APPLICATION NOTE

Determination of chitin in insects

Method based on: Chitin analysis in insect-based feeds and compound feeds: Development of a cost-efficient and practical method

Introduction

Insects are the alternative protein source of the future. On the one hand, because they have a good nutrient composition in terms of amino acids, minerals and fatty acids. On the other hand, they require hardly any water and space in cultivation, so they emit relatively little CO_2.

As the main component of their exoskeleton, insects contain the polysaccharide chitin, which in turn contains nitrogen. In protein determination, this nitrogen contained in the chitin is recorded as crude protein, which increases the total value of the latter. However, since the nitrogen from the chitin cannot be processed by humans and animals, it should be considered separately.

C. Gerhardt instruments:
- FIBRETHERM FT 12
- KJELDATHERM oder TURBOTHERM
- VAPODEST 200 – 500 C

Additional Equipment:
- Analytical balance
- Rotor mill
- Drying cabinet

In order to determine the chitin content separately, C. Gerhardt, together with the Research Institute of Feed Technology (IFF), has developed a cost-efficient and convenient analysis technique based on classical chemical methods. Namely, on the **crude fibre** and **nitrogen determination** with FIBRETHERM, KJELDATHERM and VAPODEST.

The Method

Sample preparation and weighing

For the subsequent analysis, the samples must be homogeneous. Fresh insects should be dried. Insects with a high fat content can be frozen beforehand to avoid sticking during homogenisation. After sample preparation, approximately 1 g per sample including glass spacer and FibreBag is weighed in.

➔ **App note**: If the fat content of the sample is above 10%, it is recommended to degrease the sample.

Alkaline hydrolysis and drying	The samples are placed in the carousel, then the carousel is placed in the FIBRETHERM and the method is started. Once the FIBRETHERM method is complete, the glass spacers and FibreBags are placed back into the crucibles. The glass spacers are rinsed with distilled water to remove any residue in the FibreBags. The crucibles with the FibreBags are dried at 103°C for 4 hours or overnight.

Nitrogen determination acc. Kjeldahl:

Addition of the chemicals	Each FibreBag is placed in a digestion tube. Then the appropriate chemicals are added for digestion.
Digestion	The samples are digested in the KJELDATHERM or TURBOTHERM with the specified parameters.
Distillation	After cooling the samples, a steam distillation is carried out with the VAPODEST: ➔ **App note**: When using our KJELCATS, it is important to observe a colour change from blue to brown after adding NaOH, indicating that the NaOH has been added in excess.
Titration	Add 3-4 drops of the indicator solution to the receiver solution and titrate with the standard solution until the colour changes from green to violet. If you determine the endpoint with a pH electrode, you do not need to add the indicator solution.
Calculation	The chitin content can be calculated with the following equation:

$$\omega_{chitin} = \frac{(V_1 - V_0) \times c_{eq,soll} \times t \times 20{,}319}{m_{sample}}$$

ω_{chitin} = Chitin content [%]
V_1 = Volume of standard solution used for the residue after deproteination [ml]
V_0 = Volume of standard solution used fort he process blank [ml]
$c_{eq;soll}$ = Equivalent concentration of the standard solution
t = Titre oft he standard solution
20,319 = Factor for recalculating the chitin content
m_{sample} = Weight of the sample put into the FibreBag [g]

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Example results Chitin content in insects

	Dried yellow mealworm larvae (Chitin content in %)	Mealworm press cake (Chitin content in %)	Dried crickets (Chitin content in %)
Sample 1	6.163	9.664	9.553
Sample 2	6.157	9.777	9.553
Sample 3	6.224	9.714	9.599
Sample 4	6.045	9.711	9.662
Sample 5	5.982	9.650	9.633
Mean value Chitin content [%]	6.114	9.703	9.596
Standard deviation Chitin content [%]	0.098	0.050	0.054

Results for different types of samples obtained in the study conducted in collaboration with the Research Institute of Feed Technology of the IFF, Braunschweig (Germany).

Conclusion

In the future, insects will play an increasingly important role in the nutrition of humans and animals. Since the protein content in particular is also of interest, a reliable and exact determination must be ensured with the exclusion of interfering factors. With the newly developed method by C. Gerhardt in cooperation with the Research Institute of Feed Technology (IFF), the chitin content can now be determined separately in order to subsequently determine the true protein content in insects.

For detailed information or other applications please contact:

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