Ultrafiltration of Honey – Effects on Enzymes, Chloramphenicol and HMF

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Due to the ultrafiltration process, proteins can be removed from honey, which then makes it suitable as a sweetener for the beverage industry [1]. Ultrafiltration is carried out by diluting honey with water, using charcoal as a filter aid, and then ultrafiltering this solution through a membrane. As a last step, the added water is removed again [2]. The result is a colourless syrup which is optically and organoleptically nearly neutral (Fig. 1).

This particular research concentrated on the activities of the enzymes Diastase and Saccharase, hydroxymethylfurfural (HMF) and the behaviour of antibiotics after ultrafiltration.
Our procedure was to filter different monofloral and polyfloral honeys on the laboratory scale. The honey was diluted with water 1:1, then 1% active charcoal was added according to the amount of honey. The ultrafiltration process was carried out with a cellulose acetate membrane (pore size 0.45 µm) with the help of compressed air (4 bar).
To test the behaviour of the antibiotics, honeys, which were proved to be free of residues, were spiked with 20 µg/kg chloramphenicol (CAP) and then ultrafiltered as well.

Afterwards, pure and ultrafiltered honeys were analysed and compared. The enzyme activities and the content of HMF were examined with the usual DIN-methods [3, 4, 5], and CAP was determined with LC-MS [6].

Content of HMF: In some cases, when comparing it to the unfiltered honey, it was found, that more than 90% of the HMF was removed (Fig. 2).

Enzyme activities: It was observed that the activities of the enzymes Diastase and Saccharase decreased significantly (Fig. 3 and 4) in similar manner (Fig. 5).

Residues of CAP: The recovery of the spiked and unfiltered honey samples was between 80% and 100%, but after ultrafiltration only traces of CAP were found (Fig. 6 and 7).

Fig. 1: Unfiltered (l.) and ultrafiltered clover honey (r.)

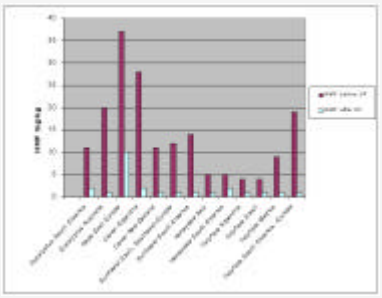

Fig. 2: Loss of HMF through ultrafiltration

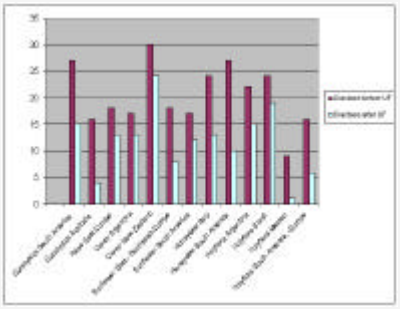

Fig. 3: Loss of Diastase activity through ultrafiltration

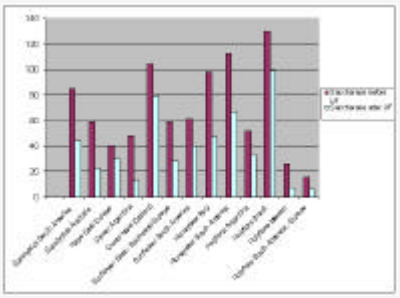

Fig. 4: Loss of Saccharase activity through ultrafiltration

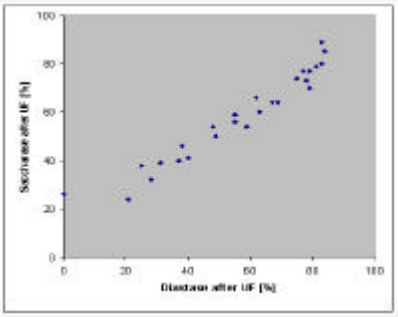

Fig. 5: Correlation of the losses of Diastase and Saccharase activity

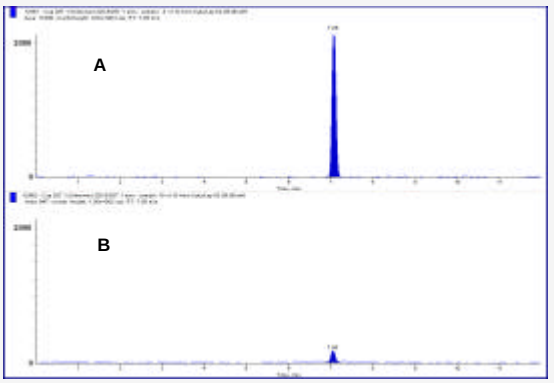

Fig. 6: MRM 321/257 of spiked (20 µg/kg) (A) and ultrafiltered clover honey sample (B) (API 4000 system, ESI, neg. mode)

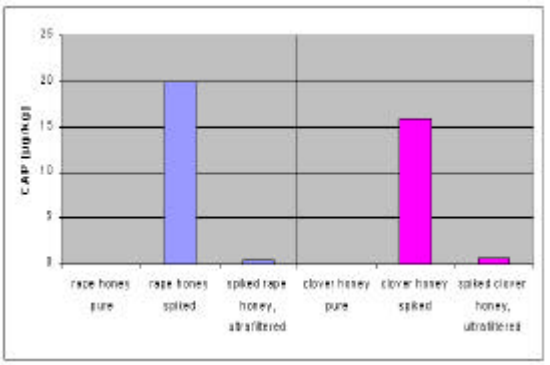

Fig. 7: Loss of CAP after ultrafiltration in spiked rape (l.) and spiked clover honey (r.)

References
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Conclusion

1. Apart from colour and flavour compounds, after ultrafiltration honey loses HMF and the activities of enzymes
2. Residues can be minimised by means of ultrafiltration