



## The Science Behind Repour

### In Short

Tom Lutz is a Ph.D. chemist and worked on Repour's development and technology for over a year.

Repour works by removing oxygen from the air above the wine as well as from the wine itself (through what he calls some "pretty cool chemistry principles") until there is no free oxygen left in the bottle. This is done inside the stopper through a reaction of a material with oxygen.

Because the oxygen is removed and air is 21% oxygen, the air is not replaced with anything, and a small vacuum is created in its absence. *(Note: If you listen carefully, you can hear the vacuum break when you open a bottle saved with Repour.)*

Tom often jokes we don't care about how much oxygen is in the air above the wine; we care about how much oxygen is in the wine itself. While he usually gets odd looks when he says that, it really is the fundamental reason Repour works so well. As oxidative damage occurs within the wine, the continuous and complete removal of all oxygen, including dissolved oxygen in the wine, is really the magic behind why Repour keeps wine fresh.

### The Deeper Dive

There's a packet in the stopper which contains material that works to continuously remove all the oxygen from the air above the wine AND from the wine itself, completely stopping the degradation process. Repour works differently than other wine preservation methods in that it doesn't purge air/oxygen from a closed bottle of wine.

Rather than purging air (like a vacuum stopper or inert gas do) oxygen is removed through a selective chemistry that reacts only with oxygen. *(Note: As Repour works to remove the oxygen, it is also depleting its active ingredient, which is why its use per stopper is not unlimited.)*

Repour's effectiveness stems from a scientific three-part process detailed below. In summary, oxygen reacts with a material via a non-reversible chemical reaction tailored to oxygen molecules. In our case, it is a reaction of oxygen with iron which creates iron oxide (and no by-products).

Diffusion continuously brings oxygen to the site of the reaction which, in combination with a chemistry principle known as Henry's Law, brings the dissolved oxygen in the wine down from approximately 8 ppm (which is what an average wine would be once exposed to air) to less than 0.03 ppm.

Because the stopper actively removes oxygen from the air it, in turn, removes all of the dissolved oxygen from the wine itself without ever coming into contact with the wine. This is where the real benefit of Repour and the technology of oxygen scavenging comes into play.

By removing all the dissolved oxygen from the wine, it can be preserved for weeks (or even months) without being degraded due to the presence of oxygen. The one result of this is that a wine saved under Repour may need to open back up again when you return for another glass. In essence, if you think of the bottle as being opened for the first time, this is how a wine saved under Repour will respond. It will open up and evolve as oxygen re-engages the aromatics of the wine.

1. **An Oxidation Reaction:** The science behind oxygen disappearing is an oxidation reaction between oxygen and another material—a non-reversible chemical reaction which is what makes Repour so effective—and also why one stopper only works on 1 bottle of wine (which contains 1500 ml of air). The reaction looks like this:  $X + O_2 \rightarrow XO_2$ . As there is 21% oxygen in the air, this means a 21% vacuum is created (another chemistry principle called Dalton's Law). If you open the bottle in a quiet room and listen carefully, you will hear (and sometimes feel) the vacuum break.
2. **Principles of Diffusion:** The second part of Repour's effectiveness relies on the principles of diffusion. The oxidation reaction is only effective because diffusion of oxygen in the air above the wine "brings" oxygen into the stopper and allows the oxidation reaction to consume it. If you opened the top of a Repour stopper, you would find a packet inside. Diffusion allows oxygen to pass through the packet and does not let material other than air pass through.
3. **Henry's Law:** Ultimately we don't really care about how much oxygen is in the air above the wine; we care about how much oxygen is in the wine itself (where the oxidative damage is occurring). In essence, oxygen is always "dissolving" into and back out of the wine, and there is an equilibrium that occurs that is based on the amount of oxygen in the air. As Repour continuously removes oxygen from the air, it in turn removes all of the oxygen from the wine itself.

Ultimately, Repour saves an open bottle of wine not because of chemistry, but because it stops biology. By eliminating oxygen in the wine, the biological process of acetobacter bacteria turning the ethanol in wine into acetic acid is averted. Since the anaerobic bacteria need oxygen to thrive, by removing all the oxygen from the wine (Henry's Law), acetobacter can't do what they do best, and your leftover wine stays fresh.