Influence of oils on plant-based meat analogues: Assessing extrudates mechanical properties to ensure quality and consumer acceptance

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Whilst the global demand for plant-based meat alternatives continues to grow rapidly, many consumers still lack diversity in marketed products, especially in terms of meat types and variety of protein sources. To meet consumers' demands, new products need to be developed that mimic taste, aroma and texture of meat as authentically as possible. However, various consumer surveys reveal that available products often do not meet consumers' expectations regarding several factors incl. texture, juiciness, and mouthfeel.

An important product feature for achieving a similar product to meat is the fibrous, anisotropic structure, which resembles the product texture of muscle meat. Additionally, to improve the texture and taste of extrudates, oils and fats are usually added to the formulation. Whilst increasing the juiciness perception of the extrudates, oil and fats can also disrupt the fibre formation and act as plasticizers. The degree of interference depends on the interactions between oil/fat and proteins and the protein's emulsifying properties. However, mechanisms involved in structure formation, oil stabilization, and interaction amongst ingredients are not fully understood and are individual for every protein-oil combination. For this reason, this contribution addresses the application of a mechanical, rheological and tribological characterization as solution approach to gain insights into formulation and process parameters, facilitate product innovations and assure an objective evaluation of the resulting product.

The effect of oil on the textural properties of the meat substitutes in terms of customer acceptance were investigated by different techniques. Results show, how parameters such as oil concentration, protein source, and extruder die temperature define the fibre formation. The influence of these parameters on product structure were evaluated using electron microscopy and image analysis. To assess mouthfeel, rheological measurements and texture analysis were performed and compared to meat. This was evaluated using an electron microscope and image analysis. For the assessment of mouthfeel, rheological and tribological measurements and texture analysis tests were performed using a Thermo Scientific HAAKE Rheometer. Results show how these measured data can be related to product structure and used as quantitative measure to compare meat analogs' product properties.