Terpenes in Cannabis: Terpene Retention from Freeze-Dried Trichomes to Live and Decarboxylated Rosin Products

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1 Introduction

Terpenes are the aromatic compounds that are responsible for the distinctive scent profiles of cannabis cultivars and also contribute to the overall therapeutic potential of the plant [1], [2], [3], [4], [5], as discussed in our previous publications. As consumer preferences continue to move toward cleaner, full-spectrum products, the focus has increasingly shifted from just cannabinoid content to also preserving the terpene profiles throughout processing.

At GES Labs, we recognise the importance of terpene retention and strive to achieve quality products with a chemical profile as close as possible to the original plant material. The following two extraction methods are currently employed within our facility:

i. **Cryoextraction using solvents** - designed to operate at sub-zero temperatures to minimise terpene loss and co-extract a broad range of volatile compounds [6], [7], [8].
ii. **Solventless mechanical extraction** - where cannabis trichomes are isolated, freeze-dried, and pressed at high pressure and controlled temperatures to produce a rosin extract without the use of chemical solvents [6], [9].

Understanding how our methods affect the terpene profiles of our products is critical to product consistency, therapeutic efficacy, and consumer satisfaction. With regards to solventless extraction in particular, this method provides live rosin extracts which are ideal for premium formulations. It is important to take into consideration terpene volatility during the pressing and decarboxylation steps. Since many terpenes have boiling points well below those of cannabinoids [5], [10], elevated temperatures used in pressing or decarboxylation could potentially reduce their presence in the final product if not controlled effectively.

The aim of this report is to evaluate terpene retention during the solventless extraction process whereby freeze-dried trichomes (FDT) are pressed into live rosin and subsequently decarboxylated. We currently manufacture:

- **Live rosin**: a full-spectrum product.
- **Decarboxylated (Decarb) rosin**: a post-processed, activated rosin product.

By comparing the terpene profiles of each processing step from freeze-dried trichomes to live rosin to decarb rosin, the objective is to gain a better understanding of the thermal sensitivity of key terpenes in the solventless product line.

1.1 In-house produced cultivars

This study investigates how the terpene content was affected by the solventless extraction steps focusing on three cultivars: Gorilla Cookies, GMO Cookies and Platinum. The terpene content, expressed as a mass percentage of terpenes of the overall sample mass (m/m%), across the three processing stages is shown in Figure 1 below.

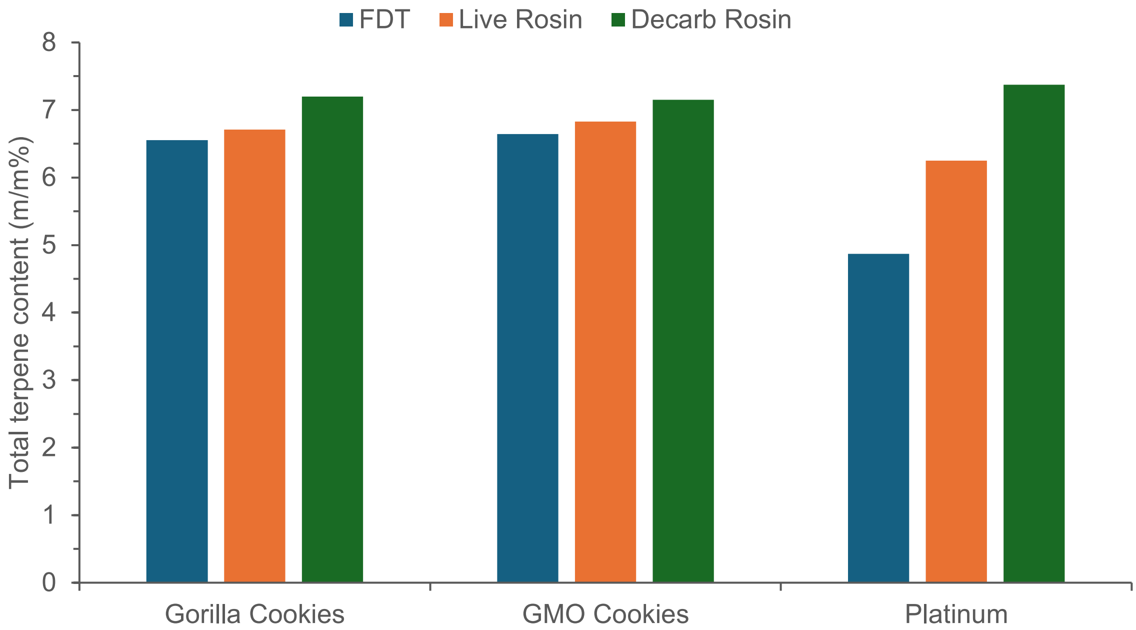

Figure 1: Total terpene content in the starting material to finished products for different cultivars

The main trend observed is an increase in the total terpene content from FDT to the decarb rosin, with the Platinum cultivar showing significantly higher increase compared to the other cultivars. This suggests that the terpene fraction was well retained as the start material was processed mechanically and thermally. To better understand this outcome, the profiles of the nine terpenes discussed in our previous articles were examined (Figure 2).

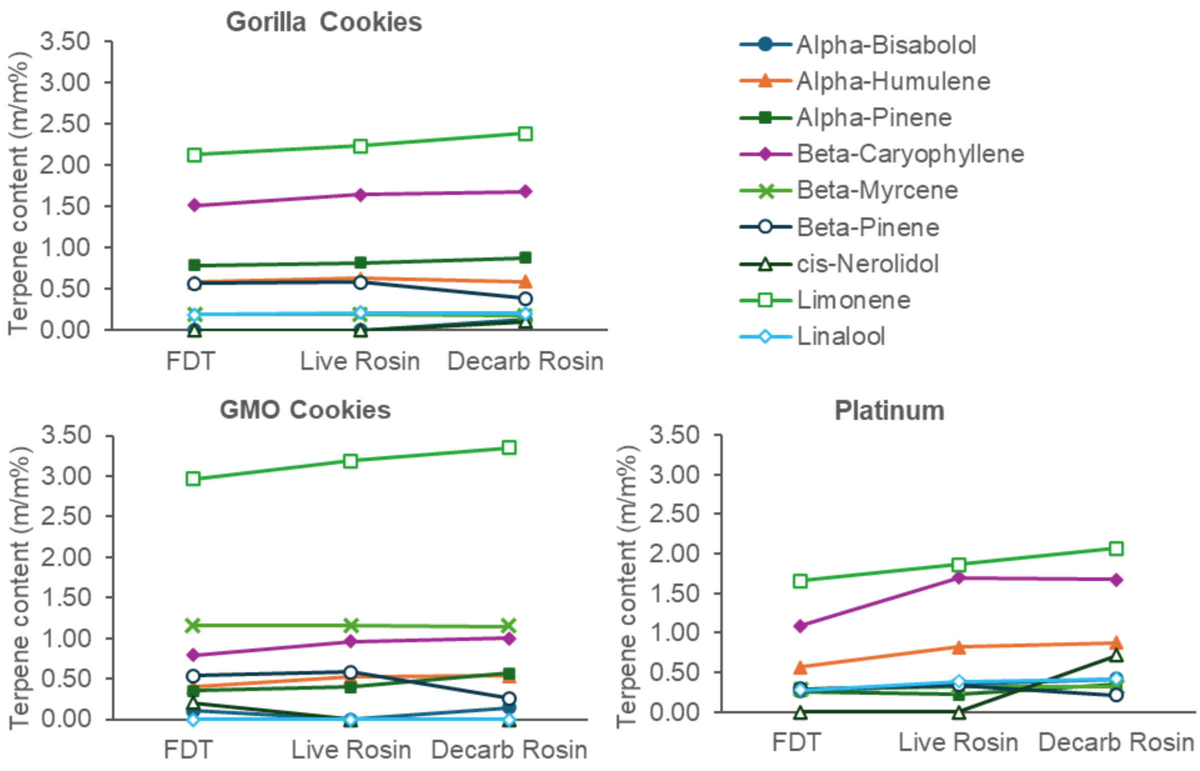

Figure 2: Terpene profiles from starting material to finished products for different cultivars

Consistent with earlier findings, limonene and beta-caryophyllene were the dominant terpenes across all cultivars and processing steps, reinforcing their role as signature compounds of our rosin products. The concentration of most of the terpenes generally increased or remained stable, which indicates strong preservation during pressing and decarboxylation. This suggests that these processing steps may enhance the release of otherwise bound or plant matrix-associated terpenes, allowing for better separation and analytical detection. However, some losses were noted. Beta-pinene showed a consistent decrease from live to decarb rosin in all cultivars. This may be due to its relatively lower boiling point and higher volatility which could potentially make it more susceptible to evaporation during decarboxylation. Though this would require further investigation to determine the cause for this observation.

To evaluate terpene recovery more accurately, Equation 1 was applied to historical data from commercial batches of each cultivar. The equation incorporates both the terpene content and the mass of material at each stage to calculate true retention percentages.

$$\text{Terpene retention (\%)} = \frac{c_{\text{terpene, product}}\ m_{\text{product}}}{c_{\text{terpene, starting material}}\ m_{\text{starting material}}} \times 100 \qquad \textit{Equation (1)}$$

where c is the terpene content (m/m%) and m is mass (g)

The results of these calculations are summarised in **Error! Not a valid bookmark self-reference.**, showing that on average more than half of the terpene mass present in the FDT was recovered in the live rosin extracts after pressing. Additionally, >89% of those terpenes were retained during the decarboxylation step.

Table 1: Terpene retention of processing steps between starting material and finished products

Cultivar	Rosin Pressing	Rosin Decarboxylation
GMO Cookies	75%	89%
Gorilla Cookies	60%	92%
Platinum	93%	106%
Average	**76%**	**96%**

Interestingly, the Platinum cultivar exhibited over 100% terpene retention after decarboxylation. This apparent increase is likely due to the detection of a high amount of cis-nerolidol post-decarboxylation, which was either below the detection limit or bound within the plant matrix in earlier stages. Upon heating for an extended period, the compound may have been liberated thus contributing to the overall increase in the total measurable terpene mass.

Overall, these findings indicate that the rosin pressing step is the crucial point of terpene loss. One probable cause is the high transfer losses where a portion of the pressed rosin (and thus terpenes, inherently) is lost during collection from parchment paper or pressing bags. Improving post-pressing recovery procedures could therefore potentially yield meaningful enhancements in terpene retention.

1.2 Conclusions

This study demonstrates that the solventless extraction process is highly effective at preserving terpenes, especially during decarboxylation. While some cultivars exhibited slight variations in terpene profiles, the trends were broadly consistent across batches. However, terpene retention is most vulnerable during the pressing stage, where losses due to physical transfer can be significant. Further optimisation in rosin handling and collection techniques could improve recovery. Our goal is to continue development based on these insights as we are committed to creating extracts as close as possible to the original plant both in chemistry and experience.

1.3 References

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