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CHOOSE WISELY: A SOLVENT SELECTION TOOL FOR SUSTAINABLE ART CONSERVATION

Background

Solvents traditionally used in art conservation are petrochemical-based, potentially toxic to humans and damaging to the environment[1].

Many researchers are exploring green solvents as alternatives. For them to be used in art conservation, a selection guide is needed to inform conservators on which solvents are suitable.

A green solvent is non-toxic, biodegradable and has reduced environmental impacts compared to conventional solvents[2]. Many are produced from biomass reducing reliance on fossil fuel resources[3].

There is currently no universal solvent selection guide targeting the art conservation sector[1].

Research Objectives

1. Evaluate the effectiveness of alternative green solvents to those traditionally used in art conservation based on their performance ability.
2. Integrate physical and chemical impacts of solvent use with ethical environmental considerations for safety.
3. Develop a decision-making tool to aid the art conservator to choose a solvent that is suitable.

Methodology

Review existing solvent selection guides from other industries.

- CHEM21
- GreenSOL
- GEARS

Establish selection parameters using literature based on:

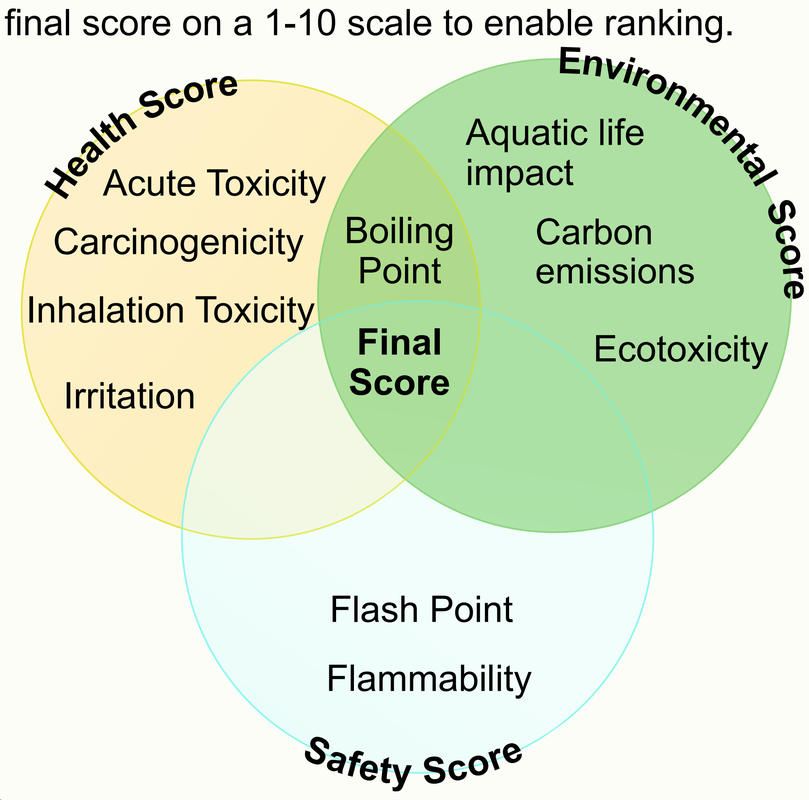
- Performance
- Health
- Safety
- Environmental impact
- Overall suitability

Calculate scores using these parameters via a worst case scenario approach[4] and classify each solvent.

- Recommended
- Problematic
- Hazardous

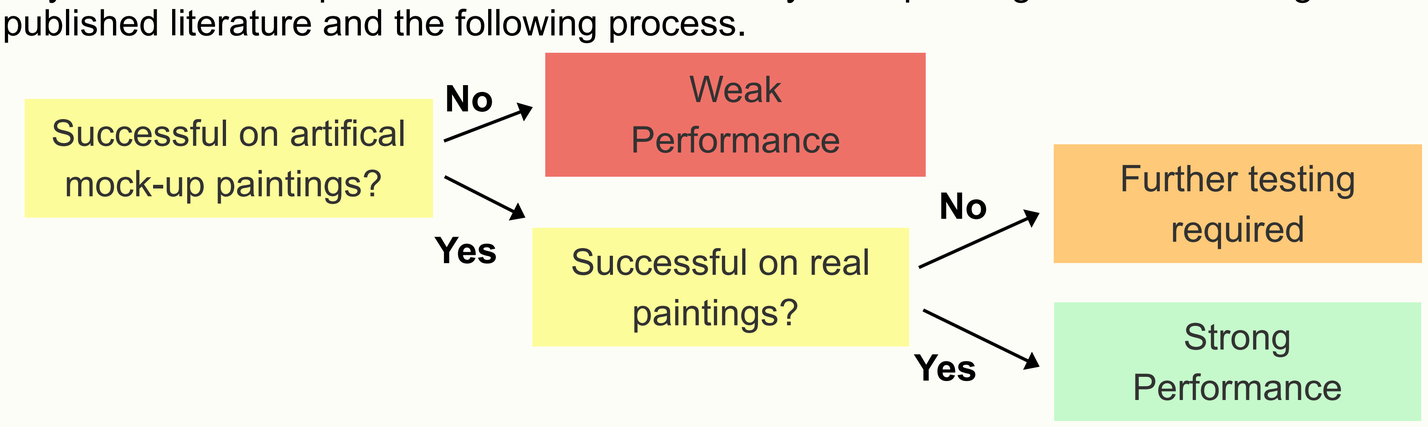
Solvent Scores

Using published data from the following categories and the approach outlined by CHEM21[4], individual scores have been calculated and combined into a final score on a 1-10 scale to enable ranking.



Performance

Physio-chemical impacts of the solvent on the layers in paintings assessed using published literature and the following process.



Findings

The three most commonly used conventional solvents for painting conservation compared to three green alternatives[5]. Suitability was categorised using a traffic-light system (yes, low risk, moderate risk) reflecting combined solvent score rankings and performance level.

Solvent	Health	Safety	Environmental	Ranking	Performance	Suitable?
Acetone	2	5	5	Problematic	Strong	Yes
Ethanol	3	4	5	Problematic	Strong	Yes
Isooctane	5	5	7	Problematic	Strong	Yes
Ethyl Lactate	5	3	3	Recommended	Testing needed	Low Risk
2-ethylhexyl Pelargonate	3	1	5	Recommended	Strong	Yes
Dimethyl Carbonate	4	4	3	Problematic	Testing needed	Moderate Risk

Acetone, ethanol and isooctane are suitable but designated an amber rating due to moderate health, safety and environmental concerns despite their widespread use in conservation[6]. The amber ranking for the yes result reflects a balance between practical application and occupational risk.

Conclusion and Beyond

The adoption of a solvent selection guide enables the inclusion and use of greener solvents in art conservation, reducing reliance on conventional solvents and increasing trust in new green alternatives.

This guide:

- **promotes green solvent use** in art conservation.
- integrates **health and safety** metrics with **solvent performance** for a holistic consideration of the impacts of solvent use.
- is **tailored** to the **cleaning of paintings**.

Future possibilities: development of a user-friendly decision protocol that includes economic and ethical factors.

References:
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4. Prat et al., 2016. CHEM21 selection guide of classical- and less classical-solvents. Green Chem, 16, pp. 288-296.
5. Melchiorre, et al., 2023. Green solvents and restoration: Application of biomass-derived solvents in cleaning procedures. Journal of Cultural Heritage, 62, pp. 3-12.
6. Ching et al., 2024. Greener Solvents Project: Solvent Use in Conservation. Sustainability in Conservation, Delaware.