Influence of Storage Time On Essential Oil Components In Dried Hops

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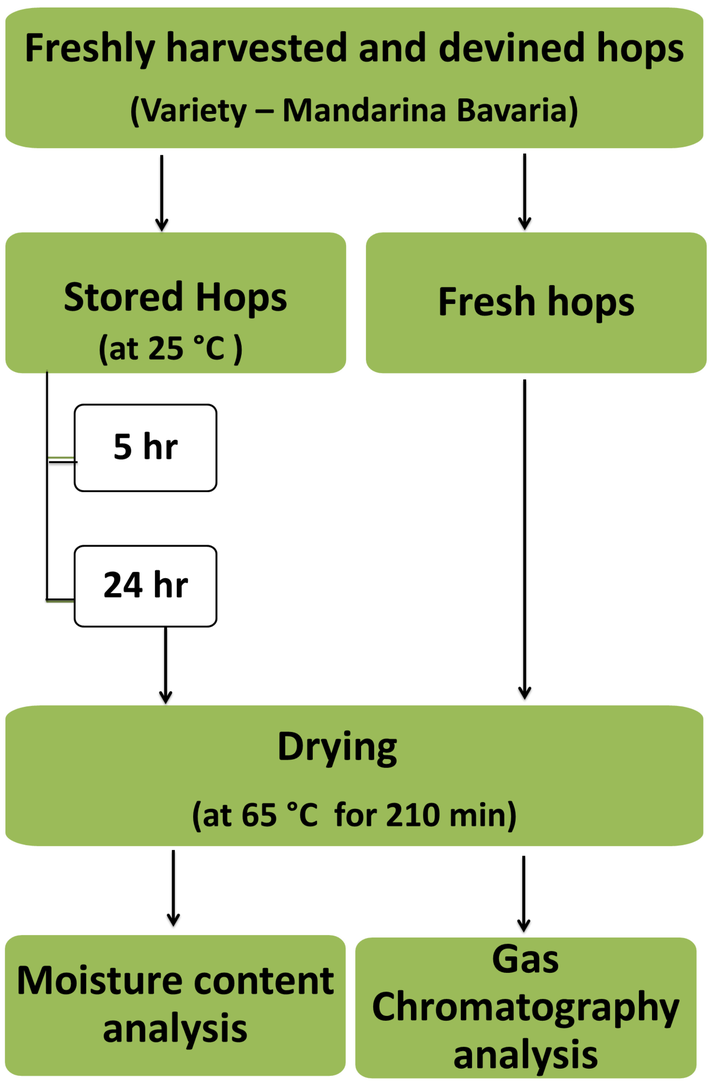
Introduction

- Hop (*Humulus lupulus L.*) is an essential raw material for the brewing industry
- It provides durability, bitterness and aroma to the beer (Wesseloh & Wesseloh, 2015).
- With harvest periods lasting for a maximum of 8 weeks per year (2 weeks per variety), post-harvest processing technologies are of great importance for quality assurance
- While it is common knowledge that the duration of storage prior drying impacts on quality, little knowledge exists regarding its actual effects on valuable components.
- In order to investigate the effects of storage duration on hop quality, freshly harvested hop cones were stored for 5 and 24 hr respectively and dried for 210 min at 65°C thereafter.

Methodology



Results & Discussion

Table 1 provides details for the non - linear regression analysis performed using the Page Model

Table 1. Details of the analysed Page model for both fresh and stored hops

Hops dried at 65°C			
Type	R^2	RMSE	AICc
Fresh	0.978	0.044	-124.7
Stored	0.984	0.039	-130.3

High R^2 values and low RMSE values were obtained in both cases. Values for AICc ranged between -124.7 and – 130.3 respectively. The fit for the predicted and measured values for moisture ratios are shown in Fig.1 & Fig.2

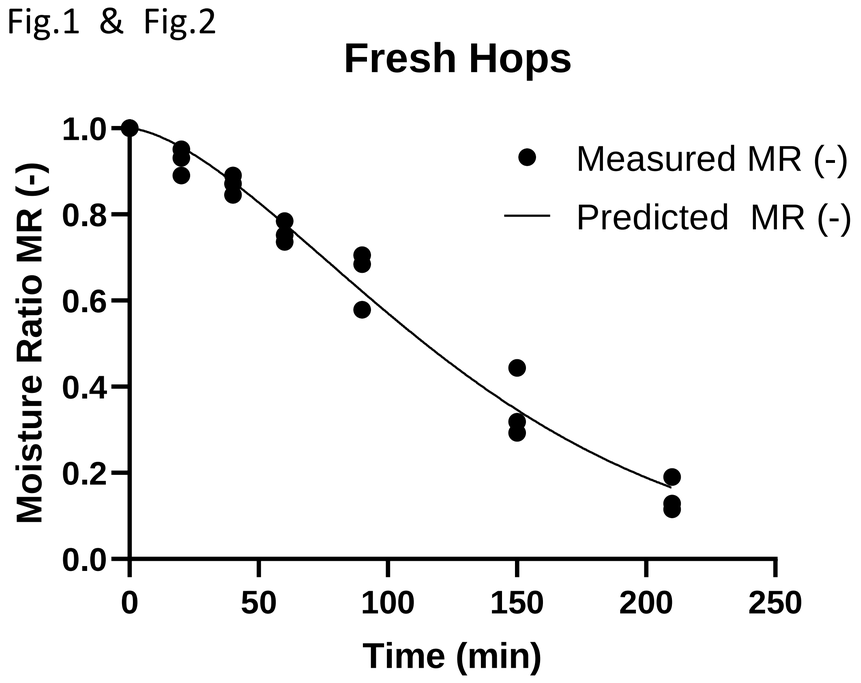


Fig. 1. Measured & predicted MR values for fresh hops

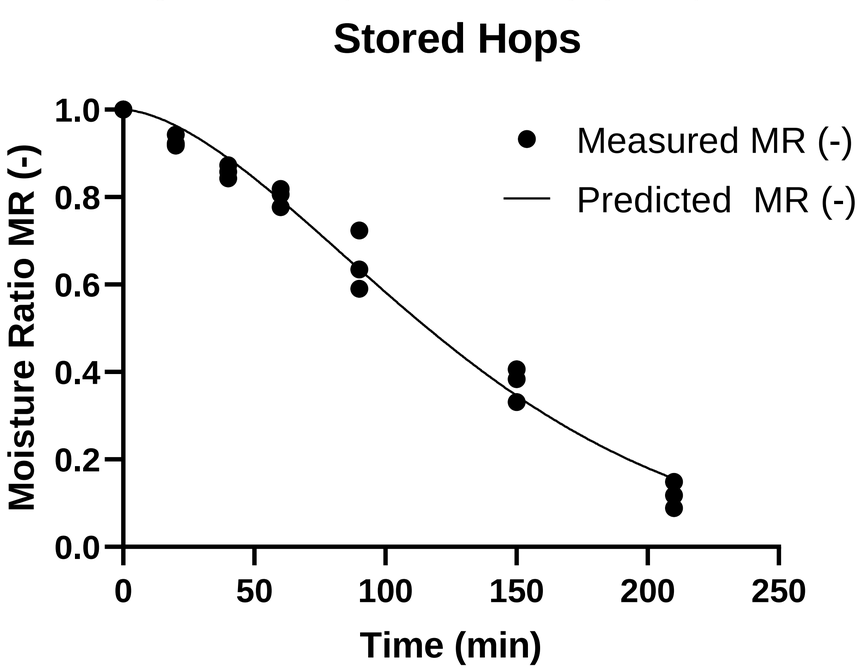


Fig. 2. Measured & predicted MR values for stored hops

Table 2 presents the data obtained from GC analysis. On comparing the data for fresh & stored hops, an increase in the amounts of linalool, ß-caryophyllen, humulen and geraniol is observed for 24 hr stored samples due to oxidation of myrcene. Oxidation of myrcene leads to cyclic reactions to form various products and terpenoids which include linalool and geraniol (Rettberg *et al.*, 2018). Furthermore, as mycrene is heat unstable, a loss of mycrene content is observed across the different storage types

Table 2. Amount of oil component identified by GC analysis (mg/100 g dm Hops)

Type	Drying Time [min]	Myrcene	Linalool	ß-Caryophyllen	Humulen	Geraniol
Fresh	0	1040.89	4.94	36.44	103.54	10.20
	210	643.61	4.53	31.01	90.94	7.73
5 hr stored	0	859.93	6.36	50.60	130.79	11.03
	210	845.99	6.47	40.51	117.77	10.28
24 hr stored	0	751.51	8.03	72.25	180.77	16.10
	210	449.25	8.71	93.23	209.90	22.42

Conclusion

- Drying process has an overall influence on the total hop oil content with losses measured up to 30 – 40 %.
- Additionally, increased storage period prior to drying also has a significant effect on the oil especially in the case of 24 hr stored hops.
- Increase in the amount of essential oils across prolonged storage period and the associated foul odour indicate the degradation of hops.
- The loss of myrcene over prolonged storage period also signifies the loss of the hoppy aroma required for beer brewing.
- R^2, RMSE, and Akaike Criterion (AICc) were used to estimate the goodness of fit for the experimental moisture content data. A model is estimated fit for the data if the values for R^2 are high, RMSE & AICc are low.
- Based on the results obtained from the non - linear regression analysis, it is can be assumed the Page Model is a representative model for hops drying.

Thus, based on the results obtained it is recommended to maintain storage period to a minimum.

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Acknowledgments

The authors would like to acknowledge the financial support for this project provided by transnational funding bodies, being partners of the CORE Organic Cofund, and the cofund from the European Commission. This study is part of the SusOrgPlus project within the framework of the CORE Organic Cofund Programme and is supported by funds of the Federal Ministry of Food and Agriculture (BMEL) based on a decision of the Parliament of the Federal Republic of Germany via the Federal Office for Agriculture and Food (BLE) under the BÖLN programme (Project number: BLE - 2817OE005).

Gefördert durch: Bundesministerium für Ernährung und Landwirtschaft aufgrund eines Beschlusses des Deutschen Bundestages; BÖLN Bundesprogramm Ökologischer Landbau und andere Formen nachhaltiger Landwirtschaft; Bundesanstalt für Landwirtschaft und Ernährung; LfL Bayerische Landesanstalt für Landwirtschaft; CORE organic; AGRARTECHNIK WITZENHAUSEN