

ISVV
INSTITUT DES SCIENCES
DE LA VIGNE ET DU VIN
BORDEAUX AQUITAINE

SCIENTIFIC STUDY

Influence of packaging on wine preservation



12 month study
2009 - 2010

ISVV (Institute of Vine and Wine Sciences of Bordeaux)



The ISVV is the largest research and development centre on vine and wine in Europe.

The 10,000m² laboratory draws together over 150 professors who benefit from an exceptional range of technical resources including state-of-the-art equipment and the largest tasting room in the world.

UMR OF OENOLOGY

More than 82 researchers devoted to:

1. Sensorial analysis
2. Phenolic compounds
3. Wine chemistry
4. Winemaking process



1. Objectives
2. Packaging
3. Analysis



OBJECTIVES

To compare the organoleptic qualities of wine in current packaging types over a two year period.

- Packaging types:
 - Glass bottle
 - Mono PET bottle
 - Multi PET bottle
 - Bag-in-box® (BIB)
- Various sizes: 75 cL/ 18.7 cL / 3 L
- Two different wines: red and white Bordeaux

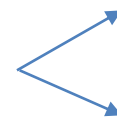
PACKAGING TYPES

1. Glass bottles

2. Monolayer PET bottles

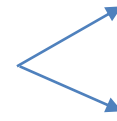
3. Multilayer PET bottles

4. Bag-in-box®



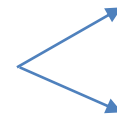
75 cL

18.7 cL



75 cL

18.7 cL



75 cL

18.7 cL



3 L



Screw caps
(30H60 and 22H40)

ANALYSIS

Sensorial analysis run by 25 tasters dedicated to wine oxidation and reduction phenomenon

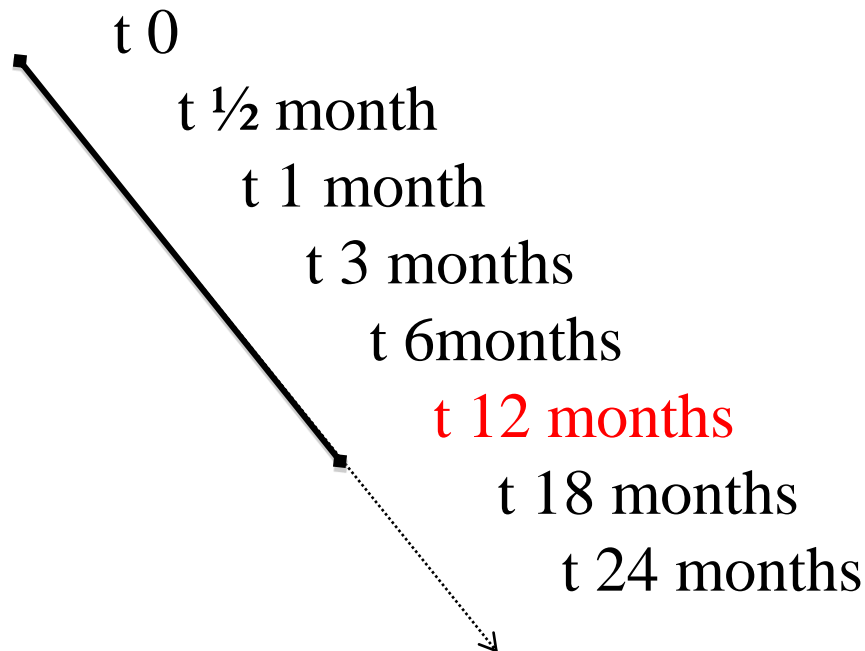


Triangular tests and tastings carried out by a professional jury were scheduled every 6 months

ANALYSIS

All analysis is done in triplicate

All analysis is run over a two year period



ANALYSIS

All analysis is carried out in the ISVV laboratory.

The results are not influenced by temperature variations or transport conditions as they would be in standard storage situations.

Preservation times are observed from the date of filling rather than when the product would have been launched on the market.

It is necessary to highlight both factors because they make a difference to the overall results.

MODALITIES



Glass
75cl & 18.7cl



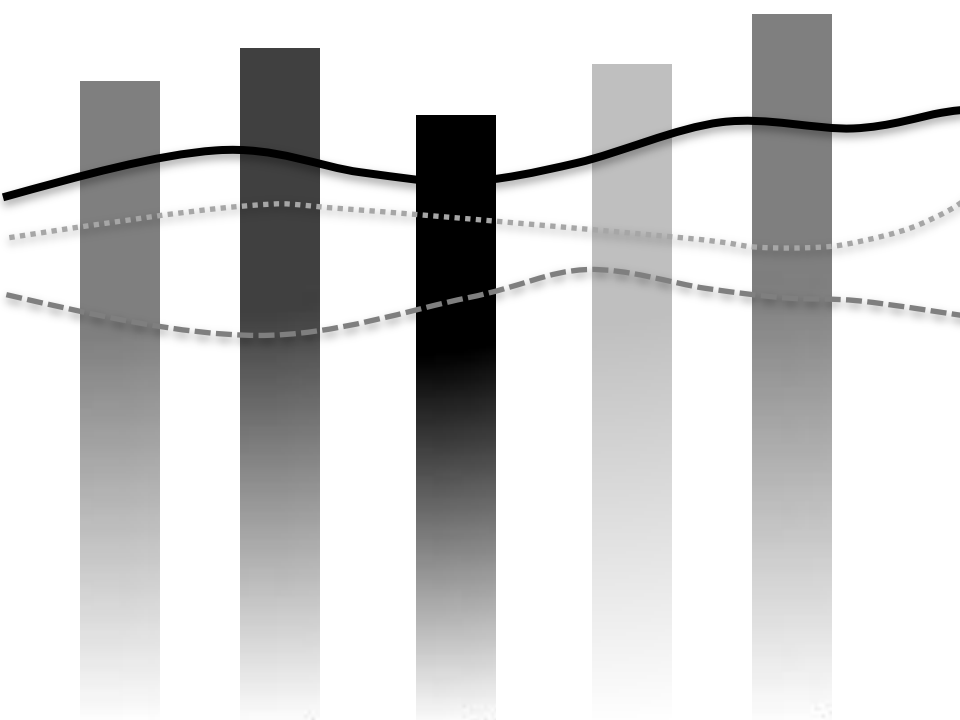
PET mono
75cl & 18.7cl



PET multi
75cl & 18.7 cl



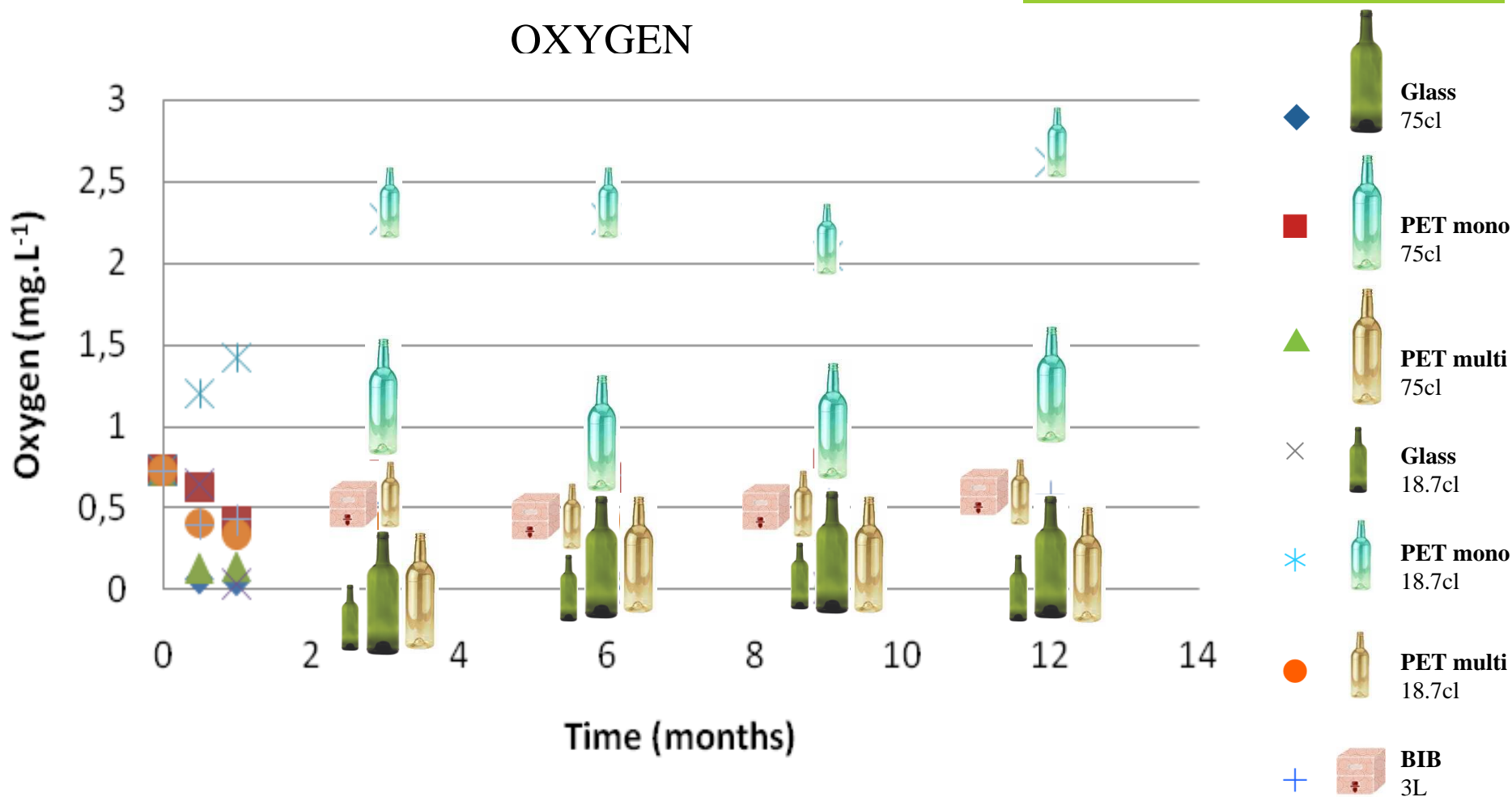
Bag-in-box®
3L



Physical analysis of gas

WHITE WINE | O₂ OXYGEN

EVOLUTION



White wine's properties do not naturally consume oxygen. The analysis clearly shows that bag-in-box®, PET mono and PET multi bottles all oxidise the wine to varying levels, already after 6 months.

WHITE WINE | O₂ OXYGEN

12 MONTHS
RESULTS



| Glass 75 | Glass 18.7 | PET mono 75 | PET mono 18.7 | PET multi 75 | PET multi 18.7 | BIB |
|-------------|---------------|----------------|------------------|-----------------|-------------------|------|
| 0,01 | 0,01 | 0,97 | 2,62 | 0,09 | 0,40 | 0,58 |

mg.L⁻¹

O₂ levels significantly increased in bag-in-box®, PET mono and PET multi bottles 18.7 cL.

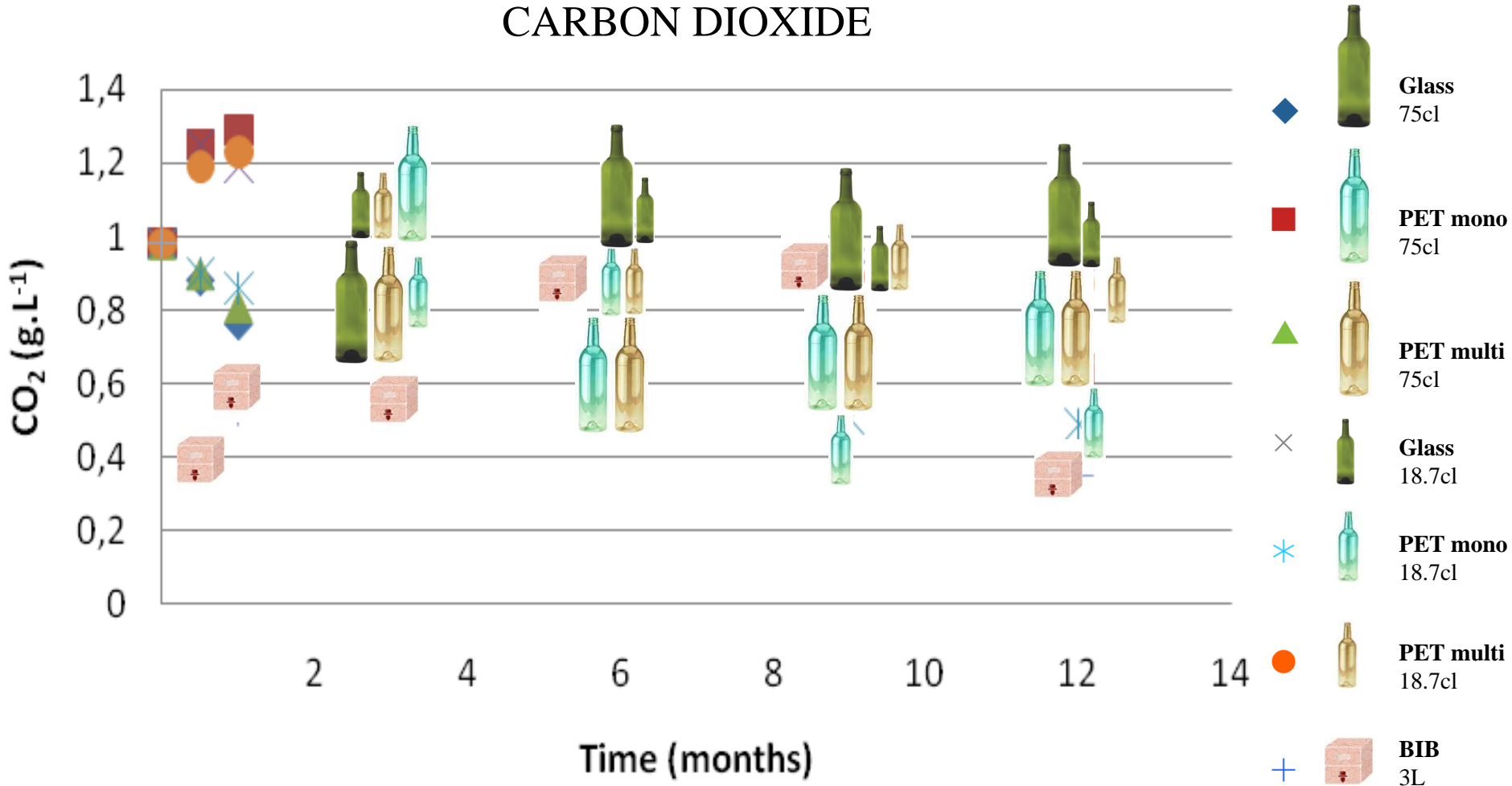
Wine's organoleptic properties can be significantly affected when oxygen levels reach 0.5 mg.L⁻¹ and over.

WHITE WINE

CO₂

CARBON DIOXIDE

EVOLUTION



CO₂ strongly decreases in bag-in-box, PET mono and PET multi.
When CO₂ decreases, it is replaced by O₂.

WHITE WINE

CO₂ CARBON DIOXIDE

12 MONTHS RESULTS



| Glass 75 | Glass 18.7 | PET mono 75 | PET mono 18.7 | PET multi 75 | PET multi 18.7 | BIB |
|-------------|---------------|----------------|------------------|-----------------|-------------------|------|
| 0,97 | 0,95 | 0,64 | 0,49 | 0,7 | 0,87 | 0,35 |

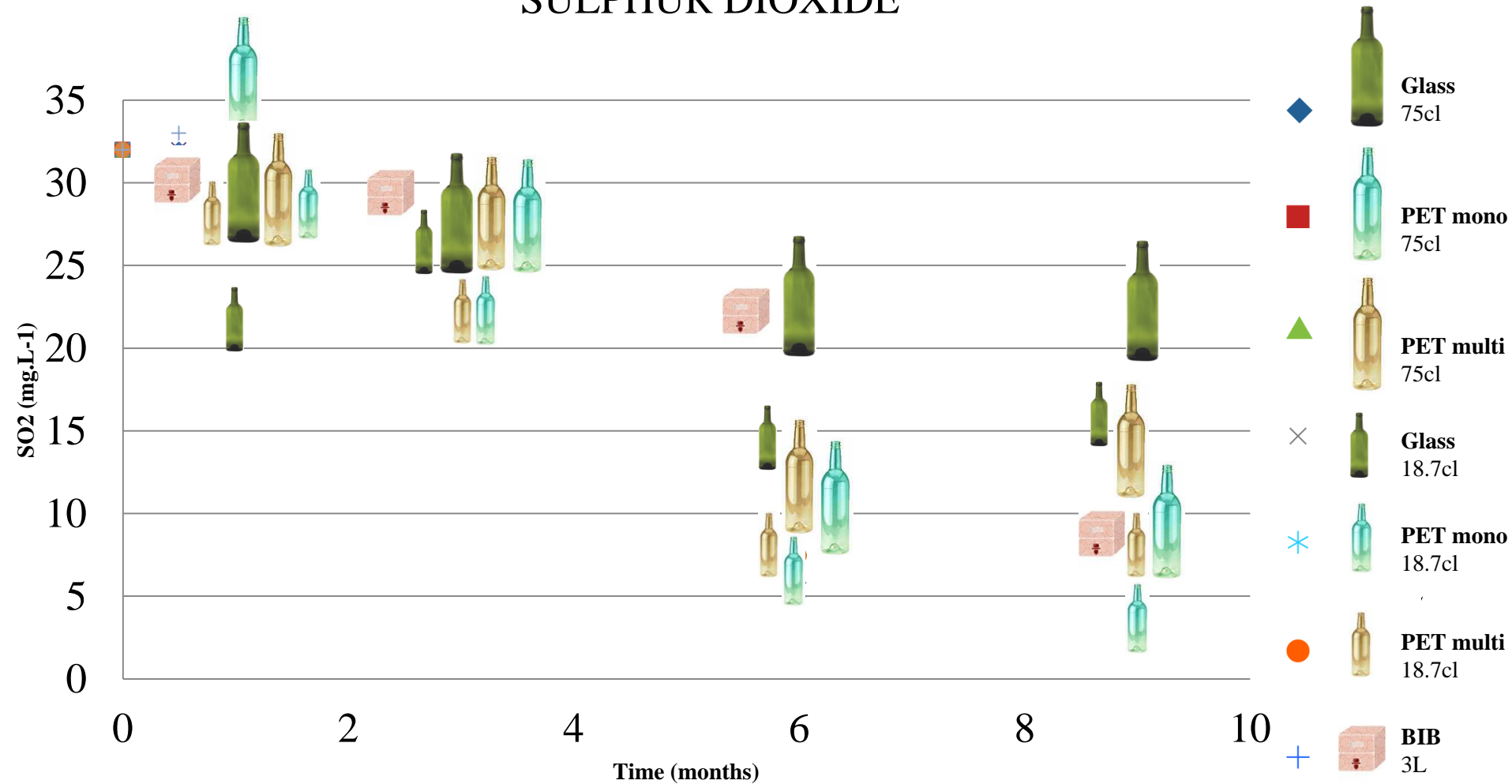
g.L⁻¹

The decreasing levels of CO₂ leads to an important increase of oxygen followed by oxidation in PET mono, PET multi and bag-in-box®. Wine remains stable in the bottles of glass.

WHITE WINE | SO₂

SULPHUR DIOXIDE

EVOLUTION



SO₂ has antiseptic and antioxidant properties. Its reduction leads to a microbiological risk, which can be seen here.

WHITE WINE



SULPHUR DIOXIDE

12 MONTHS
RESULTS



| Glass 75 | Glass 18.7 | PET mono 75 | PET mono 18.7 | PET multi 75 | PET multi 18.7 | BIB |
|-------------|---------------|----------------|------------------|-----------------|-------------------|-----|
| 21 | 11 | 5 | 3 | 10 | 6 | 8 |

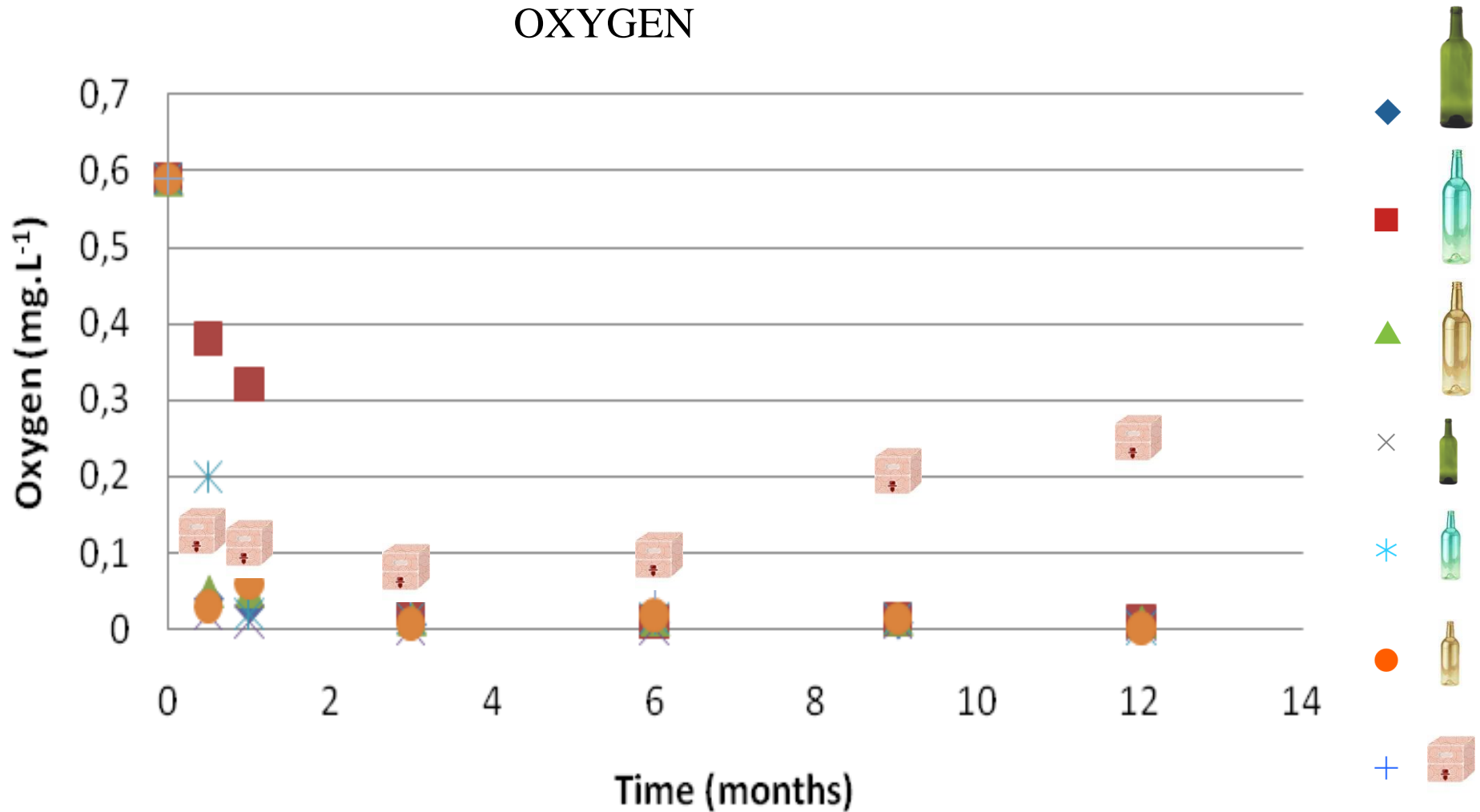
mg.L⁻¹

Bag-in-box, PET mono and PET multi bottles 18.7 cL show significant decreases in SO_2 , with figures under a 5-10 mg.L⁻¹ level that threaten stabilization. Only the 75 cL glass bottle safely preserves the wine.

RED WINE

O_2
OXYGEN

EVOLUTION



Except for bag-in-box®, oxygen decreases at a normal rate because it is consumed by the wine's phenolic components.

RED WINE

O_2
OXYGEN

12 MONTHS
RESULTS



| | | | | | | |
|-------------|---------------|----------------|------------------|-----------------|-------------------|-------------|
| Glass 75 | Glass 18.7 | PET mono 75 | PET mono 18.7 | PET multi 75 | PET multi 18.7 | BIB |
| 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,23 |

mg.L⁻¹

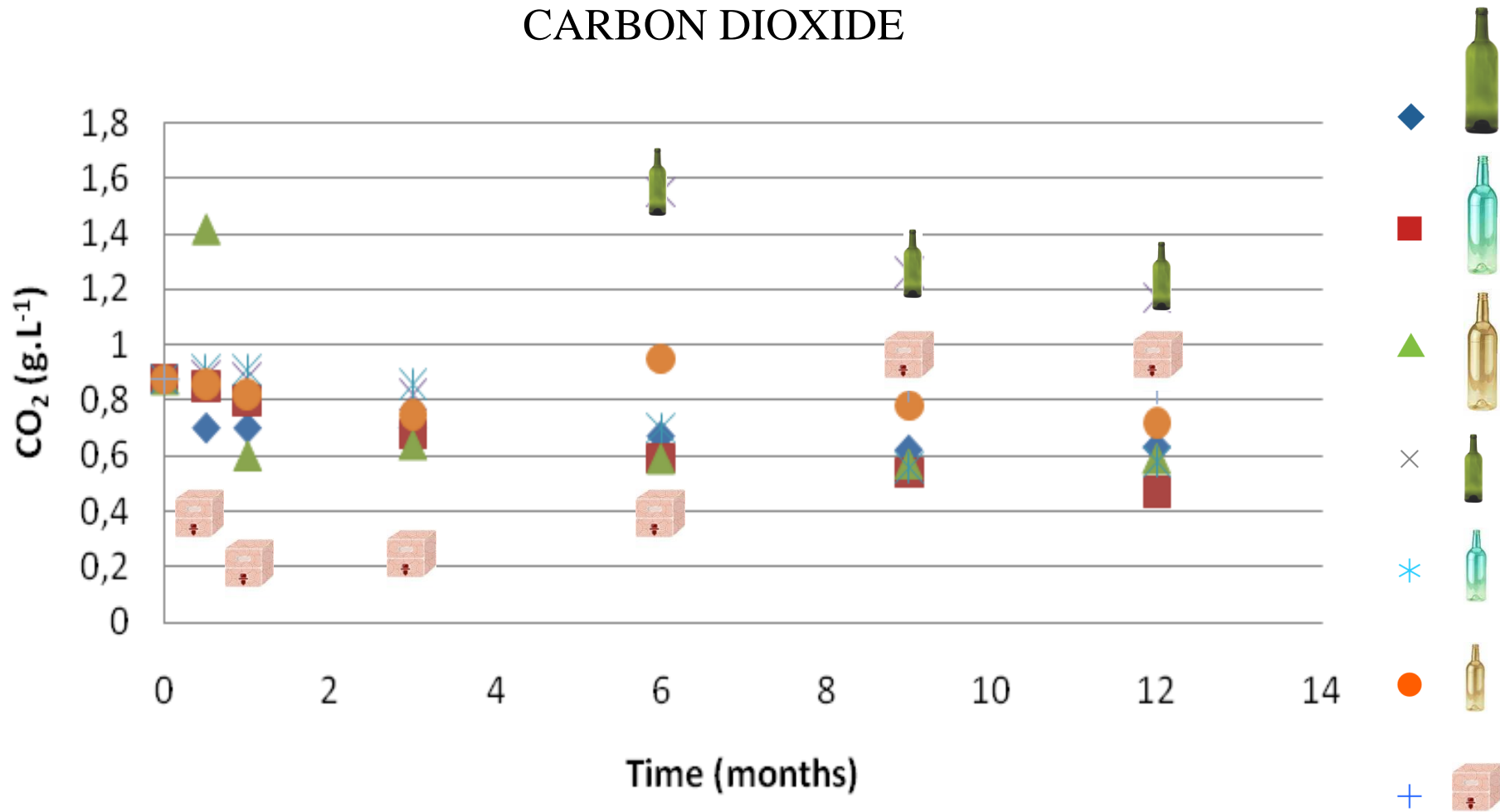
Only the oxygen contained in bag-in-box increases significantly.
There is an abnormal transfer of oxygen inside the bag-in-box®
container.

RED WINE

CO₂

CARBON DIOXIDE

EVOLUTION



The CO₂ level should be stable. Its reduction means there is a leak and gas is transferred. Leading to a large quantity of oxygen and subsequently wine oxidation.

RED WINE



CARBON DIOXIDE

12 MONTHS
RESULTS



| Glass 75 | Glass 18.7 | PET mono 75 | PET mono 18.7 | PET multi 75 | PET multi 18.7 | BIB |
|-------------|---------------|----------------|------------------|-----------------|-------------------|------|
| 0,63 | 1,17 | 0,47 | 0,58 | 0,59 | 0,72 | 0,84 |

g.L⁻¹

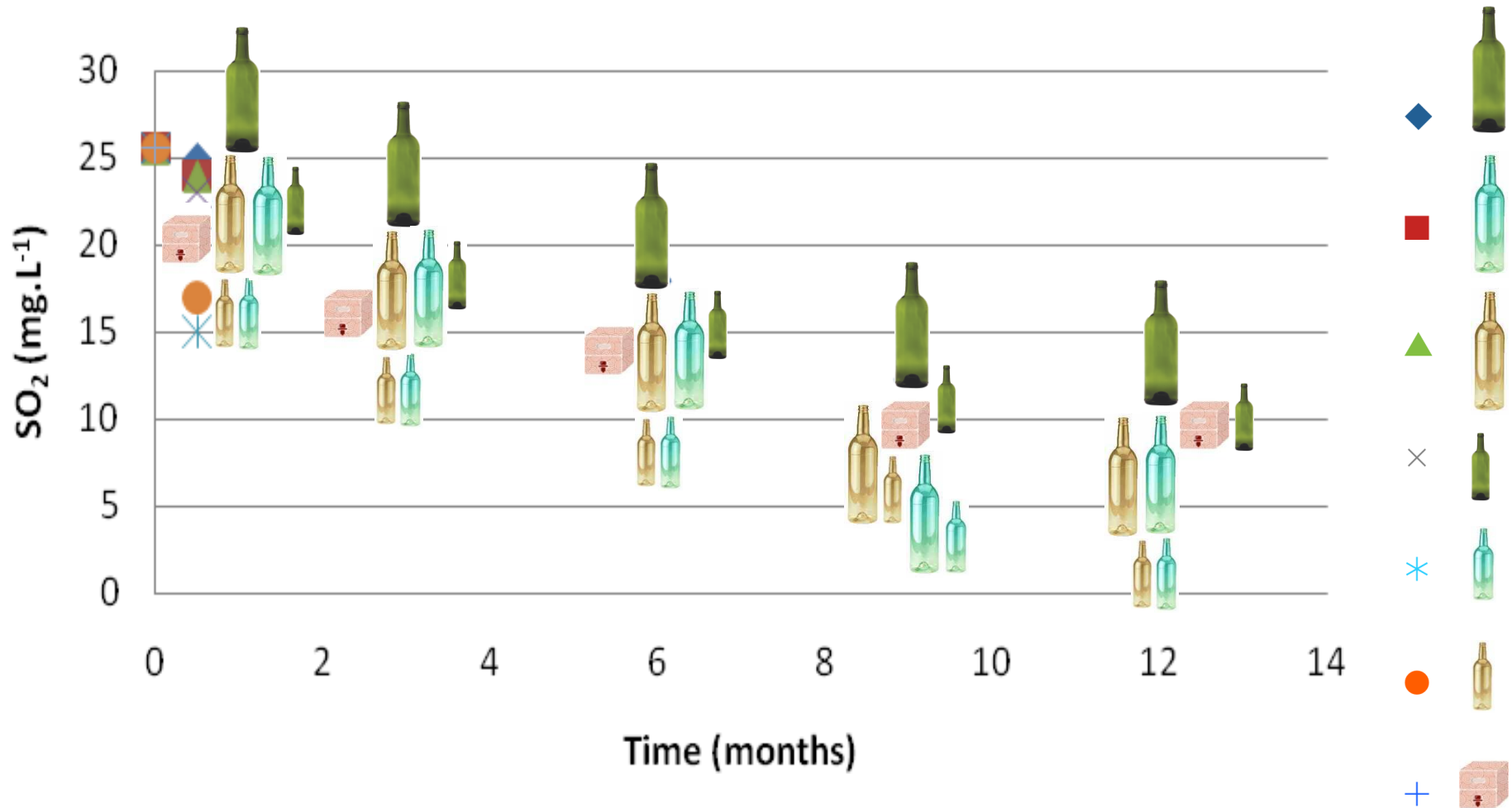
CO₂ losses are not significant enough to draw valid conclusions on all packaging types. Bag-in-box is more permeable considering its larger capacity.

RED WINE



SULPHUR DIOXIDE

EVOLUTION



SO₂ has antiseptic and antioxidant properties. Its reduction leads to a microbiological risk, which can be seen here.

RED WINE



SULPHUR DIOXIDE

12 MONTHS
RESULTS



| Glass | Glass | PET mono | PET mono | PET multi | PET multi | BIB |
|-------|-------|----------|----------|-----------|-----------|-----|
| 75 | 18.7 | 75 | 18.7 | 75 | 18.7 | |
| 12 | 8 | 6 | 2 | 7 | 3 | 9 |

mg.L⁻¹

Values that are under 5-10 mg.L⁻¹ cannot ensure stabilisation. The SO₂ contained in PET mono, PET multi bottles and bag-in-box® is lower than this limit: it shows the wine is beginning to change.

GAS ANALYSIS CONCLUSION

WHITE WINE

Bag-in-box®, mono PET and multi PET significantly modifies the characteristics of the white wines, already after 6 months (oxidation).

Glass preserves the wine characteristics without any degradation.

RED WINE

Several parameters can be observed from a container to another but the figures are not yet conclusive.

The study must continue for a few months to ensure accurate results.



Physical analysis of colours

White wine shades



WHITE WINE | INTENSITY

RESULTS
12 MONTHS



| | | | | | | |
|--------------------|----------------------|-----------------------|-------------------------|------------------------|--------------------------|--------------|
| Glass 75 | Glass 18.7 | PET mono 75 | PET mono 18.7 | PET multi 75 | PET multi 18.7 | BIB |
| 0,097 | 0,102 | 0,129 | 0,154 | 0,107 | 0,120 | 0,103 |



Differences between the shades of yellow are significant between mono PET, multi PET 18.7 cL and the other containers: they show a high level of oxidation.

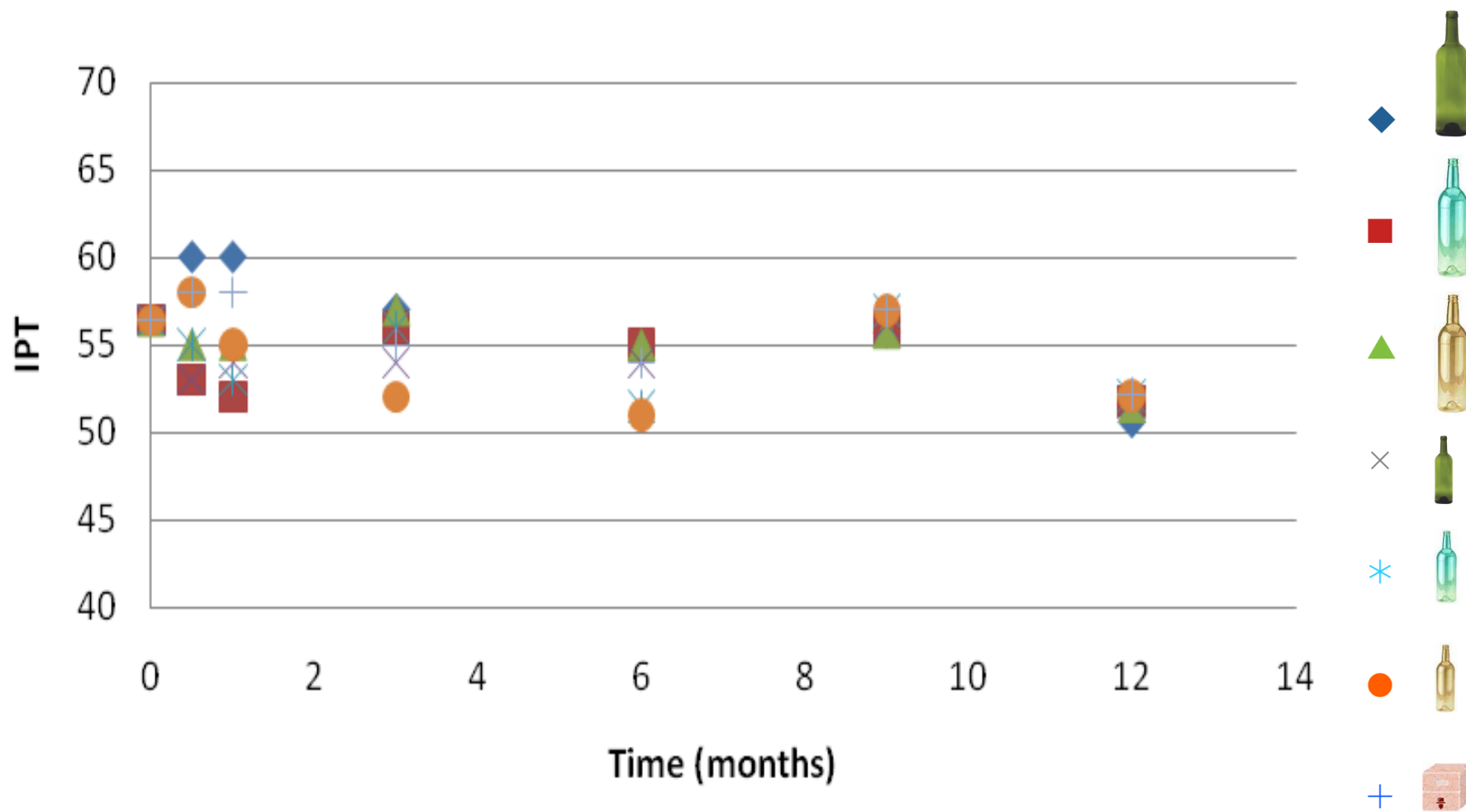
Red wine shades



RED WINE

INTENSITY

EVOLUTION



The follow-up on the Indice Phénolique Total (IPT) shows a very slight variation from one container to another. Further time is needed to test.

RED WINE

INTENSITY

12 MONTHS
RESULTS



| | | | | | | |
|-------------|---------------|----------------|------------------|-----------------|-------------------|-----|
| Glass 75 | Glass 18.7 | PET mono 75 | PET mono 18.7 | PET multi 75 | PET multi 18.7 | BIB |
| 51 | 52 | 52 | 52 | 51 | 52 | 52 |

There is no significant colour difference yet.

COLOUR ANALYSIS CONCLUSION

WHITE WINE

A strong difference in colour can be observed between bag-in-box®, PET mono and PET multi bottles 18.7cL and glass. Glass is the only container that keeps white wine safely and preserves its initial intensity.

RED WINE

Several factors can be observed but the results do not allow significant sensorial conclusions to be drawn.

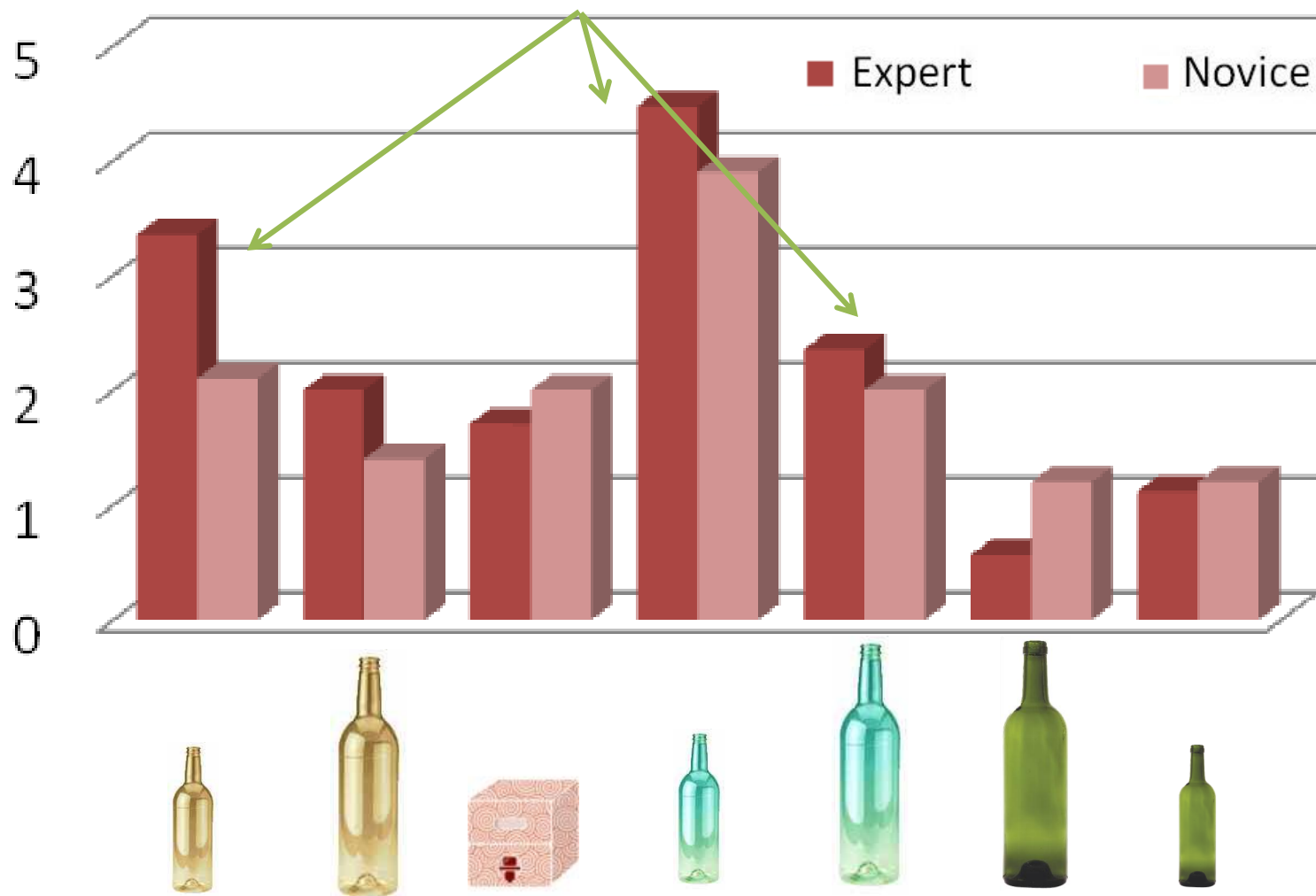
The study must continue for a few months.



Sensory Analysis (Tasting)

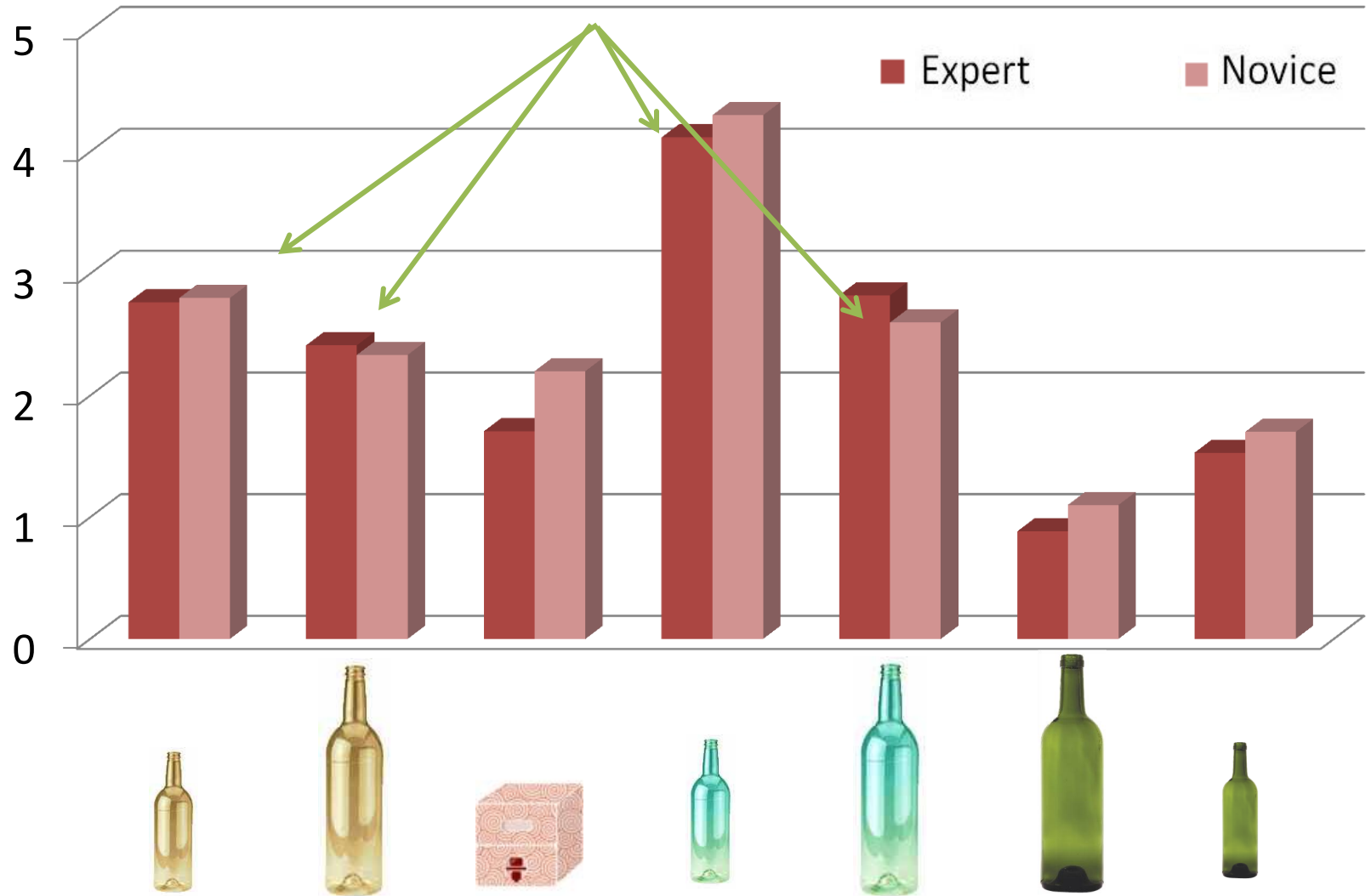
- Sauvignon characteristics
- Oxidation evolution
- Reduction

WHITE WINE | OXIDATION



During tasting PET mono and PET multi bottles 18.7 cL show a clear oxidised structure, with rotten fruit flavour.

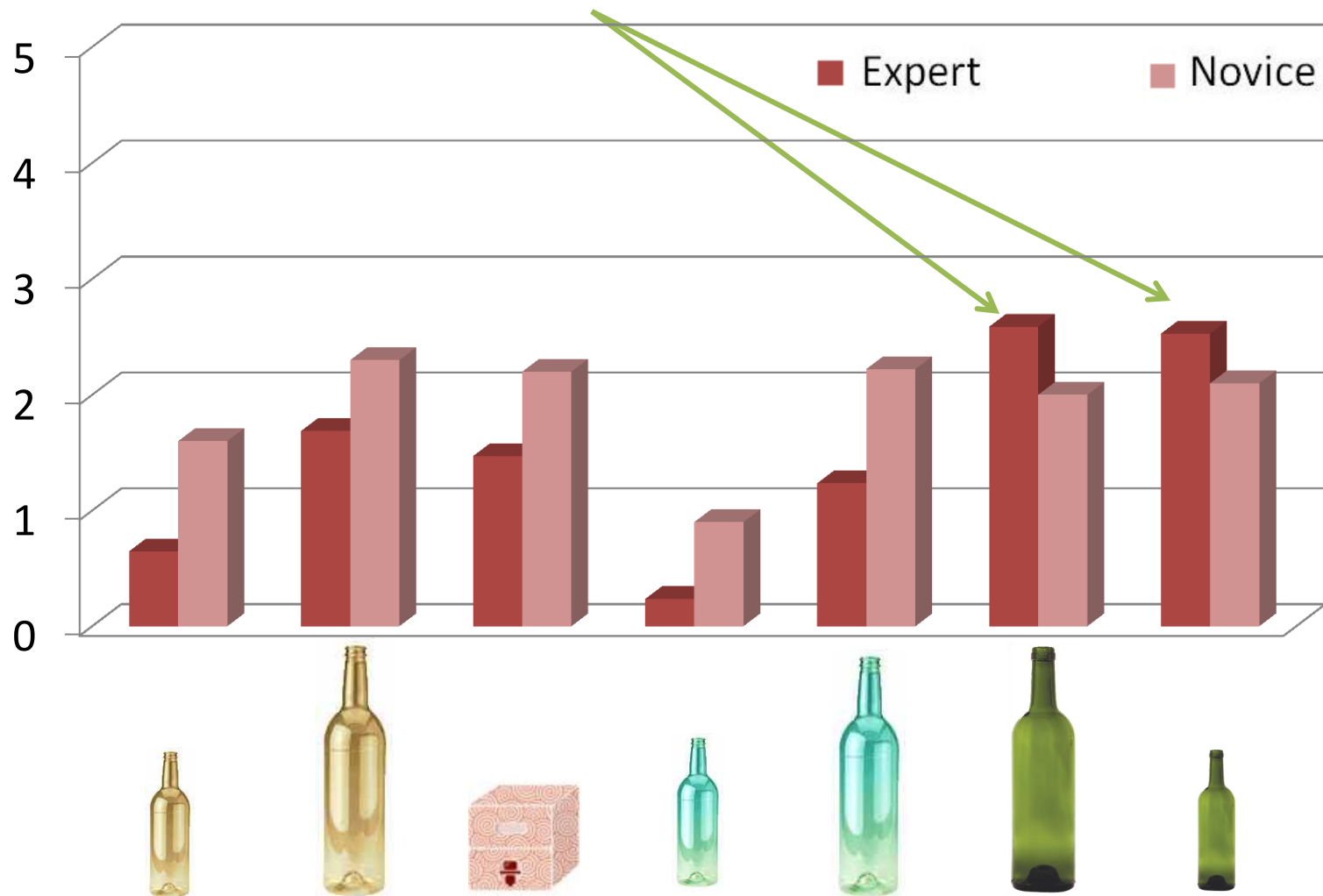
WHITE WINE | INTENSITY



During tasting mono PET and multi PET bottles show an oxidised different colour intensity: from green-yellow, it turns to gold yellow

WHITE WINE

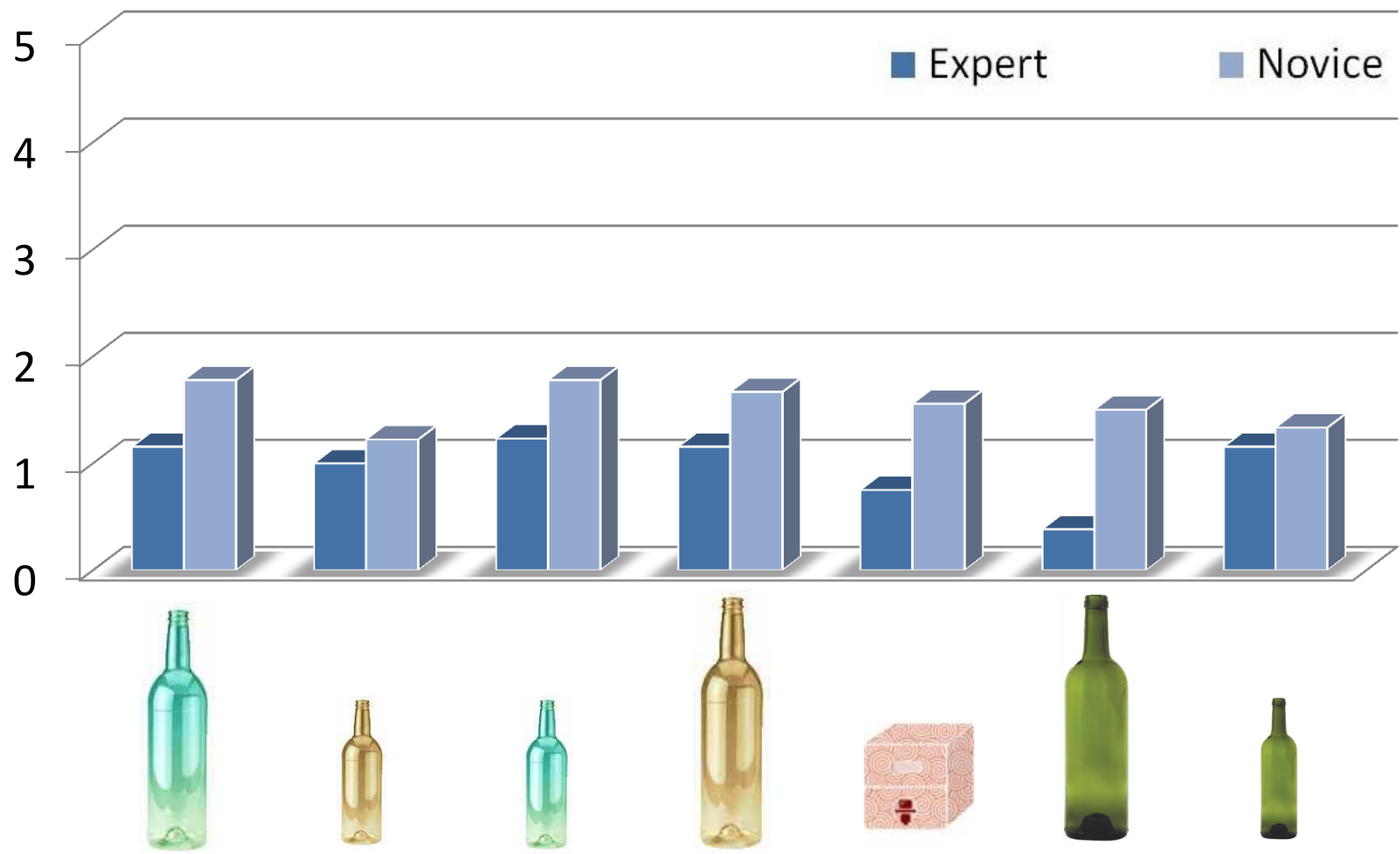
SAUVIGNON CHARACTERISTICS



Glass is the best packaging to maintain Sauvignon's characteristics, whereas PET has spoiled it.

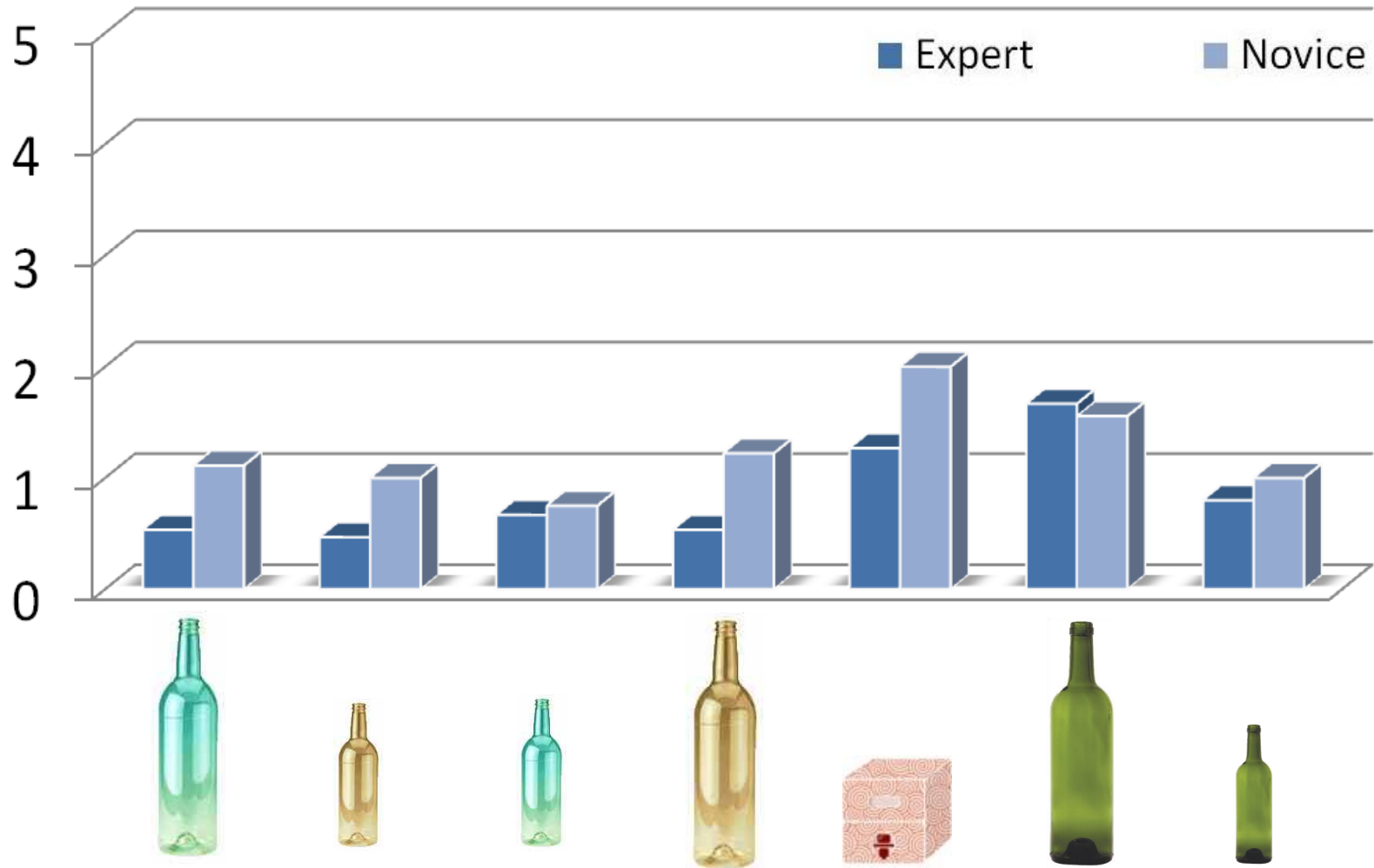


RED WINE | OXIDATION



Differences are not significant enough to draw conclusion

RED WINE | REDUCTION



In glass bottles, red wine flavours reduce: the wine is “shut” and needs to be reoxygenated in a decanter (the nature of the closure is strategic).



Last but not least

SENSORY ANALYSIS CONCLUSION

WHITE WINE

Bag-in-box®, mono PET and PET multi bottles significantly affect white wine's characteristics (oxidation process), even after a short 9 month period. The glass bottle preserves white wine's original characteristics with stability.

After 12 months, white wine is fully oxidised. The panel of professional and standard tasters all agree on its chew fruits flavour.

RED WINE

The results to date begin to show changes but they do not allow significant conclusions to be drawn from an olfactory point of view. The study must continue for a few months.