ask the AWRI

# Polysaccharides: a cause of clarification/filtration problems

AWRI helpdesk staff regularly investigate settling and filtration problems caused by polysaccharides. In this column, AWRI Senior Oenologist **Adrian Coulter** responds to questions about polysaccharides related to clarification and fouling of filter membranes.

*How do polysaccharides inhibit wine haze settling?*

Polysaccharides, whether naturally present or added to wine, can protect unstable, haze-forming colloidal particles from flocculation. They do this by coating or 'protecting' the colloid, preventing it from interacting and aggregating with other wine components. To avoid flocculation and potential filtration problems, polysaccharides must fully cover the surface of all unstable colloidal particles (Ribéreau-Gayon *et al*. 2006).

*Will turbidity measurement predict the probability of filtration problems?*

A common threshold used prior to bottling is ≤1 Nepholometric turbidity units (NTU). However, turbidity alone is not a good predictor of wine filterability because it does not indicate how the wine will interact with the filtration media. Two wines with similar NTU values can behave very differently during filtration. For example, one wine might contain fine particles that rapidly block filtration media, while another might contain larger particles that allow filtration to continue, although less efficiently. Filtration difficulties and filter media fouling can result from β-glucans in wine made from grapes infected with *Botrytis cinerea*. Since β-glucans are soluble in wine, they don't contribute to turbidity measurements. As a result, a wine with a low NTU value may still encounter filtration issues if β-glucan levels are high.

*What is the best method for predicting filtration problems?*

The filterability index (FI) is a more direct measure of a wine's potential to block filtration media over time compared with turbidity measurements. The FI is determined by passing wine through a membrane and measuring the time required to filter a known volume. A wine may have an acceptable turbidity (e.g. NTU ≤ 1) but an unacceptable filterability (high FI), meaning the wine would rapidly foul filtration membranes. Conversely, another wine may exceed the turbidity threshold for bottling but still have an acceptable FI (Bowyer and Edwards, 2018).

*How can I determine whether polysaccharides are responsible for a clarification or filtration issue?*

A qualitative alcohol precipitation test can determine problematic levels of polysaccharides in wine. This test relies on the decreasing solubility of polysaccharides as ethanol concentration increases. To perform the test, 50 mL of the test wine is placed in a 100 mL measuring cylinder. Then, 50 mL of 96% ethanol is carefully poured down the side of the cylinder to form a distinct layer of ethanol above the wine. The cylinder is left undisturbed for 30 minutes. After this time, the wine-ethanol interface is examined for the presence of a white, filamentous layer, which indicates the presence of polysaccharides (Figure 1).

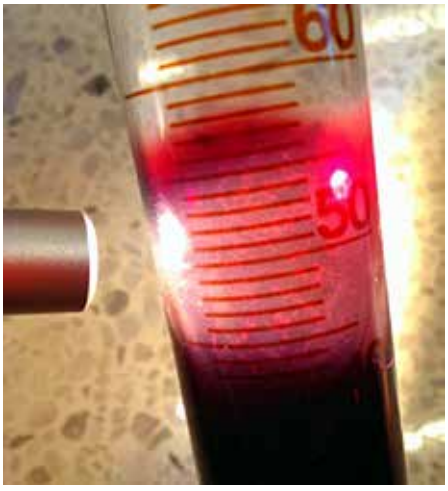


**Figure 1. Example of the white filaments formed after applying the qualitative alcohol precipitation test to a red wine that was difficult to filter.**

*How should I proceed if polysaccharides are responsible for membrane fouling?*

Treating wines with pectolytic enzymes is recommended to hydrolyse polysaccharides into smaller, less problematic sub-units. Once the polysaccharides protecting the colloids have hydrolysed, the colloidal system becomes unstable, leading to flocculation and easier clarification. Flocculation can be further enhanced by fining with a silica 'sol' (a colloidal solution of silicon dioxide) before resuming filtration. It is important to note that siliceous earths should be used before any protein fining agents and after bentonite fining.

If a wine fails the filterability test, the cause should be identified and addressed accordingly.

If there is any evidence of *Botrytis cinerea* infection of the fruit, or if bench trials using pectolytic enzymes do not improve filterability based on a filterability test, the polysaccharide causing the fouling may be a β-glucan from *Botrytis*. In this case, a β-glucanase enzyme with exo-β-1,3-glucanase activity is recommended to hydrolyse the high molecular weight β-glucan. Although β-glucanase is inhibited by the low pH of wine and tannins in red wines, Humbert-Goffard *et al*. (2004) found that commercial β-glucanase preparations were effective, increasing the volume of wine filtered before fouling by up to 55%.

*Can filter membrane fouling be avoided or delayed?*

Filter membrane fouling can be minimsed by testing wine filterability before filtering. If a wine fails the

filterability test, the cause should be identified and addressed accordingly. For example, if a wine has very low turbidity and still fails the filterability test, polysaccharides may be responsible. The polysaccharide test outlined above can confirm this, and if polysaccharides are present, the wine can be treated with pectolytic and/or β-glucanase enzymes. If filterability testing equipment is unavailable, the polysaccharide test should be performed on all wines prior to bottling, due to its simplicity.

If the issue is unrelated to polysaccharides, coarse pre-filtration or centrifugation can help remove larger particles and aggregates before light filtration. Precipitation of unstable colloids is enhanced at low temperatures, due to reduced Brownian motion, so lowering the temperature before coarse filtration or centrifugation may improve efficiency.

In the case of cross-flow filtration, reversing the flow through the membrane can help dislodge deposited material. Regular membrane cleaning, using chemicals recommended by the manufacturer, also helps minimise fouling. Since polysaccharides are a common cause of membrane fouling (El Rayess *et al*. 2012), routine cleaning with a broad-spectrum enzyme product is recommended. Regular enzyme treatments can extend the life of filter membranes by preventing the accumulation of polysaccharide-based colloidal material on or within the membrane matrix (Anon. 2021).

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## AWRI helpdesk

*The AWRI helpdesk provides a free-of-charge technical advisory service to Australia's grapegrowers and winemakers. For further information about clarification issues or any other technical matter, contact the helpdesk on (08) 8313 6600 or helpdesk@awri.com.au*

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