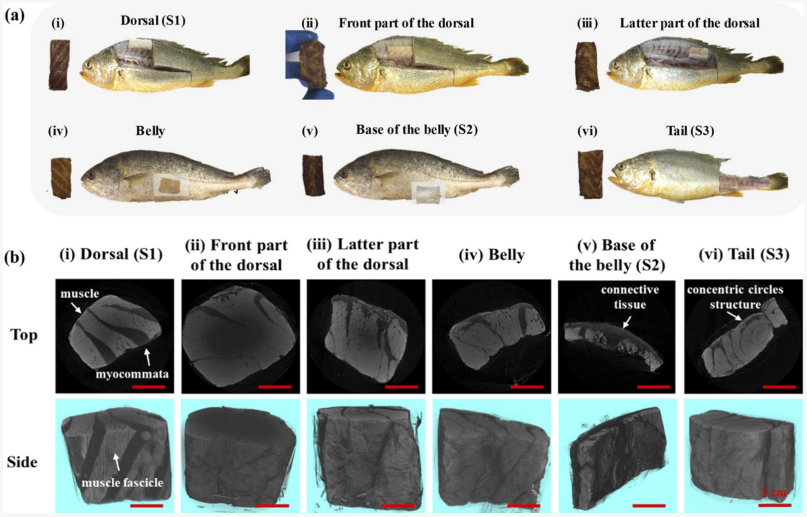
Simulated construction of plant-based fish meat with composite structure via 3D printing

GA, UNITED STATES, September 19, 2024 /EINPresswire.com/ -- Researchers used dual-nozzle 3D printing technology to construct plant-based yellow croaker tissue analogs by soy protein isolate–xanthan gum-starch complex (as simulated muscle ink) and nanostarch-carrageenan emulsion gel (as simulated fat ink). Successfully, indicators of testing demonstrated that 3D-printed plant-based yellow croaker flesh with a composite structure had a good simulation quality.



Micro-CT scanning of different parts of yellow croaker fish muscle tissue.

To date, about 90□% of fish resources worldwide have already reached their sustainable fishery limit. Meanwhile, intensive farming and aquaculture contribute to significant environmental pollution and degradation. To address both the challenges of limited production efficiency and environmental harm, plant-based fish alternatives have emerged as a potential solution to traditional fisheries.

In a recent study (doi: https://doi.org/10.1016/j.foodp.2024.100028) published in the KeAi journal Food Physics, a team of researchers from China successfully created plant-based simulated yellow croaker meat tissues by dual-nozzle 3D printing.

Based on micro-CT scanning data, a muscle/fat biphasic high-simulation model for 3D printing yellow croaker meat in three parts (the dorsal, the base of the belly flesh, and the tail) was constructed via CAD reconstruction," explains Enbo Xu, senior and corresponding author of the study. "We used soy protein isolate–xanthan gum-starch complex as simulated muscle ink and nanostarch-carrageenan emulsion gel as simulated fat ink.

After the completion of a series of immersion treatments, the fish were stained with an iodine solution, with the aim of distinguishing the distribution of fat and muscle. Nonetheless, there was the challenge of adjusting the parameters of multi-nozzle 3D printing to achieve high

precision.

“We optimized the printing process by controlling the dual-nozzle printing process parameters, including manual calibration of the dual-nozzle offset, layer height, fill rate, printing speed, air pressure, etc.,” shares lead author Jie Li. “Ultimately, a dual-nozzle 3D-printed product of plant-based fish flesh was successfully created, with a printing accuracy of more than 90% for the composite structure.”

The texture, moisture distribution and nutrient content of the simulated fish meat were analyzed and compared with real yellow croaker meat. The team reported that the texture characteristics, moisture distribution and content of many nutrients in the simulated fish were close to those of real fish.

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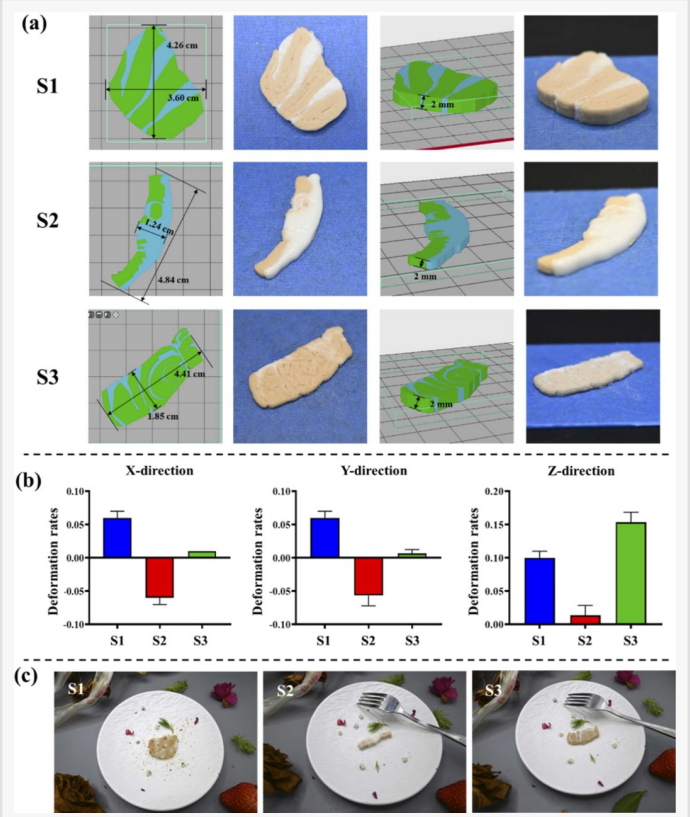

Dual-nozzle 3D printing of plant-based yellow croaker muscle tissue (S1-dorsal flesh; S2-the base of the belly flesh; S3-the tail).