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Vegetable protein in meat products (#308)

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Introduction

Vegetable proteins (VP) are used in meat products (MPd) e.g. sausages for their moisture and fat binding properties, and as stabilizers. Traditional VP sources are soybeans and wheat, mostly in textured form. Also protein isolates of legumes (soya, peas or lupines) (PI) are used in MPd.

VP structures are divided into 3 groups: Globular protein (spheroproteins), of simple composition e.g. albumins. Fibrous protein (scleroprotein), of conjugate or of derived composition e.g. keratin, collagen or elastin. Mixed proteins [1].

Food industry offers expanded textured protein (ExTP) in 4 forms, flakes, chunks, granulates and powder. PI are mostly offered in powder form.

ExTP is a thermoplastic technology, where extrusion processes are involved preparing mixtures of protein, water, flavours and other minors. Products are put into a cooker-extruder, exposed to heat and pressure and subsequently extruding [2].

PI are gained from so-called *white flakes*. They are separated in pulp and extract. The extract is precipitated by an alkali separation. After neutralization it is spray dried to obtain proteinate (powder) [3].

Altshul [4] talk about soya protein concentrates, which are used in patties, sausages and meatballs. Its main purpose of adding to meat is to emulsify.

The aim of this work is to identify by means of microscopy and histology different kinds of VP in MPd.

Literatur

1. A. Beitia Leiva, Proteinas de origen vegetal y su interés nutricional. http://zahartzaroa.artematiconorte.com/pdf/alimentacion/PROTEINAS VEGETALES .pdf. Accessed 1 April 2019

2. G. Marcia H., Expanded textured protein. in Textured Protein Products, edited by I. WIEN (Library of Congress, New Jersey, 1977), pp. 95–170

3. Food and Agriculture Organization, Chapter 6: Isolated soybean protein (ISP). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5355584/. Accessed 1 April 2019

4. A. Altschul, New protein foods. *new protein foods* (Elsevier, 2012)

5. Amtliche Methoden für die Untersuchung von Lebensmittel and Amtliche Sammlung von Untersuchungsverfahren nach § 64 LFGB (vormals § 35 LMBG) Band I (L), Untersuchung von Lebensmittel Bestimmung der geweblichen Zusammensetzung von Fleisch, Fleischerzeugnissen und Wurstwaren Routineverfahren zur qualitativen und quantitativen histologischen Untersuchung. *Untersuchung von Lebensmittel Bestimmung der geweblichen Zusammensetzung von Fleisch, Fleischerzeugnissen und Wurstwaren Routineverfahren zur qualitativen und quantitativen histologischen Untersuchung* (BVL Methodensammlung, Germany, 1989)

Methods

Samples:

1) VP: textured wheat protein, textured soya flakes and protein isolates of soya, lupin and peas.

2) Mpd: I) cuttered minced meat. II) minced meat cuttered with 1% of VP and 5% water.

VP samples were analysed microscopically in their native forms.

ExTP flakes were rehydrated and cooked before use. MPd were formed and cooked in a water bath until a core temperature of +79°C. Afterwards they were cooled down quickly and cut into cubes. Cubes were frozen at -80°C for 2 hours, subsequently conditioned at -20°C for 24 hours.

Slices of 7µm thickness were cut and stained with hematoxylin - eosin method based on the official method according to §64 LFBG 06.00-13 [5].

MPd are observed in comparison before and after cooking with help of a light microscope.

Results

1) Native extured samples show long fibrous and spongy structures (e.g. Fig. 1a). Native protein isolates appear in rounded structures (e.g. Fig. 2a).

2.I) Skeletal striated muscular fibers, connectivo-elastic tissue, vessels and adipose tissue were observed.

2.II) In slides of MPd with wheat textured protein, in addition of muscular fibers, long fibrous and spongy structures (Fig 1b) were recognized. Typical structures as aleuron cells or brush are detectable.

MPd with soya textured protein shows fibrous structures. Additionally palisade cells are recognizable.

Structures that remind of protein isolate of legumes appear as rounded structures from dark pink to light purple colour. They contain defined margins partly with vacuolar inclusions and are mostly attached to animal tissues (Fig. 2b).

Notes

Conclusion

In MPd, structures of VP can be recognized by histological analysis because wheat and legumes show specific characteristics.
However, the distinction between the individual legume classes is currently not possible by means of microscopy.
Undeclared VP can be detected with this method. Further investigation for differentiating legume is necessary, e.g. testing different staining methods.

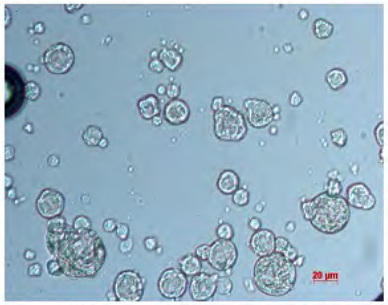

Figure 2a: Lupin protein isolate native

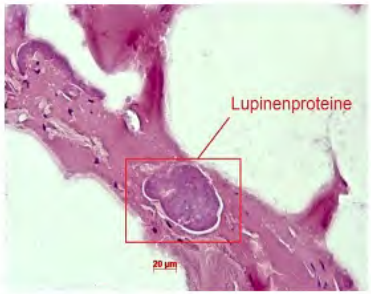

Figure 2b: Lupin protein isolate in cooked meat product.

Lupin protein isolate

Figure 2a: Lupin protein isolate native
Figure 2b: Lupin protein isolate in cooked meat product

Figure 1a: textured wheat flake native

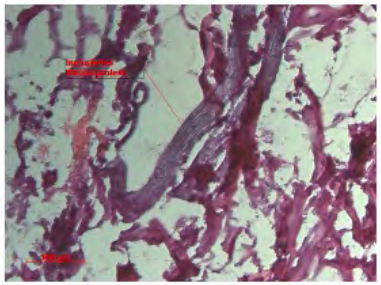

Figure 1b: cooked textured wheat flake in cooked meat product

Textured wheat flake

Figure 1a: textured wheat flake native form, 100x
Figure 1b: cooked textured wheat flake in cooked meat product, 100x

Notes