Communications en 2002, partie II

EYOUM A. , CELHAY F. , NÉRON S., EL AMRANI F. , BOUSSARD A., POIFFAIT A., POTUS J. , BARET J-L.et NICOLAS J. (2002),Biochemical factors of importance in the oxygen consumption of unyeasted and yeasted wheat flours during dough mixing,*3rd European symposium on enzymes in grain processing*, 25-27 Septembre , Louvain, communication orale, *Recent Advances in Enzymes in Grain Processing*, Ed. Courtin, C.M., Veraverbeke, W.S., Delcour J.A., (2003), 46, 303-309. Abstract : A mixer-bioreactor has been developed allowing to follow the oxygen consumption during dough mixing. Firstly, the influences of mixing rate (between 50 and 150 rpm) from the one hand and of the amount of added yeast (between 0 and 2 %) on the other hand, have been studied on the oxygen consumption and carbon dioxide production during dough mixing. Secondly, for eight unyeasted doughs obtained from different wheat varieties, the oxygen consumption has been recorded during mixing for 60 min. The obtained curves can be represented by a fourth degree polynomial equation which can be derivated to determine the instant rates of oxygen consumption at different mixing periods. For each flour, the contents of fatty acids in the neutral lipid fractions (tri-, di- and mono-glycerides and free fatty acids), ferulic acid and carotenoid pigments have been determined in the initial flour and in the dough after 60 min of mixing. The extractable activities of lipoxygenase (LOX), peroxidase and catalase have also been determined. For all the flours, more than half of the oxygen consumed during mixing can be ascribed to the oxidation of polyunsaturated fatty acids (PUFA) in the free fatty acid and monoglyceride fractions. The eight wheat varieties can be discriminated using the instant rates of oxygen consumption in the initial, intermediate and final periods of mixing. Statistical analyses showed that instant rates of oxygen consumption can be correlated to the PUFA and the LOX activity. However, the importance of these two factors varied according to the period of mixing. Thus, the PUFA content is more important for the rate in the early step of mixing whereas the LOX activity is more important in the intermediate period of mixing.

AVRAM E., BOUSSARD A., POTUS J. and NICOLAS J. (2002).Oxidation of glutathione by purified wheat and soybean lipoxygenases in the presence of linoleic acid at various pH, *3rd European symposium on enzymes in grain processing*, 25-27 Septembre , Louvain,. Poster. *VTT Symp.*, (2003), 18, 115-120. Abstract : Lipoxygenase (LOX) is the main enzymatic catalyst responsible for the oxygen consumption during the wheat dough mixing. This enzyme catalyzes the incorporation of molecular oxygen into polyunsaturated fatty acid (PUFA) to yield corresponding free radicals and fatty acid hydroperoxides. This reaction is at the origin of carotenoid and thiol cooxidations with important consequences on organoleptic and rheological properties of dough. In model system, we compare the effect of purified wheat LOX and soybean LOX at different pH on the cooxidation of GSH. The decrease of thiols is measured by the Ellman's method and by high performance liquid chromatography (HPLC) coupled with an UV detector at 234 nm. The residual GSH concentration was followed for different reaction times and initial GSH concentrations. The formation of oxidized glutathione (GSSG), hydroperoxides and hydroxy fatty acids was measured by HPLC coupled with an UV detector at 234 nm. The LOX alone was not able to oxidize GSH and the presence of linoleic acid is compulsory to observe the cooxidation of GSH. In our experimental conditions the amount of consumed GSH depends mainly on pH. The cooxidation was almost nihil at pH 6.5. It appears at pH 7.5 and increases when the pH became more basic. In all cases, the GSH oxidation is not complete and GSH is transformed in the glutathione disulfide GSSG. The cooxidation of GSH is accompanied by the reduction of fatty acid hydroperoxides into hydroxy fatty acids which are not formed in the absence of GSH. The amount of formed GSSG is proportional to the amount of hydroxy fatty acids.

BILLAUD C., ROUX E., CORBIN A. AND NICOLAS J.(2002),Inhibitory effect of Maillard reaction products prepared from glucose with L-cysteine on enzymatic browning and activity of polyphenoloxydase from apple and tyrosinase from mushroom, *Polyphenols communications , JIEP 2002 Congress, XXIe International Conference on Polyphenols, September 9-12, 2002, Marrakech-Morocco.*Poster.Abstract : Polyphenoloxidases (PPO) are of primary concern to the vegetable and fruit processor since their catalytic action is connected to undesirable browning, discoloring or darkening, as well as off-flavour generation in stored and processed

plant-derived foods and beverages, generally resulting in a loss of nutritional value. Among the wide range of chemical compounds already proposed to inhibit PPO, sulphites still represent the most powerful antibrowning agents but their utilization is being discontinued owing to their adverse effects on sensitized subjects. Numerous studies have been devoted to "natural" inhibitors of enzymatic browning. Thus, during the Maillard reaction, some compounds formed from model mixtures were suspected to produce enzyme inhibitors, owing to their antioxidant properties. They depend on several mechanisms including their ability to act as reducing agents, scavengers of reactive oxygen species, hydrogen / electron donors and divalent cations chelators. To demonstrate whether Maillard reaction products (MRP) could inhibit enzymatic browning and / or inactivate PPO, L-cysteine, D-glucose, D-fructose aqueous solutions and mixtures (1 M / 1M or 0.8 M / 0.25 M) of hexose / cysteine were each tested on purified PPO from apple and commercial tyrosinase from mushroom activity, using both spectrophotometric and polarographic methods. Inhibition was evaluated as a function of temperature (80-110 °C), time (0-48 hr) of heating, concentration of reactants and nature of the phenolic substrate selected during recording of the enzymatic oxidation rate. High (1-2 M) concentrations of hexoses were needed to develop a slight inhibiting effect on PPO activity. Heating at 90 °C for extended time periods, increased their inhibitory effect. Conversely, MRP showed a very strong inhibiting effect. Inhibition efficiency increased with heating time and increasing concentrations. The extent of inhibitory effect was positively correlated with absorbance measurements of MRP at 350 nm used as indicator of the Maillard reaction development. Moreover, results obtained revealed that both MRP systems were mixed-type inhibitors, glucose / cysteine being the most effective one. In addition to their prevention on colour formation, we found that MRP were also responsible for a direct inactivation of both PPO, in relation with a possible chelation of cupric ions of the active site of the oxidoreductases.

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