

0511 Solvent and Water Retention in Dental Adhesive Films After Evaporation

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Objective: To compare the extent of solvent and water retention in resin blends with different hydrophilicity (Hoy's solubility parameter for hydrogen bonding, δ_h) after solvent evaporation. **Methods:** For each resin blend, adhesive mixtures were prepared by addition of [1] 50 wt% acetone; [2] 30 wt% acetone and 20 wt% water [3] 50 wt% ethanol and [4] 30 wt% ethanol and 20 wt% water. The mixtures were placed in glass wells and evaporated for 30s for acetone-based and 60s for ethanol-based mixtures. The weight of the resin mixtures was measured at baseline and after solvent evaporation. Resin films were prepared for TEM after immersion in ammoniacal silver nitrate for 48h. Percentages of solvent and water retained in the resin mixtures were compared within resin groups using ANOVA with Student-Newman-Keuls and between acetone and ethanol groups using Student's t-tests. **Results:** Mean values and standard deviation of all the groups (n=10):

| Resin blend | 30s evaporation - % solvent retained | | 60s evaporation - % solvent retained | |
|--|--------------------------------------|------------------------------------|--------------------------------------|------------------------------------|
| | Group 1 (50% acetone) | Group 2 (30% acetone/20% water) | Group 3 (50% ethanol) | Group 4 (30% ethanol/20% water) |
| δ_h ; (J/cm ²) ^{1/2} | | | | |
| 12.2 | 10.45±3.67 ^a | 33.64±2.04 ^b | 12.99±4.01 ^a | 40.23±1.91 ^c |
| 11.3 | 11.75±3.37 ^a | 35.20±3.84 ^b | 13.15±3.30 ^a | 41.23±1.95 ^c |
| 12.9 | 12.21±2.39 ^a | 34.87±1.73 ^b | 13.17±3.28 ^a | 41.63±1.80 ^c |

Significantly more solvent and water were retained in ethanol-based adhesive mixtures (P<0.0001) when compared to acetone-based adhesive mixtures after evaporation. TEM revealed unevaporated water trapped as droplets in Group 2 resin films. Water trees were seen along the film periphery of all groups and throughout the entire film in Group 4. **Conclusions:** The addition of water to resin-solvent mixtures creates azeotropes that theoretically the evaporation of water; however, the net result increased retention of acetone/ethanol and water in resin-solvent mixtures. (Supported by grants DE04911 and DE015306 from the NIDCR)

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