Fat replacers for meat products

Identification

Key words
Fat replacer, Meat product

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How does it work?

Primary objective
The primary objective of fat replacement is lowering the fat content and the energy value of meat products. Fat replacers should have the proper properties to mimic the fat globules and retain similar sensorial properties of the modified product compared to control with full fat content. Innovation apparent in recent research works is the aim to replace fat pieces in meat product where fat pieces are typical (sausage fat).

Working principle
The basic principle of the technology of the fat replacer in meat product is using some fat or oil, thicken it with stabiliser to be stable in meat product heat treatment. Fat replacer has to survive the final heat processing in meat product. Some fat replacers are made from not fat particles such as extracted poppy seed paste etc.

As fat replacers, many ingredients have been tested and applied in industry. Below, there is a list of selected relevant papers describing details of applications, substances used and meat products, in which the specific substance was successfully used. Fat replacers can be applied in meat batters, sausages, frankfurters, meat burgers, minced meat preparations, meat balls, various national specialities (sucuk, kofte – Turkish meatballs), meat patties, chevron loaves, ham pâté, beef burger, salami chicken breakfast sausage, summer sausage etc.

Real fat pieces replacer have been prepared from vegetable or fish oils combinations emulsified in water and stabilized with sodium caseinate, soy protein and tran glutaminase [1]. Poppy seed paste [2] is in this respect interesting to be used as a fat replacer. Most of other fat replacers have been applied as ingredient emulsified homogeneously into the meat product (no effort to mimic the fat pieces). There is a long list of ingredients: precipitated skim milk [3], walnut [4] etc. Overview of these combinations is given in [5]. Opinion of American dietetic association on fat replacers is given in [24].

List of fat replacers mentioned in selected literature [6-34]. Water deserves special attention as a fat replacer [16]. We can mention the most frequent fat replacers: sodium caseinate, carrageenan, tapioca starch, whey protein concentrate, silkworm powder and vegetable worm, oat's soluble fibre (beta-glucan), combination of isolated soy protein with olive oil, carrageenan, and maltodextrin, modified potato starch, inulin, egg white protein, yams (Dioscorea alata), sodium alginate, citrus fibre, soy protein concentrate; whey powder, globulin and plasma; barley beta-glucan, corn flour, short chain fructooligosaccharide, carrageen gum, modified cassava starch, microparticulated whey protein, and oat bran, lupin-kernel fibre, fish proteins, carrageenan, combination of high-amylose cornstarch, maltodextrins, and canola oil, oligofructose, granulated low-calcium (0.2%) skim milk co-precipitate, rice granules, potato flour/beet fiber, rice flour, pectin, commercial mixture of carrageenan and locust bean gum, aqueous suspensions of curdlan.
Using fat replacers means the risk of changes in quality parameters (flavor, odor, taste, the total cholesterol content and mainly texture). Therefore, the amount of added fat replacer has to be carefully tested and optimum combination of original fat and fat replacer predicted. Replacers have frequently better emulsifying and water bonding properties than replaced fat.

<table>
<thead>
<tr>
<th>Important process parameters</th>
<th>mixing time, cooking temperature and time of meat product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Important product parameters</td>
<td>fat replacer concentration, ingredients combination, final product texture (shape, hardness, juiciness), flavor, taste. Changes of fat replacers during all processing steps should be monitored.</td>
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</tbody>
</table>

**What can it be used for?**

<table>
<thead>
<tr>
<th>Products</th>
<th>Meat products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations</td>
<td>Meat product formulation</td>
</tr>
<tr>
<td>Solutions for short comings</td>
<td>Fat content reduction in meat products.</td>
</tr>
</tbody>
</table>

**What can it NOT be used for?**

<table>
<thead>
<tr>
<th>Products</th>
<th>Fat replacers mentioned here can be used only for meat products not for bakery products (this search was limited to bakery products but some fat replacers mentioned here can be used also for bakery products).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations</td>
<td>Vigorous mixing can destroy the gentle emulsion of fat replacer and water and fat in meat homogenate. During subsequent heat treatment of meat product phase separation can occur.</td>
</tr>
<tr>
<td>Other limitations</td>
<td>In some countries, limits of added fat replacers were defined. Overcoming of limits can be regarded as meat product adulteration. In this respect, the reference [35] is included into our list of references, providing overview of existing analytical methods for adulteration prediction. The design of fat replacer amount is therefore time consuming step and can cost more than using original fat pieces in meat product.</td>
</tr>
<tr>
<td>Risks or hazards</td>
<td>Misuse of fat replacers for adulteration of meat products. It is much more important when meat proteins are exchanged by proteins of the plant origin (this is actual also here; see the list of fat replacers where the soya protein isolate or concentrate can be found).</td>
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</table>

**Implementation**

<table>
<thead>
<tr>
<th>Maturity</th>
<th>This technology is currently applied in the meat industry.</th>
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<tr>
<td>Modularity/Implementation</td>
<td>Fat replacers are added mostly during cutting of meat and mixing with other ingredients.</td>
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<tr>
<td>Consumer aspects</td>
<td>This is sensitive, country by country specific topic. The consumer should be informed about composition. Low calorie meat product is attractive.</td>
</tr>
<tr>
<td>Legal aspects</td>
<td>Some products are protected by regulation (ham) and some product not. There is not common EU regulation for meat product. Using fat replacer changes meat product into different product having impact on all aspects of the production (HACCP steps, safety etc.). This difference should be officially reflected and official documents changed for totally new product.</td>
</tr>
<tr>
<td>Environmental aspects</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

Facilities that might be interesting for you

<table>
<thead>
<tr>
<th>Title</th>
<th>Institute/company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditorium IRTA</td>
<td>IRTA</td>
</tr>
<tr>
<td>Clean room - Histocell</td>
<td>Noray</td>
</tr>
<tr>
<td>Video observation system for market research and product development tasks - Keki</td>
<td>NAIK EKI</td>
</tr>
</tbody>
</table>

Further Information

Institutes  ICTAN, Afyon Kocatepe University, University of Hohenheim, Univ. of Veterinary Medicine Hannover, Ege University, University College Cork - FNS, Teagasc, Nestlé Research Centre, Max Rubner Institute, University of Parma, Queen's University Belfast

Companies
References


[26] Sarıdaroğlu, M., Dejirmençoğlu, O., Effects of fat level (5%, 10%, 20%) and corn flour (0%, 2%, 4%) on some properties of Turkish type meatballs (Kofte), (2004) Meat Science, 68 (2), pp. 291-296.


