**Same as Meat? – Rheology as a Tool for Simulating the Digestion of Meat and Meat Substitutes in the Gastrointestinal Tract**

C. Küchenmeister-Lehrheuer1, Gabriela I. Saavedra Isusi1, U.S. van der Schaaf2

*1 Thermo Fisher Scientific, Pfannkuchstraße 10-12, D-76185 Karlsruhe, Germany (*[*Cornelia.Kuechenmeister@thermofisher.com*](mailto:Cornelia.Kuechenmeister@thermofisher.com)*; gabriela.saavedraisusi@thermofisher.com)*

*2 Chair for Food Process Engineering, Institute of Process Engineering in Life Sciences, Karlsruhe Institute of Technology, Gottfried-Franz-Str. 3, D-76131 Karlsruhe, Germany (*[*ulrike.schaaf@kit.edu*](mailto:ulrike.schaaf@kit.edu)*)*

More people are adopting a plant-based diet for health benefits, ethical and environmental considerations, among other reasons. Nowadays, meat substitutes not only convince with their taste but also with their structure, thanks to the latest extrusion technology and structural characterization by means of rheology or tribo-rheology. Although consumer acceptance has increased, it is still unclear how these products compare to real meat in the digestive tract. Rheology offers simpler experimental designs to assess the digestibility of plant-based alternatives than conventional, complex in vivo studies.

To simulate the journey of a bite through the gastrointestinal tract (GIT), a submersion flow cell in combination with a rotational rheometer, equipped with a serrated plate-plate geometry, was designed. This setup can be used to analyze the viscoelastic properties of a semi-solid material under "ambient conditions," i.e., in contact with a temperature-controlled liquid. The measuring cell is equipped with an inlet and outlet so that the liquid can be varied to simulate the gastric or intestinal fluids. This allows pH alterations and enzymatic digestion to be observed in situ while assessing changes in the viscoelastic properties of the samples.

Different meat and meat alternatives were prepared for rheological measurement. Initially, the cooked food was compressed to simulate the chewing process, then the samples were placed in the measuring cell and the cell was flooded with synthetic saliva. The proteins in the meat and meat substitutes remain largely intact. As food enters the stomach through swallowing and the peristaltic movements of the esophagus, it encounters the acidic conditions of the stomach. This is simulated in the measuring cell by changing the rinsing medium to a lower pH value of approximately 2, including digestive enzymes such as pepsin. The stomach acid denatures the proteins in both meat and meat substitutes, causing them to lose their structure. After gastric digestion, the process can continue in the small intestine. During the simulation, the pH value is increased to approx. 7 and further enzymes such as trypsin are added.

Meat and meat alternative extrudates will be digested and measured using the Thermo Scientific HAAKE MARS Rotational Rheometer equipped with a submersion flow cell. The results of these rheological measurements will include texture analysis tests, including normal force and oscillatory tests, as well as tribology measurements. These results show how the rheology can be related to the path of food through the digestive tract.