



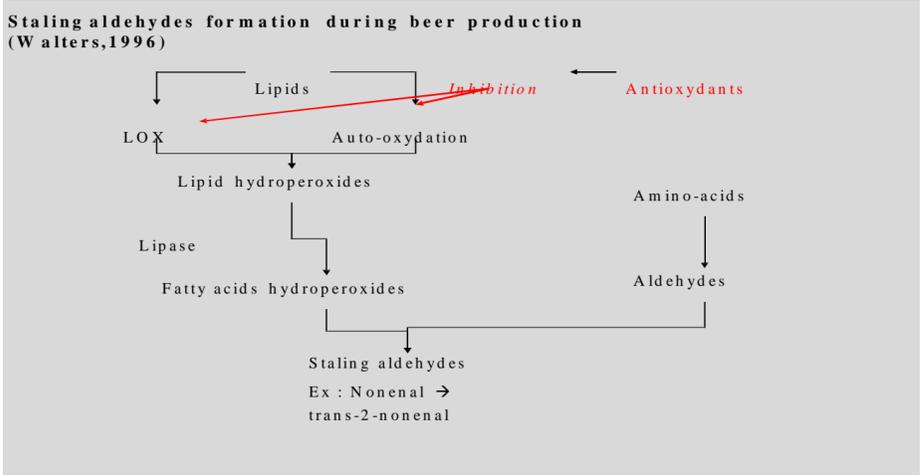
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### INTRODUCTION

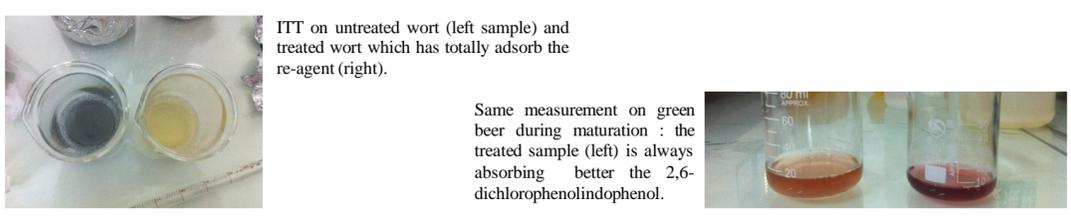
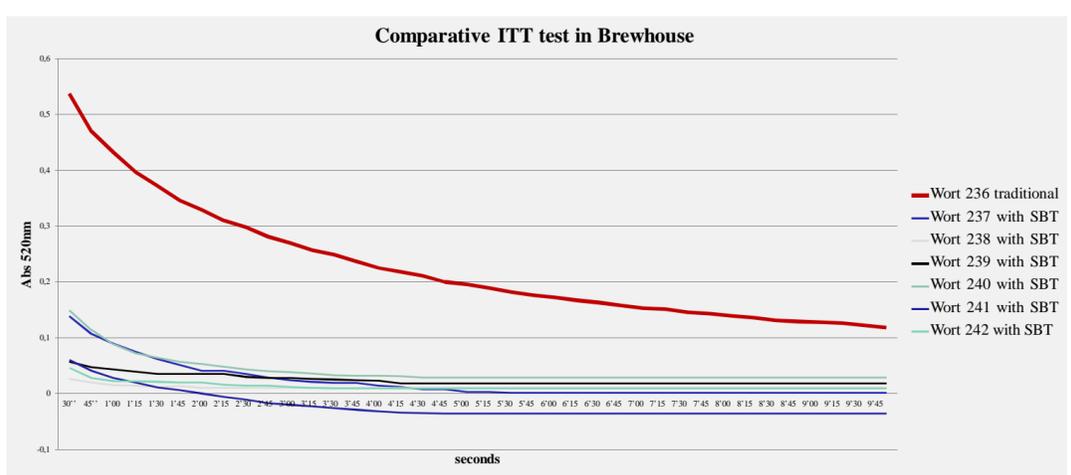
In order to optimize the organoleptic characteristics and ageing of beer, a treatment composed of tannins and classical antioxidants in the brewhouse has been studied, to inhibit the LOX activities and other oxidative function active in the wort, through the analysis of several lager and specialty beers in European and African breweries.  
 The major problems due to oxidative conditions in the brewhouse are the presence of lipoxygenase and the coloration of the wort or the melanoidines oxidized; in the final product, an auto-oxidation of the lipids, with a deviation of the ageing and the flavour stability, accentuated by catalyst such as heavy metals (Fe<sup>2+</sup>, Cu<sup>2+</sup>), high pH or inefficient polyphenols extraction.  
 Through the addition of an antioxidant - **Antioxin® SBT** from the mash tun between 5 and 10g/hL of wort, the improvement of beer freshness has been industrially demonstrated.



### Indicator Test Time (ITT), material and methods



Using 2,6-dichlorophenolindophenol, it is possible to analyze the redox potential of hot and cold wort, green beer or final beer. When Antioxin® SBT has been used, the DCPIP reacts faster during analysis, demonstrating a positive action during physical and mechanical action during brewing process and showing a better Redox level of the wort produced. Such result has been observed on the latest modern equipment, also more expressive while using unmalted cereals (maize, rice, barley) or imported malt.



### Treatment from the mash tun to improve freshness of the final beer

Adding antioxidant from mashing brings a number of advantages :

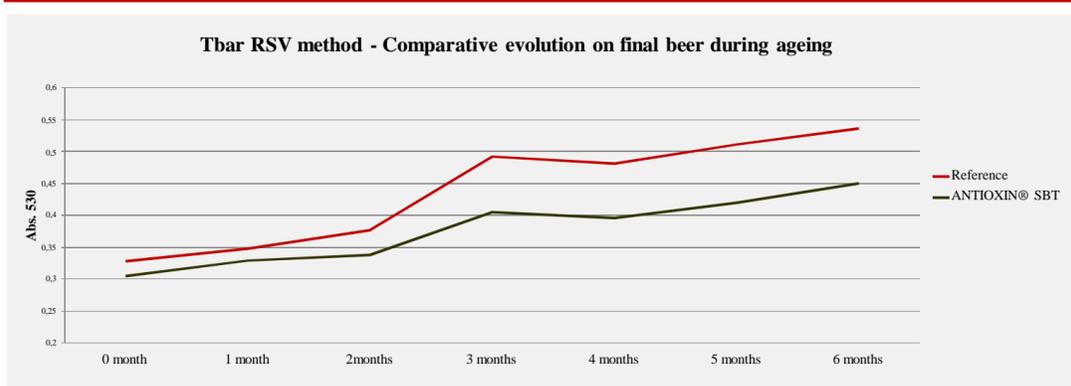
- The antioxidant inhibits the LOX, which will bring a crucial benefit on the final beer;
- The impact on color is usually important, decreasing a lot in case of treatment, demonstrating the action on oxidation in the brewhouse;
- The brewing process permits an elimination of the auxiliaries, by evaporation during boiling or by sedimentation in the whirlpool : there is no more trace of Antioxin® SBT when fermentation starts. The yeast development is therefore identical than with a traditional brew;
- In case of lauter tun, it is possible to register an improvement of wort filtration, up to ½ hour;
- It has been analyzed that traditional antioxidant evaporate when wort is above 75 ° C. Tannins (Ellagic and Gallic) remain in the wort until they precipitate in the trub, highly reacting with high molecular weight protein.

Wort follow up before transfer to fermentation (winter malt - 2012)	Brew nb.	pH	Colour	Average colour
Untreated wort	233	5,11	36,28	38,38 EBC
	234	5,13	38,55	
	235	5,09	38,86	
	236	5,10	39,83	
Wort treated with Antioxin® SBT	237	5,11	30,54	28,15 EBC
	238	5,09	22,54	
	239	5,10	26,44	
	240	5,12	33,11	

It has been demonstrated through analytical test and triangular taste that the presence of oxygen in final beer has no more impact on shelf life, the interaction between lipids and aldehydes has been imitated with the presence of antioxidant in the brewhouse.  
 Analyses from the University of Louvain la Neuve (Belgium) have shown that the use of Antioxin® SBT does not affect the other enzymatic function of the wort (certif. 2007, Unité de Brasserie UCL).

Analysis	Final beer after bottling		Final beer after Forcing test		
	Trad.	Antioxin® SBT	Trad.	Antioxin® SBT	
pH	4,26	4,22	4,21	4,19	T 20°C
Turbidity	0,41	0,41	1,45	1,31	90°EBC
Colour	9,19	9,20	12,40	9,25	EBC
ITT	112	30	251	109	Sec.
Sulphite	3,8	3,9	3,6	3,6	ppm
Oxygen	40	41	40	40	ppb
Polyphenols (flavonoids)	113 (26)	115 (27)	118 (25)	115 (27)	ppm
Bitterness	19	19	18	19	BU

### Analysis of final beer



Compounds	Traditional (ppb)	Antioxin® SBT (ppb)	% Change
Trans-2-nonenal	0,120	0,085	-29%
2-methylbutanal	2,9	2,9	0%
3-methylbutanal	7,2	6,1	-15%
Methional	7,6	3,0	-59%
Benzaldehyde	4,2	2,4	-43%
Phenylacetaldehyde	14,5	12,0	-17%
2-methylpropanal	8,3	6,9	-17%



Result of Head Space analysis specifically designed to measure aldehydes.  
 Each comparative trial is always operated from the same lot of raw materials, using always the same yeast generation. Triangular tasting has systematically shown a better freshness for the treated beer. This is more relevant in countries with high temperature range. Addition of antioxidant from mashing has permitted to decrease or eliminate the use of antioxidant during bottling, therefore the total sulphites measured in final beer come exclusively from fermentation and remains below 10ppm.

### CONCLUSION

Addition of antioxidant from mashing guaranties a better protection and a reproducible quality of beer flavour stability, whatever the type of equipment within the brewery and the type of malt or unmalted cereals:

1. Antioxin® SBT acts on oxygenases and sensible precursors, materialized by a very high reduction of 2,6-DCPIP (ITT);
2. Colour of wort is reduced and its filterability has been improved up to ½ hour in lauter tun;
3. Major off-flavours have been reduced by 30% in average, allowing to bring (E)-2-nonenal under the perception threshold;
4. All the component of antioxidant, after acting during brewing, evaporate before boiling or settle in the whirlpool, without affecting the main enzymatic function of the wort, consequently allowing a standard fermentation and maturation of beer;
5. Triangular tasting has confirmed a better freshness for treated beer, after forcing test as well as after natural ageing up to 1 year. Flavour, colour and foam stability have been systematically improved;
6. It has been demonstrated that the addition of antioxidant during mashing, as well as GSH from selected strain F-GSH during propagation, represent a positive alternative for brewers.

### REFERENCES

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