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

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Due to the global need for sustainably produced protein, novel protein sources like insects are currently being explored. In the insect industry, processes like blanching are currently used to inactivate micro-organisms. However, these methods denature proteins, limiting their use in industry. Mild alternative methods like pulsed electric field processing, high pressure processing, and microfiltration could be an alternative to blanching, but are not yet used in the growing insect industry. The aim of this study was to investigate whether dead-end microfiltration (0.2 µm polyethersulphone membrane) can be used on soluble fractions of lesser mealworm larvae (Alphitobius diaperinus) and adult house crickets (Acheta domesticus) at pH 3 and 8, to obtain functionally active, sterile fractions, without the use of blanching. The results showed that microfiltration was succesful in terms of microorganism removal, as no microorganisms (<100 cfu/mL) were detected in any of the permeates after microfiltration. The protein recovery of pH 3 fractions was higher than pH 8 fractions, and lesser mealworm fractions showed better protein recovery than house cricket fractions. Higher protein recoveries in pH 3 fractions could be explained by higher activities of endogenous proteases, thus obtaining smaller proteins that could easier pass the membrane. Permeates obtained at pH 3 showed significantly less enzymatic browning than pH 8 permeates, indicating that browning enzymes were inactive at pH 3. In terms of protein functionality, permeates showed a significantly improved foaming capacity compared to pre-filtrates. Fouling due to protein aggregation was the main factor limiting the membrane flux and thus the protein recovery. This caused more than half of the protein to be left behind in the retentate after one-step microfiltration. These retentates were found to be able to form heat-set gels for food applications. In conclusion, dead-end microfiltration (0.2 µm pore size) is a successfull and 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 gave the highest protein recovery and can be used to combat browning.