**Strategies for the manufacture of adipose tissue mimetics using hydrocolloids**

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One of the most pressing problems in the world today is climate change, accelerated by greenhouse gas (GHG) emissions generated by human activity. This problem is compounded by the very high, and unsustainable, use of fresh water for animal-based food production. Pressure from an ever-increasing human population has put humanity in a tough place. Compounding this dynamic is the fact that most countries and their inhabitants are doing almost nothing to address these key issues related to the survival of the human species. One way to reduce the impact of agriculture on GHG emission and freshwater usage is to transition from animal-based foods to plant/microbial/fungal-based foods. The problem here is that consumers demand familiar indulgence in every meal without compromise, while demanding the lowest prices. One critical recent example is the decrease for the demand of plant-based meat analogues. This is creating a critical situation in that whole sector. The reason for the demise of plant-based indulgent foods (burgers, nuggets, etc.) is the fact that they cost ~2x more, and their sensorial characteristic are very far away from their animal counterparts. These products lack the color, flavor and texture of their animal counterparts. Here we will discuss the very important issue of the fat used in these products. Fats are key ingredients in a meat analogue. One may argue that fat is more important than the protein itself. Unfortunately, all the focus has been directed to plant proteins instead of approaching it from a more wholistic, whole food, perspective and ultimately ignoring the required structure. Fats are critical components which carry flavor, provide mouthfeel, and are mostly responsible for the indulgent characteristics of foods. Where would cheese, chocolate, ice-cream be without fat? Adding fat to a meat analogue is not merely adding a liquid of semisolid fat into a mixture of protein particles bound by cellulosics or gluten. Animal fats are structured into collagenous adipose tissue in a muscle; they are not free1. The physical functionality of fat is irrelevant if not considered as a component of a hydrocolloid-fat macroscopic complex. In this talk, I will review current strategies used to create scaffolds and oleogels which could be filled with fats and oils to more closely functionally resemble adipose tissue2. The approach changes completely when we realize that the tissue must soften, not melt, at cooking temperatures, but hardens if the heat treatment continues. This thermally-induced hardening is critical in the creation of solid particulates which provide the expected chewing sensation while consuming these products. Also, the adipose tissue limits oil losses which a both annoying and characteristic of these products. Hydrocolloids are the only possible macromolecule which could fulfill the functional role of collagen, which we cannot use since it is animal-derived. Plant proteins are good candidates, but ultimately non-functional materials. Polysaccharides are the key to this problem. Some recent advance from our laboratory will be presented.

1. Khakhanang Wijarnprecha, Christopher Gregson, Matt Sillick, Philipp Fuhrmann, Sopark Sonwaic and Dérick Rousseau. 2022. Temperature-dependent properties of fat in adipose tissue from pork, beef and lamb. Part 1: microstructural, thermal, and spectroscopic characterisation. Food Funct. 13: 7112-7122.  <https://doi.org/10.1039/D2FO00581F>

2. Claire Bomkamp, Stacey C. Skaalure, Gonçalo F. Fernando, Tom Ben-Arye, Elliot W. Swartz, and Elizabeth A. Specht. 2022. Scaffolding Biomaterials for 3D Cultivated Meat: Prospects and Challenges. Adv. Sci. 9: 2102908. <https://doi.org/10.1002/advs.202102908>