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RESEARCHES CONCERNING THE BEHAVIOR FOR THE MAIN REDOX AGENTS FROM COW'S MILK IN ACIDITY CHANGE

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Abstract

The redox agents from cow's milk are more important for milk processing and preserving. The study for the behaviour for main redox agents from cow's milk in acidity change are important for establish the best conditions for keeping the tasting characteristics.

Keywords: *cow's milk, redox agents, behaviour, acidity change*

Introduction

The fresh milk has acidity from 16 to 19°Thorner. The acidity can be increase follow transform the lactose to lactic acid. The increase of acidity for cow's milk can produce different changes for the properties of milk and this milk cannot use in processing.

The study of the redox agent behaviour in the case of acidity change is very important in analyse for consumer milk's risk.

Experimental

For measure the Eh – redox potential and pH, it was used a Multitester C535 with glass electrode and platinum ring tip SP60X. To increase the acidity of milk it used 0.1n lactic acid solution and for decrease the acidity 0.1n NaOH solution was used. The used milk has density of 1.029 g/cm^3 and 3.5% fat.

To eliminate the analytical errors the pure analysis substances: glutathione, riboflavine, and ascorbic acids, L-cysteine, from Merck SA were used. For comparing the obtained results for the raw milk, the function Eh (V) / pH (units) was used

Results and Discussions

If in the raw milk we introduce substances for neutralise the milk acidity (in the case of false of acidity –with Natrium or Calcium Carbonate) can be observed the decrease for the Eh potential with 0.2V and the increase for the pH with 6 units (figure 1).

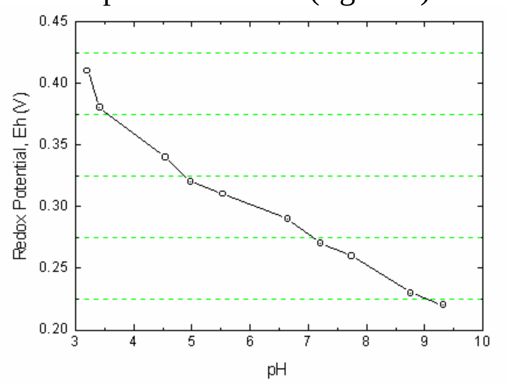
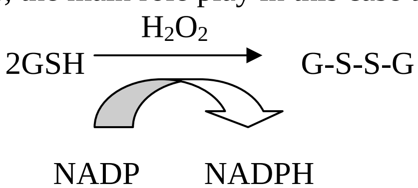


Fig. 1. Correlation between Eh (mV) and pH for raw milk

The pH increase is caused by consume of H^+ ions by added the neutralise substances and decrease for oxidative groups content from milk. Like this curve is the value's curve for Eh potential of glutathione from cows milk as response for the increase the pH (figure 2).

The decrease for Eh is great like as raw milk but less than decrease for milk with L-cysteine Eh. This is follow different Eh = - 0.039V and r_H = 15.4 for glutathione and only Eh = -0.14V and r_H = 9.3 for cystine. The redox system for glutathione are determined by more enzymatic systems, the main role play in this case the glutathione peroxydase:



The reverse reaction is catalysed by glutathione reductase (NADP-controlled); the glutahione are considered a reverse redox system in the cell metabolism and activator for thiolic enzymes.

The glutathione can oxidise the unsaturated fats, can activate the enzymes, can transform the reduced sulpho-proteins in bond proteins, oxidise metilglioxal to lactic acids.

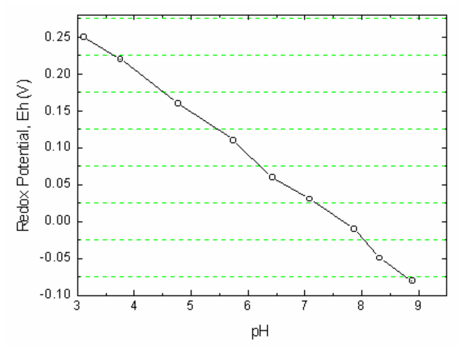


Fig. 2. Correlation between Eh (mV) and pH for glutathione from milk

In presence of glutathione peroxidase (GSHP), glutathione can be oxidised at G-S-S-G (disulfide glutahione) and reduce the hydrogen peroxide to water (without radically mechanism). Cysteine is readily converted to the corresponding disulfide, cystine, under oxidative conditions. Reduction of cystine to cysteine is possible using thiol reagents (e.g. dithiothreitol) (figure 3).

At higher pH values and by processing of cow's milk are possible losses of available lysine, cystine, serine, threonine and some other amino-acids. In the case of cystine, the eliminated thiol-cysteine can form a second dehydroalanine residue (figure 4).

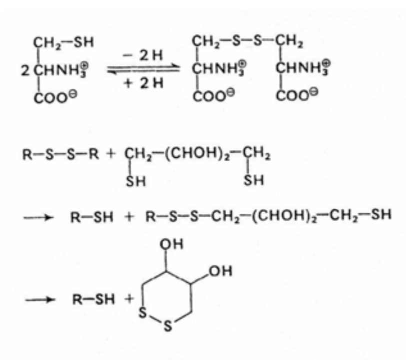


Fig. 3. Oxidation of cysteine to cystine – redox mechanism (Belitz, 1999)

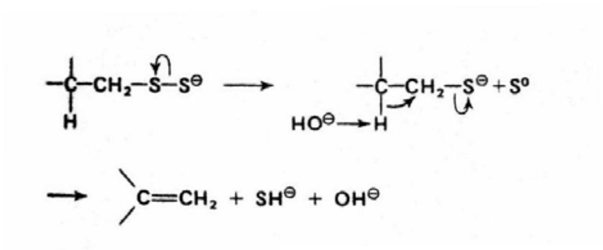


Fig. 4. Elimination of thiol-cysteine from cysteine –chemical mechanism (Belitz, 1999)

The correlation Eh/pH for the cow's milk with L-Caseyne is presented in figure 5.

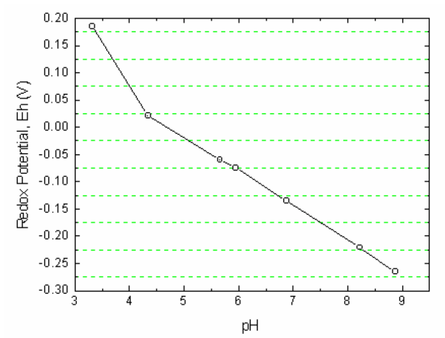


Fig. 5. Correlation between Eh (mV) and pH for Cysteine from milk

Cysteine is more reduced Eh potential than glutathione, and glutathione are strong reduced Eh potential than dehydroascorbic acid (DAsc) and transform the dehydroascorbic acid to ascorbic acid (AAsc). The oxidation of ascorbic acid to dehydroascorbic acid (figure 6) and its further degradation products depends on a number of parameters: oxygen partial pressure, pH-very important here, the presence of heavy metal ions, traces of heavy metal ions Fe^{3+} and Cu^{2+} results in high losses (Ciobanu, 2002).

A decreasing tendency (but in the positive range of Eh) is registered for the Eh/pH curve of ascorbic acid from milk (figure 7).

The rate of C vitamin degradation in airless media, which is substantially lower than that of non-catalysed oxidation is maximal at pH = 4 and minimal at pH = 2.

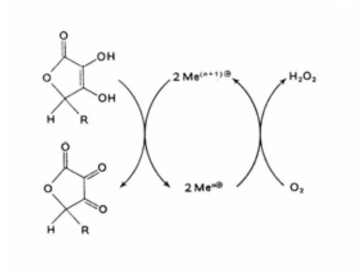


Fig. 6. The principle of metal catalysis –scheme (Belitz, 1999)

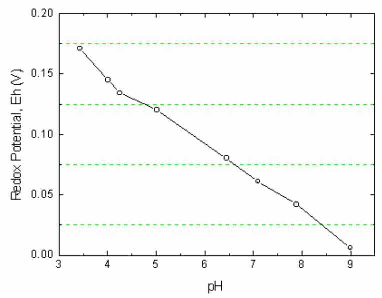


Fig. 7. Correlation between Eh (mV) and pH for ascorbic acid from milk

Riboflavin (7,8-dimetyl-10-ribityl-isoalloxazine) is the building block of flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD) and is implicated in the electronic transfer (dependence Eh – pH in figure 8). Riboflavin is coenzyme for more air media dehydrogenase (like as Xanthine oxidase) and can transfer the electrons to molecular oxygen, produced H_2O_2 and flavoquinone (figure 9).

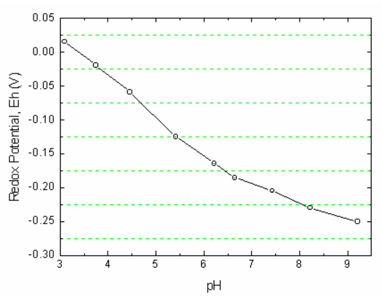


Fig. 8. Correlation between Eh (mV) and pH for riboflavin from milk

Follow he methylene blue added in milk, the media begin the oxidation, the methylene blue is reduced with an point of timed stability at pH = 8.2 (figure 10). The Eh decrease tendencies continue after pH = 8.2 and the methylene blue is reduced to blue colour.

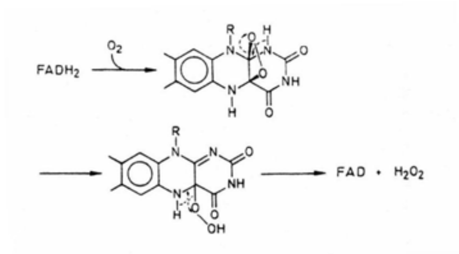


Fig. 9. Flavin enzymes transfer the electrons to molecular –mechanism (Belitz, 1999)

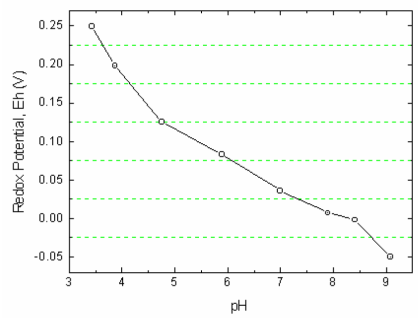


Fig. 10. Correlation between Eh (mV) and pH for metylene blue added in milk

Conclusions

The behaviour for the main redox agent from cow's milk in the acidity media change is most important. Following this behaviour, the milk can be processed in more directions. The redox processes from milk are very important for tasting, physical and chemical properties changes. The control for the redox processes from cow's milk can be a good indicator for food processing technologies.

References

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