HYPOCHLORITE AND PERACETIC ACID INDUCED OXIDATION OF MILK PROTEINS: THE IMPACT OF PH AND OXIDANT CONCENTRATION

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Oxidation of dairy products during processing and storage has a major impact on their nutritional and sensorial quality. Besides, possible toxic components are produced. This consideration is specifically worrying since dairy products are frequently consumed by at risk populations, such as young children. Since proteins are a primary target for oxidation, this study focuses on the oxidative changes of whey and casein proteins. As oxidative agent, the disinfectant hypochlorous acid was chosen since it reacts rapidly with amino acids, peptides and proteins. It is moreover frequently used in the food industry where its use is under discussion because of the formation of harmful chlorinated by-products. Therefore new sanitizers such as peracetic acid are recently evaluated and included in this study in order to compare the molecular changes induced by peracetic acid and hypochlorous acid. Besides the effect of the type of oxidant and oxidant concentration, the impact of pH was thoroughly investigated as well since little is known about the effect of pH on protein modifications.

Milk proteins were oxidized under well-controlled experimental conditions in practically relevant model systems. A whole range of techniques was combined to assess specific oxidative modifications of the milk proteins. Hypochlorous acid proved to be the most potent oxidant, despite the fact that at pH 3.8 it was considerably less active compared to pH 8. This oxidant affected a broad range of amino acids and resulted in a stronger decrease of the total amino acid content in comparison to peracetic acid. The most vulnerable amino acids were cysteine, tryptophane and methionine, followed by tyrosine and histidine. Whereas the amino acid analysis was able to differentiate the differences between both oxidants and pHs, the protein carbonyl content did not result in a clear differentiation between those parameters. Therefore it could be concluded that the carbonyl content was a rather unspecific marker for protein oxidation.

Besides amino acid changes, aggregation and fragmentation was measured by poly-acrylamide gelelectrophoresis. Hypochlorous acid induced oxidation at pH 8 resulted in protein aggregation while at pH 3.8 and during peracetic acid induced oxidation no high molecular weight aggregates were observed. This aggregation seemed moreover to be linked to tryptophan and tyrosine degradation.