Antioxidant activities of wine spirits aged by a sustainable technology using chestnut wood staves and micro-oxygenation

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INTRODUCTION

In the beverages, the antioxidant activity is mainly correlated with phenolic composition. The AA of phenolics is linked to their protective effects, since they are responsible for the body's defensive mechanisms against pathologies associated with the attack of free radicals ('oxidative stress'). Thus, daily intake of phenolics is involved in the prevention of chronic diseases[1].

OBJETIVES

This study aimed to investigate, for the first time, the influence of the storage in bottle on the evolution of antioxidant activities, TPI, and LMW compounds contents of the wine spirit (WS)s aged for 12 months through four ageing modalities (three micro-oxygenation levels and control) with chestnut wood staves, and to examine the correlation of these characteristics as well.

OUTCOMES

EXPERIMENTAL DESIGN AND METHODS

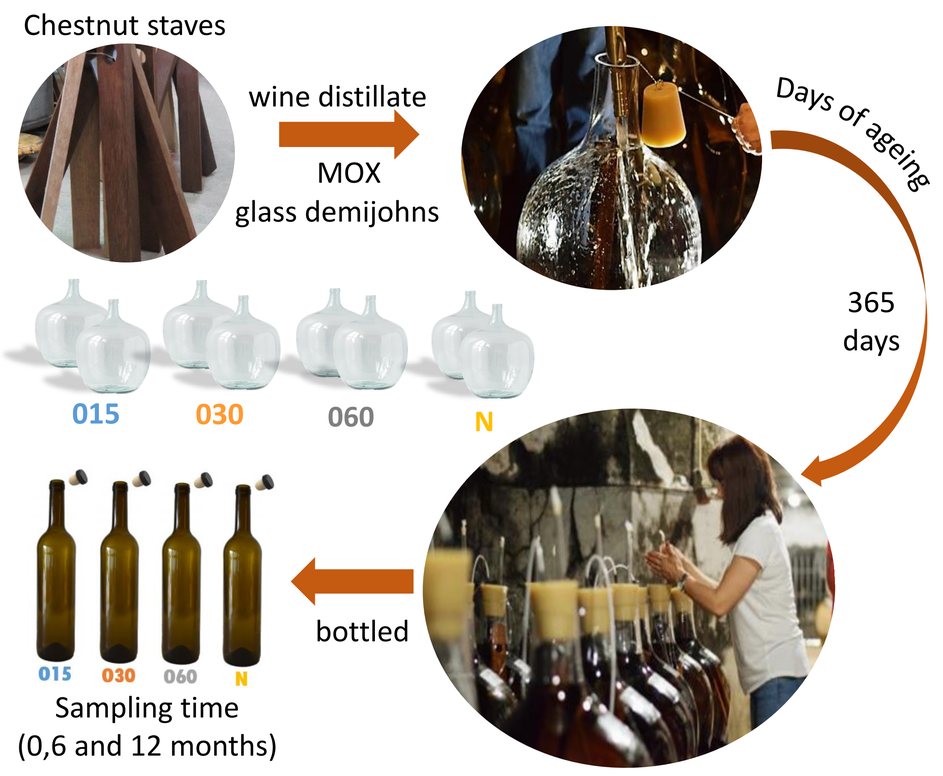


Figure 1. Experimental design and aged WSs sampling.

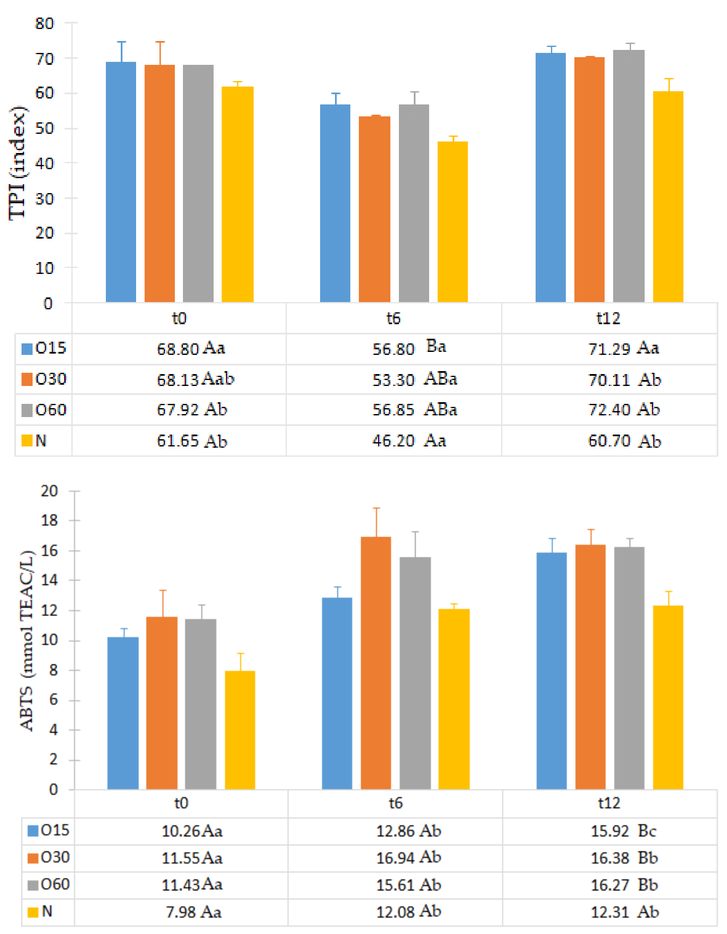
Experimental design: a detailed explanation is provided in https://projects.iniav.pt/oxyrebrand - Oxyrebrand project (POCI-01-0145-FEDER-027819). Wine distillate produced by Adega Cooperativa da Lourinhã (Lourinhã, Portugal), was aged in 50 L demijohns with Portuguese chestnut (*Castanea sativa* Mill.) wood staves, comprising different micro-oxygenation (MOX) modalities (O15, O30 and O60), and one modality with nitrogen application (N, control), in replicates. After 365 days of ageing, the aged WSs of each modality were bottled in amber glass bottles (750 mL).

Low molecular weight (LMW) compounds analysis: phenolic acids [gallic (gall), vanillic (van), ellagic (ellag), ferulic (fer), syringic (syrg) acids]; phenolic aldehydes [(vanillin (vanil), syringaldehyde (syrde), coniferaldehyde (cofde), sinapaldehyde (sipde)]; furanic aldehydes [furfural (furf), 5-hydroxymethylfurfural (HMF), 5-methylfurfural (5Mfurf)] were quantified by HPLC method[2].

Total Phenolic Index (TPI): According to Cetó et al[3].

Antioxidant activities (AA): FRAP (ferric reducing antioxidant power)[4], DPPH (2,2-diphenyl-1-picrylhydrazyl)[5], ABTS (2,2-azinobis(3-ethylbenzothiazoline-6-sulfonic acid), diammoninum salt)[6] were performed using the described methods.

ANTIOXIDANT ACTIVITY AND PHENOLIC CONTENT



TPI (index)	t0	t6	t12
O15	68.80 Aa	56.80 Ba	71.29 Aa
O30	68.13 Aab	53.30 ABa	70.11 Ab
O60	67.92 Ab	56.85 ABa	72.40 Ab
N	61.65 Ab	46.20 Aa	60.70 Ab

DPPH (mmol TEAC/L)	t0	t6	t12
O15	9.80 Aa	15.27 Bb	11.63 Ba
O30	9.48 Aa	11.99 Ab	11.10 Bb
O60	10.71 Aa	12.21 Aa	11.29 Ba
N	9.06 Aa	10.67 Aa	8.84 Aa

ABTS (mmol TEAC/L)	t0	t6	t12
O15	10.26 Aa	12.86 Ab	15.92 Bc
O30	11.55 Aa	16.94 Ab	16.38 Bb
O60	11.43 Aa	15.61 Ab	16.27 Bb
N	7.98 Aa	12.08 Ab	12.31 Ab

FRAP (mmol TEAC/L)	t0	t6	t12
O15	14.95 Aa	16.40 ABa	15.43 Ba
O30	13.25 Aa	16.78 Ba	14.80 ABa
O60	12.67 Aa	16.05 ABb	15.06 ABb
N	11.31 Aa	14.85 Ac	12.38 Ab

Figure 2. Average values of TPI and AA of aged WSs in each storage time according to ageing modalities. Different uppercase letters (A,B) in same column denote significant differences between ageing modalities in each storage time; different lowercase letters (a, b, c) in same row denote differences between storage times for each ageing modality; Tukey´s test (p<0.05).

- **The MOX modalities (O15, O30 and O60) showed higher AA and TPI than the N modality.**
- **Weak influence of storage time on LMW compounds and AA of aged WSs with different MOX were found.**
- **Higher performance of O60 and O15 modalities in terms of AA and TPI.**
- **O30 and N modalities showed differentiation.**
- **ABTS, FRAP, DPPH methods applied to determine the AA of aged WSs are correlated.**

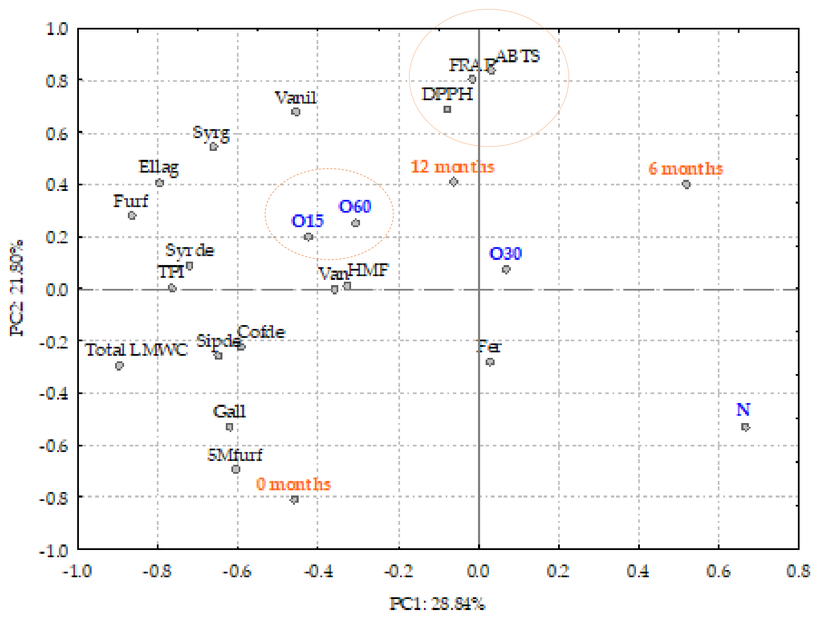


Figure 3. Principal Component Analysis (standardized score).

CONCLUSION

- **The differences in the chemical composition and AA of aged WSs imparted by the ageing process (resulting from different MOX levels) were retained after 12 months of storage in bottle.**
- **The higher results of AA, TPI and LMW compounds contents were obtained for the MOX modalities (O15, O30 and O60), which showed similar evolution.**

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