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Topic III – Gentle and smart food processing

Microfiltration as a milder decontamination and fractionation method for lesser mealworms and house crickets

L.J.H. Sweers, C.M.M. Lakemond, R.M. Boom, V. Fogliano, M. Mishyna, J.K. Keppler

Novel protein sources like insects are currently being explored due to the global need for sustainably produced protein. In the insect industry, heat treatments like blanching are used to inactivate microorganisms and reduce enzymatic browning. However, these methods denature proteins, which limits their functionality and thus their use in high-quality food products. Non-thermal treatments like microfiltration and high-pressure processing could be an alternative to blanching but are not yet applied in the growing insect industry.

We here report on how dead-end microfiltration (0.2 μm polyethersulphone membrane) can be used on soluble fractions at a pH of 3 and 8 of lesser mealworm larvae (*Alphitobius diaperinus*) and adult house crickets (*Acheta domesticus*), to obtain functionally active, microbiologically stable fractions, without the use of blanching.

Microfiltration was successful in the reduction of microorganism count, as no microorganisms (<100 cfu/mL) were detected in any of the permeates after microfiltration. Permeates at a pH of 3 showed significantly higher protein recoveries than permeates obtained at a pH of 8, while lesser mealworm fractions showed significantly higher protein recovery in the permeates than house cricket fractions. The higher protein recoveries obtained in fractions at pH 3 can be explained by the higher activity of endogenous proteases, thus obtaining smaller proteins that could pass the membrane more easily. Enzymatic browning occurred significantly less however in permeates obtained at pH 3 than in permeates obtained at pH 8, indicating that browning enzymes were inactive at pH 3. The permeates have a significantly improved foaming capacity compared to the original protein solution. The main factor limiting the membrane flux and thus the protein recovery was fouling by protein aggregation. This caused more than half of the protein to be retained by the membrane after one-step microfiltration for all conditions studied. Still, these retentates could form heat-set gels, which demonstrates their usefulness for food applications.

In conclusion, dead-end microfiltration with a pore size of 0.2 μm is a promising technique for the removal of micro-organisms from soluble fractions of lesser mealworms and house crickets. A pH of 3 is recommended during the extraction process, as it gives the highest protein recovery and can be used to avoid extensive browning.