Properties of Acrylate Material under Different Storage Environments

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Introduction: Acrylate material is widely used in the various medical devices. However, properties of acrylates material may be different under different storage environments[1]. In this study, various properties of a hydrophobic acrylate material such as refractive index, Abbe number, UV–Vis transmission, infrared spectra and glass transition temperatures were evaluated.

Material and Methods: Acrylate material was prepared in-house with different types of mono- and di-functional acrylate monomers. After fully cured and purified, these materials were stored under three different conditions, 1) DI water at 25°C (Wet) 2) 25°C and 40% relative humidity (Normal) and 3) 100°C oven under vacuum oven (Dry) for at least one day before any testing. Various properties were evaluated and compared.

Results: **Table 1** shows results of average refractive index (RI), and Abbe Number of acrylate materials under different storage environments.

Average	Wet	Normal	Dry
RI	1.4721	1.4734	1.4736
Abbe	54.8	55.9	55.8

Table 1. RI and Abbe Number of Acrylate Material under Different Storage Environments

As shown in **Table 1**, RI of wet sample was slightly lower when compared to samples stored under normal and dry conditions. Dry sample has the highest RI. This observation is not unexpected because the wet sample contained small amount of water and the RI of water is 1.3323, much lower than acrylate material (1.4736 in this case). Based on our results, average weight gain for wet samples is around 0.59% and the weight loss for dry sample is around 0.35%. The total moisture difference between wet and dry samples is almost 1%. If we included weight percentage of RI of both acrylate material and water. RIs of wet and dry samples matched very well.

UV-Vis Scans of acrylate materials under different storage environments are shown in **Figure 1** below.

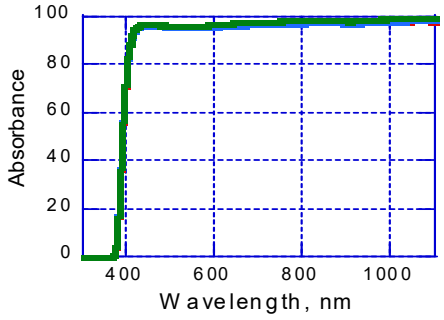

Figure 1. Representative Overlay of UV-Vis Scan of Acrylate Material under Different Storage Environments

Table 2 shows results of average 1% and 10% cut off wavelength (nm) under different storage environments

Wavelength	Wet	Normal	Dry
1% Cut off	370.9±0.5	371.3±0.2	370.7±0.1
10% cut off	373.7±0.7	374.2±0.0	373.5±0.1

Table 2. The 1% and 10% cut off wavelength of Acrylate Material under Different Storage Environments

Analysis of Variance Results (ANOVA) performed by KaleidaGraph showed that p values of 1% and 10% cut off wavelengths are 26.4 and 34.5, respectively. The high p values (>0.05) indicated there is no significant difference of 1% and 10% cut off wavelengths of these samples.

Infrared absorption of acrylate under different storage environments are also comparable in overlay spectra as shown in **Figure 2.** Correlation between these spectra was >0.999 for all acrylate samples in this study.

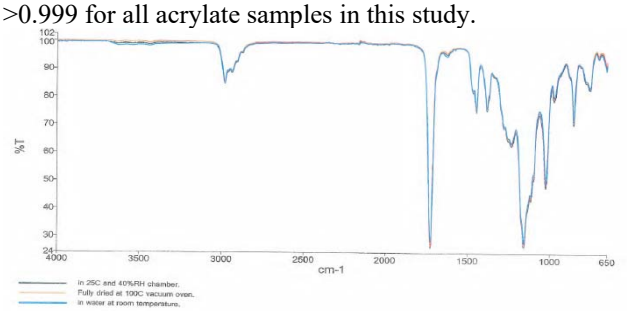

Figure 2. Representative overlay infrared spectra of Acrylate Material under Different Storage Environments

Table 3 shows results of average glass transition temperature (Tg) of acrylate materials under different storage environments Tg_1 is measured for samples as prepared and Tg_2 is measured for sample after first run to remove thermal history. A significant difference of Tg was clearly demonstrated for these samples.

Average (°C)	Wet	Normal	Dry
Tg_1	5.4 ± 0.5	8.9 ± 0.6	11.3 ± 0.5
Tg_2	5.2 ± 0.6	8.9 ± 0.4	11.3 ± 0.4

Table 3. Glass Transition Temperatures of Acrylate Material under Different Storage Environments

Conclusions: In this study, we found that UV-Vis transmission and infrared spectra are comparable for acrylate material under different storage environments, Refractive index shows slightly difference and the glass transition temperature demonstrated the significant difference for samples under different storage Environments.

References:

1. M Sabouhi"The effect of Time and Storage Environment on Dimensional Changes of Acrylic Resin Post Patterns", Open Denta J. 9 87-90 (2015).