

Chemical Resistance and Solvent Uptake of Vat-Printed Photopolymers: Qualification Boundaries and Recovery

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3Dresyns by Resyner Technologies S.L.

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Statement of Significance

Unstressed immersion can identify solvent uptake, dimensional change and retained properties, but it cannot establish environmental stress-cracking resistance. Chemical resistance must remain bounded to the defined printed state, liquid, concentration, temperature, exposure and recovery history.

Keywords: chemical resistance; solvent uptake; desorption; recovery; vat photopolymerisation; qualification.

Abstract

Three topical sources address solvent effects on UV-modified printing plates and ink films, mechanical-property changes in 3D-printed dental materials, and postwashing effects on residual-monomer elution, conversion and mechanics. Their conditions and material families are not interchangeable. This note uses ISO 175:2010 and ASTM D543-21 as general method anchors for immersion and chemical-reagent evaluation. Environmental stress cracking is excluded because no cited primary study applies a defined stressed-exposure protocol to a vat-printed photopolymer. RP-02 defines the shared qualification method.

1. Evidence boundary

Environmental stress cracking is outside this review. No cited primary study reports ESC of a vat-printed photopolymer under a defined constant-strain or constant-load protocol; ESC is retained only as a research priority and no ESC claim is made. Tomašegovic et al. study UV-modified flexographic plates and EPDM, not vat-printed articles [1]; the source is used only for general solvent-interaction context and its magnitudes are not transferred. Tayeb et al. address solvent-dependent mechanical properties of printed crowns [2], while Jin et al. address postwashing, residual-monomer elution, conversion and mechanics [3].

2. Topic-specific findings

- Chemical identity, concentration, temperature and exposure duration jointly determine uptake and property response [1,2].
- Solvent exposure can change mechanical properties of a defined vat-printed article; the effect is formulation- and process-specific [2].
- Washing conditions can change residual-monomer elution, degree of conversion and mechanical results [3].
- Recovery after drying must be measured rather than assumed: the cited set does not establish that restored mass implies restored dimensions or mechanics.

3. Minimum measurement and reporting set

Control	Method and minimum record	Required interpretation
Exposure	ISO 175:2010 immersion or ASTM D543-21 practice selected for use case; identify liquid, purity/concentration, temperature, time, agitation and replenishment	Short exposure supports only the tested condition; record wet-patch/wipe versus immersion
Mass/dimensions	Time-resolved uptake plus desorption/recovery at controlled intervals	Report reference state, geometry, balance/metrology uncertainty and equilibrium rule
Property retention	Conditioned mechanical/functional test against unexposed controls	State wet, surface-dried or fully reconditioned state and test timing
Chemistry	Extractables or spectroscopy where relevant to the claim	Visual PASS or returned mass is insufficient for chemical equivalence
Replication	Independent builds and lots where material variation matters	Retain swelling, cracking, softening and invalid/censored specimens

4. Interpretation limits

- ISO 175:2010 remains current and addresses effects of immersion in liquid chemicals; it does not reproduce every end-use contact mode.
- ASTM D543-21 is active and includes immersion and, where selected, mechanical stress plus reagent exposure; results are comparable only when conditions and procedure match.
- ISO 175 and ASTM D543 differ technically; their results must not be pooled as interchangeable values.
- An unstressed immersion result cannot support an environmental stress-cracking claim.

5. 3Dresyns implementation examples

3Dresyns resins and cleaning/removal workflows are manufacturer-controlled implementation candidates, not independent chemical-resistance evidence. Before naming a grade, the record must identify its controlled TDS/IFU revision, printer and full wash, dry, post-cure and conditioning state. WP-06 and WP-36 may supply corrected screening context but cannot replace exposure and recovery testing with the intended liquid and article.

6. Limitations and priorities

The source set is small and dominated by dental or non-VPP material systems. Priorities are time-resolved uptake/desorption datasets for production-equivalent VPP articles, retained-property measurements after drying, and separate stressed-exposure studies before any ESC claim is considered.

7. Conclusions

- Chemical resistance is conditional on the complete material-process-liquid-time-temperature state.
- Mass recovery does not establish dimensional, mechanical or chemical recovery.
- Environmental stress cracking is excluded from the title and findings because the cited set contains no VPP ESC dataset.
- No 3Dresyns grade should receive a public resistance claim without exact product documents and application-specific exposure testing.

Declarations

Funding: none. Competing interest: the author is Founder and Scientific Director of 3Dresyns by Resyner Technologies S.L. No new dataset was generated. Juan Segurola verified the article and accepts responsibility.

References

- [1] Tamara Tomasegovic, Sanja Mahovic Poljacek, Maja Strizic Jakovljevic, Rasa Urbas. Effect of the Common Solvents on UV-Modified Photopolymer and EPDM Flexographic Printing Plates and Printed Ink Films. *Coatings*. 2020;10(2):136. <https://doi.org/10.3390/coatings10020136>
- [2] Hunaida Khaled Tayeb, Abdulrahman Jafar Alhaddad, Nick Silikas, Julian Satterthwaite. Effect of solvents on mechanical properties of 3D-printed materials for definitive crowns. *Dental Materials*. 2026. <https://doi.org/10.1016/j.dental.2026.07.019>
- [3] Gan Jin et al. Influence of postwashing process on the elution of residual monomers, degree of conversion, and mechanical properties of 3D printed crown and bridge materials. *Dental Materials*. 2022;38(11):1812-1825. <https://doi.org/10.1016/j.dental.2022.09.017>

Standards

ISO 175:2010. Plastics - Methods of test for the determination of the effects of immersion in liquid chemicals. <https://www.iso.org/standard/55483.html>

ASTM D543-21. Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents. <https://store.astm.org/standards/d543>

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