

# **A Textural Revolution: 3D Printing and Biosurfactants for Plant-Based Meat Alternatives**

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## **Abstract**

The burgeoning market for plant-based meat alternatives reflects a growing consumer focus on health, affordability, and environmental sustainability. However, replicating the mouthfeel and texture of real meat remains a significant hurdle for these products. This study delves into a novel approach that leverages the combined power of 3D printing technology and biosurfactants to overcome this challenge. Soy protein isolate (SPI) formed the foundation for our plant-based meat analogues. We embarked on a meticulous investigation, exploring the substitution of traditional oil with various biosurfactants at different concentrations (20% to 100%) within the 3D printing ink formulation. The spectrum of biosurfactants employed encompassed acetylated starch (ACT), octenyl succinic anhydride starch (OSA), and ethyl (hydroxyethyl) cellulose (HEC). The analysis of the rheological properties, which govern the flow and deformation of the ink, unveiled a captivating interplay between the type and concentration of the biosurfactants. Formulations containing specific combinations – 40% HEC (HEC40%), 40% OSA (OSA40%), and 60% ACT (ACT60%) – exhibited exceptional printability. These precise ratios yielded a remarkable increase in viscosity recovery with elevated biosurfactant content. Additionally, they demonstrated superior structural strength, enhanced storage stability, and a gel-like character – all essential attributes for successful 3D printing of realistic textured meat alternatives. These findings illuminate the immense potential of biosurfactants, particularly HEC40%, OSA40%, and ACT60%, to revolutionize the textural landscape of 3D-printed plant-based meat alternatives derived from soy protein isolate. Their remarkable ability to augment printability and texture paves the way for the development of more appealing and truly meat-like plant-based meat substitutes, further bolstering the burgeoning market for these sustainable and health-conscious food options.

## **Keywords**

3D printing, Biosurfactants, Texture, Rheological properties.

## **Biographies**

**Anant Oonsivilai** was born in Khon Kaen Province, Thailand, in 1963. He received his B. Eng. from Khon Kaen University, his M. Eng. from King Mongkut Institute of Technology North Bangkok, Thailand, and his PhD. From Dalhousie University, DalTech, Canada, all in electrical engineering, in 1986, 1992, and 2000, respectively. Dr.

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