anything, quality is the first factor to be compromised when the price is a concern.

We are not a warehouse with an elaborate voice recording service in some backlot in Shanghai, LA or Eastern Europe, we are real people, in Australia here to serve you. We do not ship outside of market which is Australia for the OxySorb™ and from whence the trademark is registered and trade secrets are enforced.

We at Wholesale Group International focus on strengthening long-term profitability not cutting corners on quality. A cut in quality may render your companies business worthless overnight due to a small by crucial error.



Some oxygen absorbers on the market may contain zeolite or activated carbon for moisture absorption but others agricultural lime (CaCO_3). Would you eat an agricultural chemical? Some contain metal filings and not iron carbonate. Some use packaging, which may not pass solvent leeching tests. So color from packaging may contaminate the food product. Our packaging conforms to relevant Australian standards.

We have endeavored to create the highest standard through a combination of a pleasing person approach, long term relationship building and most of all technical advice.

We are scientists and food technologists. We are not two bit sales people in a warehouse somewhere trading products with mylar bags or the like, or a trading office trying to sell you yesterday's bad stock. We are not a Chinese company with no real guarantee, we are a registered Australian company with shareholders who have experience in the food industry as Q.A. auditors, manufacturers, distributors and sales people. We do not write articles to ridicule other companies and other products like some companies do. We manufacturer and sell on quality and value, not price, and we do not use defamation in our marketing material.

Our oxygen absorbers are safe, and if eaten are non-toxic. We have toxicology reports to prove this. The absorber clearly states 'Do Not Eat' as it presents a choking hazard and hence why we use the color bright blue and white to deter any accidental consumption. We do not use 5-10 foreign languages on our absorber, and our writing is in larger font than other companies. Why would you write in Japanese, Chinese or Spanish on a product used in an Australian food product that is not exported?

Sounds like someone else's, and somewhere else's stock. The official and legal language of Australia is English. If food is to be exported we can re-design the satchel so the language of the exported destination is shown as well.

Also, do these other manufacturers rigorously test their products? We cannot ensure the safety of sub-standard absorbers that may claim to have the same function or ingredients



as our products. If you want cheap prices, then you will get cheap ingredients and a large room of error with the oxygen absorber efficiency. You may even get some once a year pdf fraudulent certificate produced in a photocopier in some town you cannot pronounce on the other side of the world. Is it a valid certificate?

Did you check the lab and receive original paper duplicates with the laboratory stamp on them? We do not to waste time with cheap imitations and pathetic substitutes, as there is no substitute for quality nor the truth.

2.0 Questions you may have about oxygen absorbers may include;

2.1 What Are Oxygen Absorbers?

Oxygen absorbers are not OxySorb™, Ageless™ or O Buster™, these are trademarks.

Oxygen absorbers are devices that as the name suggests, absorb residual oxygen in a plastic bag or container that is impermeable to oxygen. Oxygen absorbers are made of a chemical compound, the active ingredient of which is a powdered FeCO_3 which reacts with oxygen and water to become iron oxide.

Our absorbers are completely safe as evidenced by rigorous laboratory reports performed by SGS laboratories a Swiss based laboratory company.

While they are not edible (i.e. choking hazard), they are not toxic. No harmful gases are created and the oxygen does not remove the fresh smell and taste of the product. When used with proper packaging and sealing, the oxygen in the packaging is greatly reduced.

Our absorbers bring the oxygen level down reliably to 0.01% or less when the correct calculations are used which take into account OTR, packaging dimensions and oil surface content and moisture (available) of your product.

2.2 How do oxygen absorbers work?

As mentioned, oxygen absorbers absorb oxygen. WGI oxygen absorbers are made of Iron Carbonate, activated carbon and salt. When these components react with residual



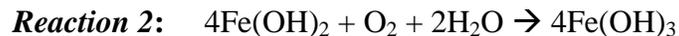
moisture in the atmospheric air or humidity from the product, the components commence to 'absorb' oxygen.



Summary Reaction



Creation of Iron[II] hydroxide.



Creation of Iron[III] hydroxide from Iron[II] hydroxide.



Creation of Iron (III) oxide (ferric oxide) from Iron[III] hydroxide

Fig. 1 Chemical reaction of ferrous based oxygen absorber to absorb oxygen and water

Next, as figure 1 shows, oxygen absorbers absorb oxygen. It is your packaging (which should be impervious to oxygen and moisture), a correct seal which extend the shelf life of your product. Ask your packaging/ plastic bag supplier for a product specification sheet, especially the OTR (*oxygen transmission rate*).

Do not just assume because your plastic looks 'thick', it will retain oxygen. Next, the quality of your heat sealer is directly proportional to the function of oxygen absorbers and your products shelf life. Why do some many manufacturers invest some much time and



money in the right packaging, oxygen absorbers, consultancy and advice and then, have poor performing heat sealers and thus a leaky bag?

2.25 Old Oxygen Absorber Versus New Oxygen Absorber – Color change

<u>How do I know if the Oxygen Absorber is Old (Expired) or New (Ready to Use)?</u>	
	
<p align="center"><u>Expired (Old)</u></p> <ul style="list-style-type: none"> • <u>Red rusty colour</u> • <u>'Hard Feel' from exterior of satchel</u> • <u>Particulate matter</u> • <u>Clumping of powder</u> 	<p align="center"><u>Ready for Use(New)</u></p> <ul style="list-style-type: none"> • <u>Black colour</u> • <u>'Powder Loose Feel' from exterior of satchel</u> • <u>No Particulate matter</u> • <u>Sometimes a warm feeling (indication of reaction activity – absorbing oxygen)</u>

Figure 2. Old and New Color change of oxygen absorber

2.3 What is the function of Oxygen Absorbers?

When used with proper packaging and sealing, the oxygen in the packaging is greatly reduced. Our absorbers bring the oxygen level down reliably to .01% or less

2.4 Perceived versus Real Benefits of Oxygen Absorbers

Some companies may just sell oxygen absorbers, with no technical knowledge. Why not, they already sell packaging or something else? Wrong, food technology and nutrition are expert fields not for the uninformed or technically novice. You have product integrity and most of all, people's lives (i.e. food poisoning) if the system fails. What is the price of product re-call, bad public publicity of your food product and company? I will let you ponder these thoughts. 'They' believe that oxygen absorbers just 'do' on their own. They



‘extend product shelf life’ and make food ‘more fresh’. I have heard these statements from the ill informed, I wish my job was this easy, making random statements without evidence or technical knowledge, realistically it isn’t, every food product is different and recipe different. The real benefit of oxygen absorbers are in their correct implementation.

- Oxygen Absorbers significantly improves keeping qualities of polyunsaturated fats and oils – have you ever smelt or tasted rancid fat before?
 - Helps retain fresh-roasted flavor of coffee and nuts
 - Prevents oxidation of water and fat soluble vitamins (eg. Vit A, C and E
 - Extends life of pharmaceutical products
 - Inhibits mold in natural cheeses and other fermented dairy products
- Delays non-enzymatic browning of fruits and some vegetables; also see the diabsorber and ethylene absorber as well
 - Inhibits oxidation and condensation of berries



3.0 How To Use an Oxygen Absorber & Re-seal bag

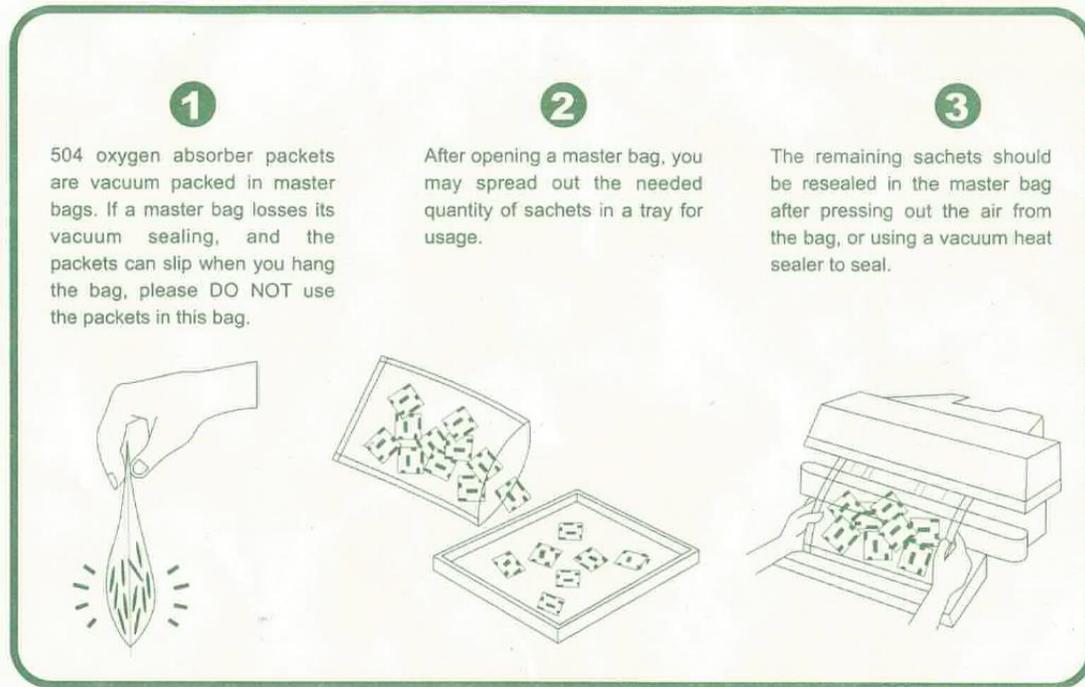


Figure 3. Re-packaging of an oxygen absorber

3.1 How To Measure Volume of Containers & Conversion Table

Milliliters (mL) or cubic centimeters (cc) are interchangeable units. Most people may know that liquids are measured in mL, but did you know that gases are as well? If you have a plastic box, lets say 25cm in length x 25cm in width and 2cm in height, the volume is length x width x height = 1250mL or 1.25 liters.

To calculate how much oxygen absorbing capacity you need, you must understand that 20.1% of the air is oxygen. So you must absorb 20.1% of the volume calculate (1250mL x 20.1%) minus the volume occupied by the food product plus the transmission rate of oxygen through your plastic bag.

For precise calculations please email our technical team at Wholesale Group International (info@wholesalegroup.com.au).



4.0 Quality, Pricing and Packaging

Wholesale Group International provides the highest level of quality in manufacturing of oxygen absorbers. We manufacture and distribute our own oxygen absorbers, we are not just re-sellers or agents. We do not seek to out-compete our competitors; there is enough room in the market for all. How Wholesale Group International differs is by employing specialized and trained scientists, food technologists and nutritionists both in Australia and also Japan. We have a competitive global standard and technical advantage. We have a technical team on call to assist you with any questions relating to the absorbers implementation and also any other aspect of packaging or food technology/ nutrition.

4.1 How to increase food shelf life with modern packaging?

The first questions to ask is, what is the specification of my plastic? What is the plastic made of, what is the transmission of oxygen or moisture (normally denoted OTR or WTR with units of $\text{cc/m}^2/24\text{hrs}$)?

What is the void space surrounding my product? Is my product moist or dry, better known as the available water co-efficient (A_w). What factors affect the freshness of food? (i.e. oxygen, moisture, UV, temperature).

How to choose the right packaging materials to keep your product fresh (with respect to above factors, with respect to type of food, packaging material etc.)? For specialist advice call our please email our technical team at Wholesale Group International (info@wholesalegroup.com.au).

4.3 What Are The Benefits Of Using Them?

- * Extends shelf life of food products
- * Prevents growth of aerobic pathogens and spoilage organisms, including molds



* Eliminates the need for additives (i.e. Calcium propionate, sulphur dioxide, sorbates, benzoates, etc).

* Use with gas flushing / vacuum packaging to absorb virtually all oxygen and absorb any oxygen that may permeate the package.

*Significantly improves keeping qualities of polyunsaturated fats and oils. Fats which are prone to become rancid degrade with exposure to oxygen, heat and light. So if you have oil in your product (eg., typical tortillas contain between 6 – 10% fat) what will your product taste like in 10 days, 30 days?

*Helps retain fresh-roasted flavor of coffee and nuts.

*Prevents oxidation of spice oleoresins present in spices themselves and in seasoned foods.

*Prevents oxidation of water and fat soluble vitamins (eg. Vit A, C and E

*Extends shelf-life of pharmaceutical products that may be susceptible to oxidation



4.4 What are the Applications of Oxygen Absorbers?

- * **Bakery Goods;** Breads, Flat Bread, Pita Bread, Tortillas, Lebanese bread, Cookies, Cakes, and Pastries
 - * **Snack Foods;** Nuts and other confectioneries
 - * **Dried Beverages;** Coffee and tea
- * **Dried Meats;** processed, smoked and cured meats (eg., beef jerky, biltong), cheeses and dairy products (skim milk powder)
- * **Dried fruits and vegetables,** spices and seasonings, flour, grain, rice, pasta
 - * **Pharmaceuticals,** vitamins and herbal medicines
 - * Birdseed and dried dog/ cat food
- * **Artwork** and other compounds susceptible to oxidation