

AUTOLYSIS

(Is it really bad...?)

Q: What is autolysis?

A: It is simply the breakdown of all or part of a cell or tissue by self-produced enzymes - cell disintegration. The process of self-digestion by a cell through the action of enzymes originating within the same cell is known as autophagy.

From Reference 1:

As soon as the alcoholic fermentation is complete, the viability of yeasts decreases dramatically and they begin to autolyse. Yeast autolysis is a very complex and slow phenomenon which involves hydrolytic enzymes such as proteases, nucleases, lipases and glycanases. Under the action of these endogenous hydrolases, yeast cytoplasmic (peptides, amino acids, nucleotides, fatty acids,...) and wall (mannoproteins) components are released into the wine.

This change in composition is associated with an organoleptic improvement of wine which manifests as better mouth feel, depth and a more complex aroma. Wines aged on the lees also give improved technological characteristics, since their stability for both protein haze and tartrate crystal formation is improved by the presence of specific mannoprotein fractions.

The improvement of wine due to spontaneous autolysis occurs very slowly during ageing on the lees, traditionally performed in oak barrels with a weekly "batonnage" of lees. The release of mannoproteins is generally followed as a marker for spontaneous autolysis during the ageing: in traditional process, less than 50 mg/l of mannoproteins are solubilised within 10 months [chart shows this process is fairly linear]. The slow and limited character of autolysis has been confirmed by scanning electron microscopy of 10 month-old lees whose apparently intact cell ghosts have been observed. These unaltered cell walls form a barrier to the diffusion of other yeast components into the wine and dramatically limit the benefits of ageing. Recent studies have shown that the kinetics of mannoprotein release is independent of the yeast strain.

From Reference 2:

The evolution of amino acids in champagne has been studied over a period of several years from the start of the bottle fermentation to aging for 4 to 5 years in contact with the yeast. After the excretion of amino acids by yeasts at the end of the bottle fermentation, the concentration of amino acids remains stable for several months. Then it begins to rise again, slowly but continuously. This second phase of enrichment with amino acids corresponds to the autolysis of the yeast cells. This phenomenon has also been studied with active dry yeasts after rehydration. It depends on some parameters such as the pH, the ethanol concentration, and the temperature. For Champagne, the age of the yeast sediment also plays a role.

Autolysis proceeds only if the wine is aged for several months in contact with the yeast. Indeed, the yeasts are the seat of intracellular proteolytic activity which causes the degradation of cytoplasmic constituents and the enrichment of the wine in amino acids. Autolysis has truly a great influence on the organoleptic properties of champagne, particularly on its aromatic properties. Investigations are now underway for the production of yeast autolysates in fermenters for the purpose of addition to the wine at the time of the bottle fermentation in order to accelerate the aging process.

So what do we know from all this?

- 1) Autolysis begins as soon as the alcoholic fermentation is complete (albeit quite slowly).
- 2) Yeast autolysis is a very complex and slow phenomenon which involves hydrolytic enzymes.
- 3) Spontaneous autolysis occurs very slowly during ageing on the lees (months).
- 4) Autolysis is not necessarily a bad thing.

References:

- 1) *Aging on The Lees*, Dr Patrice Pellerin - Application Research Manager, DSM, Feb 2004
- 2) *Autolysis of Yeasts in Champagne* (M. Feuillat & C. Charpentier), University of Dijon, Campus Universitaire, 21000 Dijon, France