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Reduction of sodium in sausages by a colloidal approach

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Popular science summary

There has been a constant increase in consumer demand for low sodium products as a result of the findings from several researches indicating that excessive sodium consumption can cause high blood pressure which is a major risk factor for stroke and cardiovascular diseases. Meat products are one of the major sources of sodium since sodium chloride, or known as table salt, is an essential ingredient that influences their texture, flavour and shelf life. As many important roles in meat products are performed by sodium chloride, developing low sodium meat products without sacrificing the product quality is not straightforward. In most cases, reduction of salt contributes to different quality aberrations of the meat products compared to those with normal salt content. Regarding sausages, salt acts as a taste enhancer and also exert some antimicrobial activity. Moreover, another key function of salt in sausage is to solubilize the muscle proteins in meat and thus aid in their water and fat binding properties which results in a desirable gel texture upon cooking. This study aims to see the possibility to produce emulsion-type sausages, e.g. frankfurters, kochwurst, with reduced salt content by using different meat protein extracts to aid in the formation of gel-emulsion-suspension, which a sausage consist of. “Sarcoplasmic proteins”, which mainly consist of most enzymes, and “myofibrillar proteins”, which essentially comprise of myosin and actin that play a major role in muscle contraction, were extracted from pork. Their aggregation, emulsifying, suspending, and gelling properties were investigated. The aggregation behavior of the proteins was observed by dispersing them in salt (sodium chloride) solutions between the concentration of 0.15 and 0.8 mole/liter at pH 5.5 and 5.8. The emulsifying ability of these proteins, i.e. the capability to facilitate and stabilize the dispersion of oil droplets into water phase, was examined by mixing oil, water and protein extracts at different ratio to make emulsions. This method was also applied to evaluate the suspending ability, which is described as the capability to keep solid particles suspended in the medium, by replacing oil with minced meat. For the gelling ability, it was tested by heating the emulsions and suspensions and see whether they can form strong gels. The result showed that the increase in salt concentration led to aggregation of sarcoplasmic proteins as well as swelling of myofibrillar proteins. When the protein extracts were blended with oil or meat and heated up, the gel-emulsions and gel-suspensions were able to form. Varied types of protein, salt concentrations, oil, and meat contents had different impacts on gel properties. Myofibrillar proteins contributed to stronger gel-emulsions and gel-suspensions than sarcoplasmic proteins did. When heat was applied to the combinations of oil, meat, and protein solutions, gel-emulsion-suspensions were formed. Their strengths were dependent on oil and meat content as well as salt concentration. By the use of extracted myofibrillar proteins in 0.4 – 0.8 mole/liter salt solutions at pH 5.8, good gel-emulsion-suspensions which are necessary for sausage texture were obtained. Overall, the concept of using meat protein extracts seems possible to be applied in sausage making in order to reduce sodium in emulsion-type sausages. However, in order to achieve a proper sausage texture and consumer acceptance, further research is necessary to investigate the optimal oil and meat content.