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BILLAUD C., NICOLAS J., (2001). **The primary oxidoreductases involved in the malting and brewing technological processes**, *Sci. Aliments*, **21**(2), 83-131 **Abstract:**Organoleptic quality of beer during storage can be dramatically altered as a result of chemical. and/or enzymic oxidation. of endogenous polyunsaturated lipids and phenolic compounds originating from brewery barley. Enzymic-mediated oxidative reactions can take place during different stages of the process, viz barley germination, malt kilning and at the beginning of mashing. In this respect, the action of oxidoreductases can lead to flavor deterioration resulting in the development of staling and off-flavours, occurrence of haze, modification of bitterness and astringency, as well as a modification of the color of the processed product. This review is undertaken to get a better knowledge on the relative importance of five oxidoreductases in beer deterioration. As a matter of fact, superoxide dismutase is one of the most important antioxidative enzymes which protects the medium from superoxide radicals by catalyzing the dismutation of O^{-2} into molecular oxygen and H_2O_2. The action of this oxidoreductase can next be relayed by catalase. This latter, by speeding up the dismutation of H_2O_2, a reactive oxygen species, may constitute an in situ primary antioxidant system. Polyphenoloxidase and peroxidase are able to catalyze the O_2 or H_2O_2-mediated oxidation. of endogenous polyphenols in reactive quinonic compounds and give rise to secondary oxidations altering the quality of beer. Moreover, peroxidase is also susceptible to realize oxidative crosslinking between proteins and/or soluble pentosans and, consequently, may hinder lautering and filterability of beer. Lastly, lipoxygenase, which catalyzes the oxidation of polyunsaturated free fatty acids, is mostly responsible for the production of volatile aldehydes such as trans 2-nonenal, originating from 9-hydroperoxide, widely suspected of leading to staling of beer. In this respect, the main biochemical. characteristics of oxidoreductases and some of their physico-chemical. properties will be first summarized; thereafter, the effects of these enzymic reactions during the processing, from barley to beer, will be described, with a special attention for the evolution of oxidoreductases activity as well as some possible interventions of these oxidoreductases on organoleptic and rheological properties of mash and beer during the technological process.

BILLAUD C., ADRIAN J. (2001). **Le fenugrec : composition, valeur nutritionnelle et physiologique.** *Sci. Aliments*, **21**(1), 3-26. **Fenugreek: composition, nutritional value and physiological properties.** **Abstract** : In many countries, uses of fenugreek (*Trigonella foenum graecum L.*) are numerous, in culinary preparations as well as in human and veterinary medicine. This annual legume, traditionally cultivated in Europe, Africa and Asia, is a popular food, consumed in various ways. For example, ground seeds which are highly flavoured are used in spice mixtures., mainly in curries; young seedlings and other portions of fresh plant material are eaten as vegetables; powder or flour of the grain is utilized as a supplement in home-baked bread; raw seeds are used to brew a hot beverage, or are eaten boiled in water, roasted after germination for 2-3 days, etc. Moreover, both the fresh green shoots and the seeds of fenugreek are used in cattle feeding. Fenugreek seeds contain high levels of proteins rich in lysine, and lipids (> 5%) constituting an important source of polyunsaturated. (linoleic and linolenic) fatty acids. Carbohydrates representing over 50% of the dry matter are almost devoid of nutritional interest. Storage carbohydrates in the dry seed, mainly galactomannans contained within the endosperm cell walls, exhibit interesting emulsifying properties. Concerning fenugreek as a food source of minerals and vitamins, the seeds contain high amounts of iron and germination of the fenugreek improves its vitamins A, B and C content. 4-hydroxyisoleucine, a peculiar free amino acid extracted. from seeds potentiates an insulinotropic activity through a direct effect on pancreatic B cells in rats and humans. Consumption of the seed also results in a hypocholesterolemic effect due to the presence of steroidal saponins the aglycons sapogenins which can be used for the steroid synthesis. As for others leguminous plants, dormant seed has been reported to contain anti-nutritional factors, more particularly human and bovine trypsin and chymotrypsin inhibitors and trigonelline, which is convertible into niacin during the roasting of grain. Finally, although fenugreek seed does not constitute a basic foodstuff, it is generally recognized as safe for human consumption as a spice or natural seasoning and as a plant extract.

AMEILLE V., CASTELLO P., GARCIA R., RAKOTOZAFY L., POTUS J., NICOLAS J. (2000). Influences de l'ajout de glucose oxidase et de lipase sur l'évolution de la consistance et de la consommation d'oxygène de la pâte de farine de blé tendre au cours du pétrissage. *Sci. Aliments*, **20 (4/5)**, 441-455. **Effects of glucose oxidase or lipase addition on**

dough consistency and oxygen consumption during mixing of unyeasted flour dough. **Abstract** : Addition of glucose oxidase enhances dough oxygen consumption and promotes transient peaks of consistency. The delay of apparition of these peaks is shortened with increasing amounts of glucose oxidase added, with the amount of glucose added and with the peroxidase activity. Conversely, the delay of apparition of these peaks increases with increasing amounts of free ferulic acid added to the flour and when catalase activity is added to the dough. Results are discussed by hypothesizing that the glucose oxidase activity in the dough produces hydrogen peroxide and enhances peroxidase activity. This latter enzyme would catalyze macromolecular crosslinking by phenolic linkages. Addition of exogenous lipase promotes both dough consistency and dough oxygen consumption during mixing. Results are in agreement with the fact that lipase activity in the dough increases the polyunsaturated free fatty acid concentration, enhancing the flour endogenous lipoxygenase activity.

GARCIA R., KAID N., VIGNAUD C., NICOLAS J. (2000). **Purification and some properties of catalase from wheat germ (*Triticum aestivum* L.).** *J. Agric Food Chem.*, **48 (4)**, 1050-1057. **Abstract** : Two isoforms of catalase, CAT-1 and CAT-2, were purified from wheat germ after extraction, $(NH_4)_2SO_4$ precipitations, hydrophobic chromatography, and 2 ion-exchange chromatographys. The global yields and the purification. factors were close to 3% and 50-fold for CAT-1 and close to 6% and 100-fold for CAT-2. Both isoforms exhibited optimum activity at pH 7. When the pH was decreased from 7 to 5.6, CAT-1 showed a decreasing affinity for its substrate, whereas the opposite was found for CAT-2. Both isoforms were irreversibly denatured when exposed to acid pH, with CAT-1 being more sensitive than CAT-2. Conversely, CAT-2 appeared to be more sensitive to inhibitors. The rate as well as the extent of denaturation during incubation with 3-amino-1,2,4-triazole (AT) were higher with CAT-2 than with CAT-1. Guaiacol was a competitive inhibitor more potent with respect to CAT-2. The difference in affinity for H_2O_2 as well as the poor stability of CAT-1 in acidic medium suggests that this isoform could be less effective during dough mixing.

KAID N., POTUS J., NICOLAS J. (2000). **Development of simultaneous determination thiols, ascorbic acid and their oxidized forms using HPLC with electrochemical detection**. *Sci. Aliments*, **20**, 237-252. **Abstract** : A rapid and sensitive high performance liquid chromatography method has been developed for the simultaneous determination of ascorbic acid (AA), glutathione (GSH) and cysteine (CSH) which can be applied to supplemented wheat flour doughs. Electrochemical detection was used and allowed thiol detection without chemical derivatization. The mobile phase was composed of 100 mM ammoniumdihydrogenphosphate, adjusted to pH 2.8 with o-phosphoric acid. The first electrode potential was fixed at 1.05V for thiol detection. The detection limits were 5 and 10 pmoles for CSH and GSH, respectively, and 1 pmole for AA. Oxidized forms can be quantified after reduction with dithiothreitol. The method has been applied to model system to highlight the mixed disulfide GSSC formed during the reaction catalyzed by GSH-dehydroascorbate oxidoreductase in the presence of its substates (GSH and dehydroascorbic acid) and CSH.

AMEILLE V., DAVIDOU S., DRAPRON R., POTUS J., NICOLAS J. (2000). **Mesure en continu de la consommation d'oxygène de la pâte de farine de blé tendre au cours du pétrissage**. *Sci. Aliments*, **20**, 221-236. **Continuous measurement of oxygen consumption during mixing of unyeasted wheat flour dough.** **Abstract:**A mixer-bioreactor has been developed with instrumentation allowing continuous measurement of the torque and of oxygen consumption during kneading of unyeasted wheat flour dough. Oxygen consumption was 1.7 **m**mol**à**g-1 d.m. after 10 min and 3.3 **m**mol**à**g-1 d.m. after 1 h of mixing. Oxidoreductase activities were mainly responsible for this consumption, since it declined markedly following treatment which denatures enzymes. Conversely, oxygen consumption increased when exogenous oxidoreductases were added to the flour. In addition, measurements of polyunsaturated fatty acids in aliquots of dough allowed fatty acid changes to be linked with the amount of oxygen consumed. An oxygen balance can be calculated.. Thus, after 10 min of mixing, half of the oxygen consumed is utilized by the lipoxygenase system, whereas after 1 h, this enzymic activity explains only one third of oxygen consumption.

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