The Impact of Benzyl Alcohol and 1-Phenylethanol Gelled Emulsion Cleaning Systems on Oil Films in Easel Paintings

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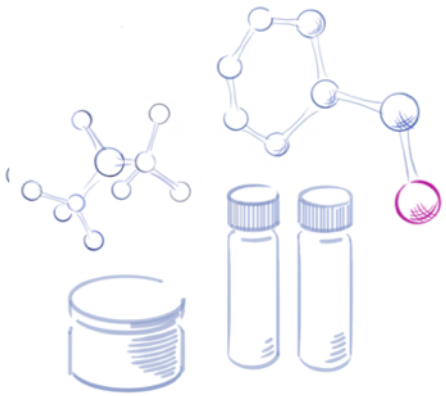

Hello, over this last year, I've really enjoyed designing and testing a new cleaning gel that features a benzyl alcohol derivative, 1-phenylethanol, as its active ingredient. While the title accurately reflects what I did, this project is really a long-term endeavor that extends beyond this single compound tested…

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Novel Benzyl Alcohol Derivative Cleaning Solutions

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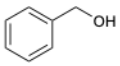
… and can be better summarized as a broad exploration of ‘New Benzyl Alcohol Derivative Cleaning Solutions’.

To contextualize the interest in benzyl alcohol derivatives, it’s worth revisiting the properties of benzyl alcohol that make it such a popular ingredient in cleaning solutions for paintings.

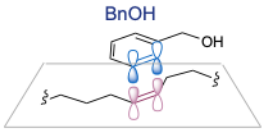
Novel Benzyl Alcohol Derivative Cleaning Solutions

INTRODUCTION

Benzyl Alcohol

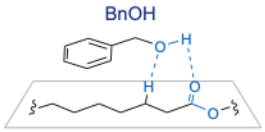


BnOH aromatic moiety - pi-stacking interactions



alkene from drying oils

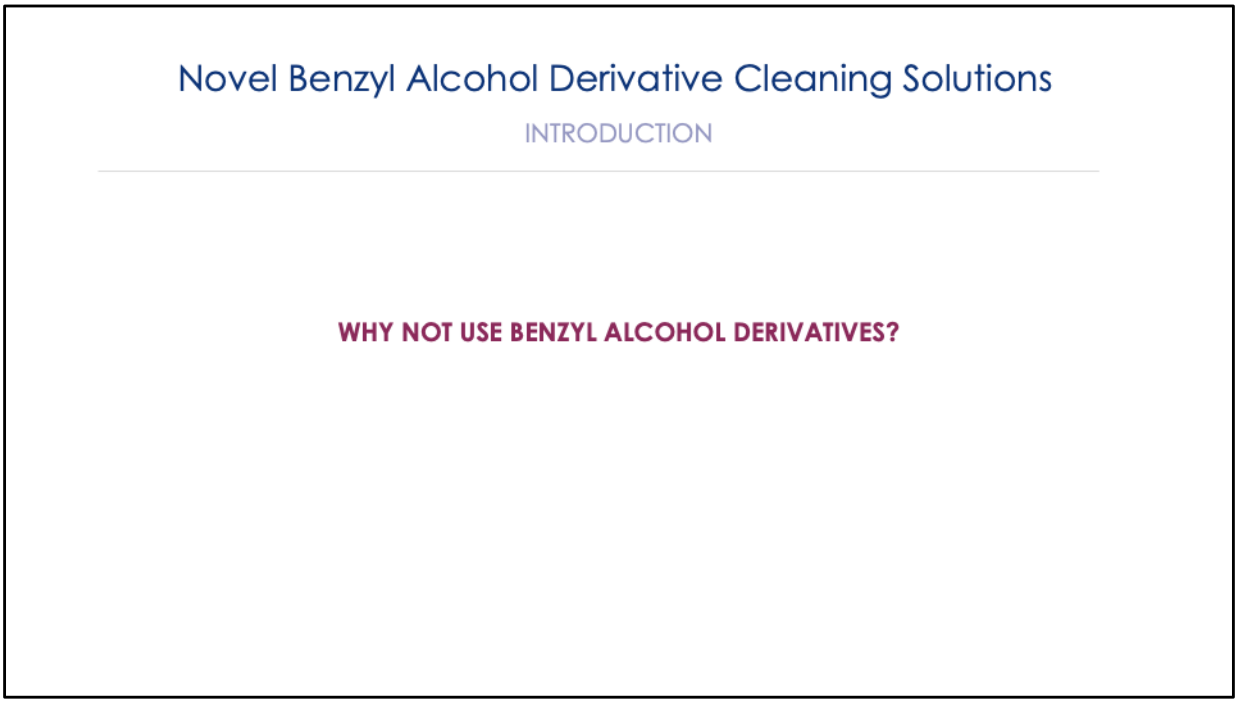
BnOH alcohol moiety - H-bonding and dipole-dipole



ester in aged oil

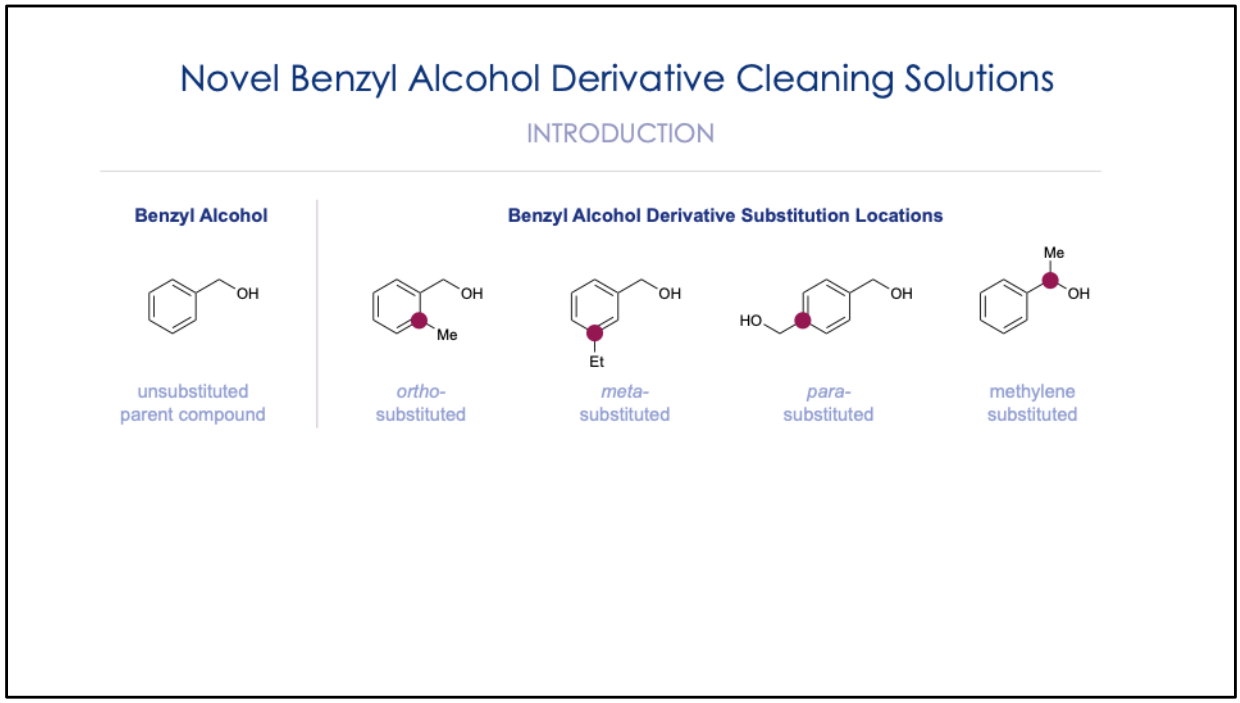
Benzyl alcohol's combination of aromatic ring and hydroxyl group allows it to engage in multiple types of non-covalent interactions with functional groups generally present in aged oil films, which is what makes benzyl alcohol efficient at swelling hardy oil-resin varnishes often found on Old Master paintings.

Given their efficacy, something I wondered was …

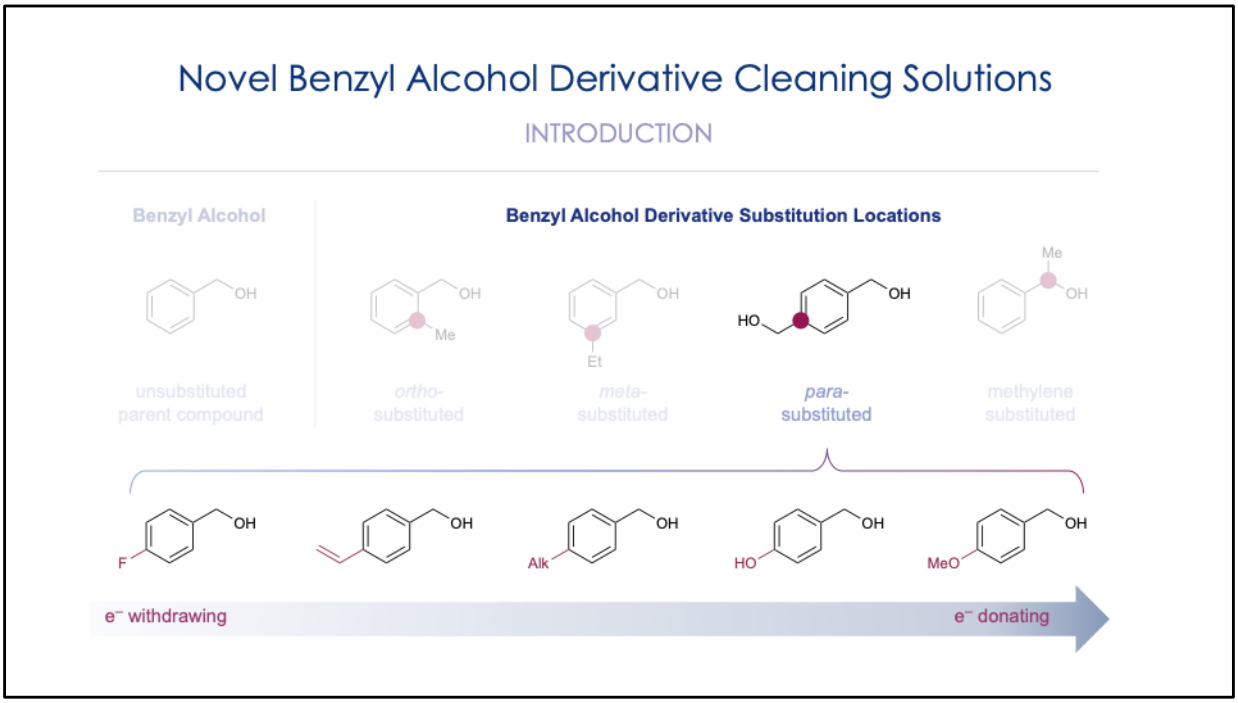


…why conservators have not yet used benzyl alcohol derivatives.

What is a derivative?



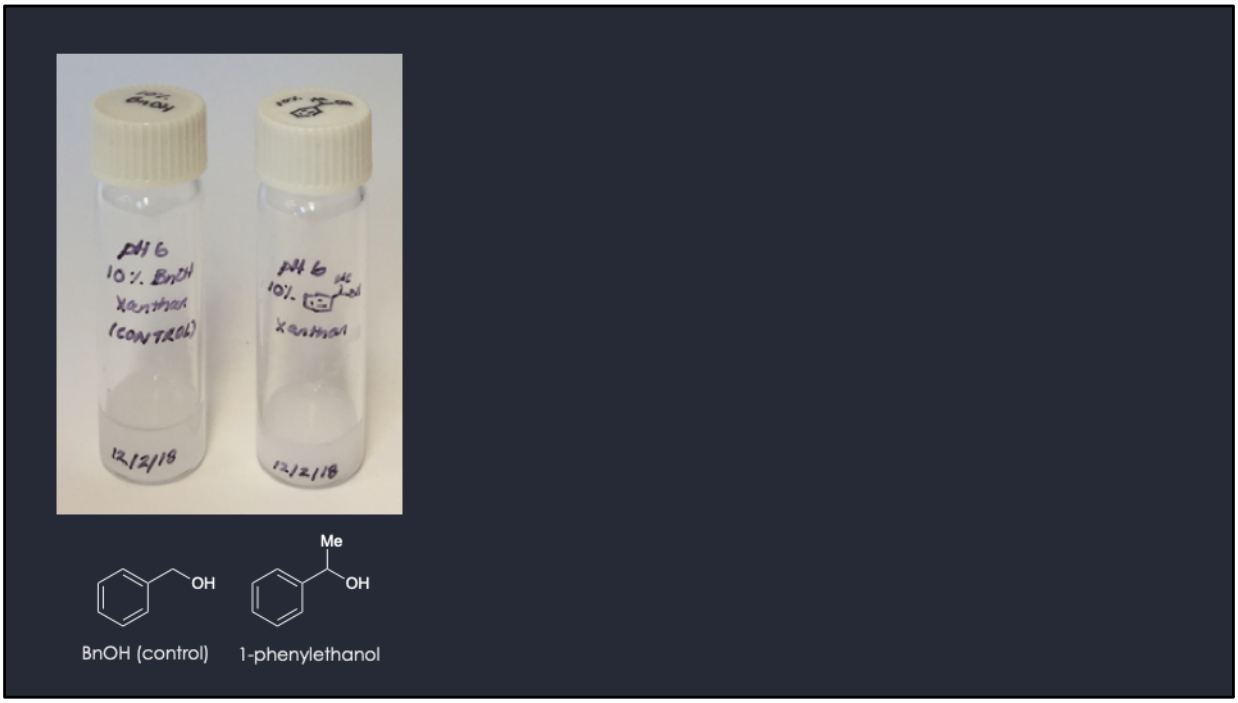
It's a compound that has the benzyl alcohol core, but additional functional groups on either the ring or the methylene unit (as indicated with the red dot). And they are worth exploring as cleaning agents because with any one of these four classes of substitution…



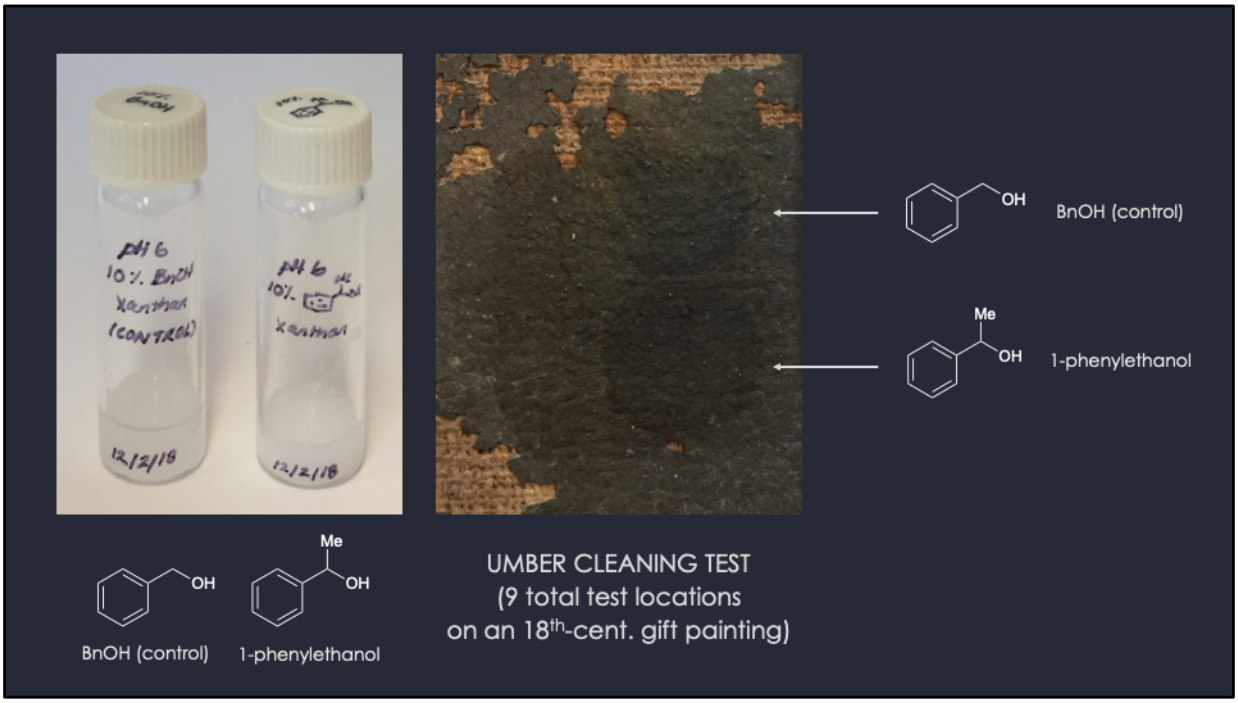
…depending on the specific functional group appended on, it will have different electronic properties within the aromatic ring, which matters because depending on the specific composition, age, or degree of oxidation of the oil-resin varnish targeted for removal, these derivatives could achieve a better chemical match resulting in more selective cleaning.

However, it's important for us to understand the chemical effects on the ORIGINAL oil film before applying new reagents to paintings.

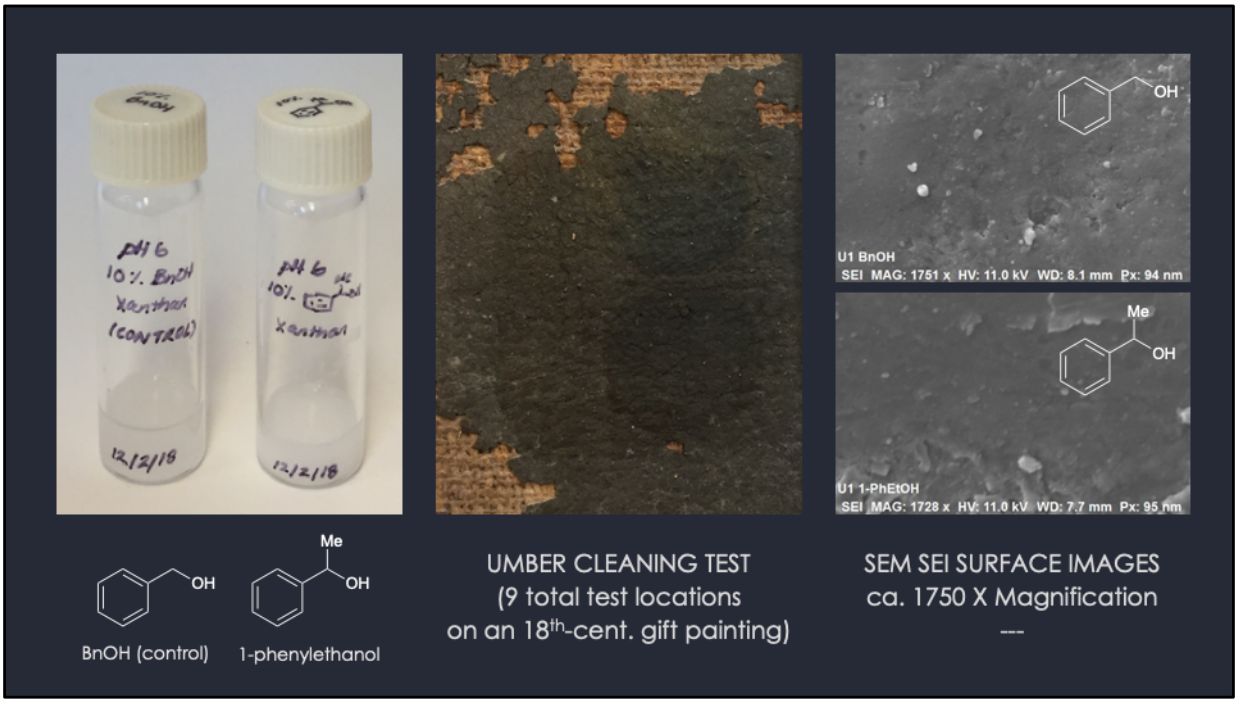
Thus the focus of my work this semester was not evaluating the efficacy of benzyl alcohol derivatives in cleaning, but rather evaluating their impact on the original paint film and comparing that to the effects of benzyl alcohol (my control).



This semester I focused on just one derivative – 1-phenylethanol, shown here along with the benzyl alcohol control. Both were gelled as 10% solutions in a pH 6 xanthan gum carrier, which resulted in physically similar gels.



In cleaning, the derivative proved to be a slower acting gel and clearing swabs carried less pigmentation.



There was no significant change in surface morphology from SEM imaging and GC analysis indicated the derivative cleaned areas leached lower quantities of palmitic and stearic acid.

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I'd be happy to delve further into details during Q&A. Thank you!