Responsible Seafood ADVOCATE

Intelligence

Purging, processing freshwater crawfish

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By George J. Flick, Jr., Ph.D.

Maximize yield with female crawfish and minimize loss by quick-freezing

The growing popularity of crawfish calls for more effective ways of distributing the product while maintaining consumer safety.

The commercial production of freshwater crawfish has expanded greatly in recent years across North and South America, Australia and China. Fresh crawfish are brought in live and prepared for immediate consumption. The commercial processing of crawfish involves thermal processing to extend shelf life and permit the removal of the tail meat and/or claw meat from the carapace, followed by packaging and chilled or frozen distribution.

The growing popularity of crawfish calls for more effective ways of distributing the product while maintaining consumer safety. Extending crawfish shelf life may necessitate packaging and freezing the meats, which can result in a less desirable texture. However, there are possibilities for distributing a product that is safe for human consumption without compromising the taste and texture of the crawfish.

Bioaccumulation issues

Crawfish reside in a niche of the ecosystem where they have the potential to bioaccumulate contaminants from water, sediment and diet. Many studies have shown that crawfish accumulate metals in their tissues. Mercury, for example, has been found to accumulate at low levels in the tail meat of crawfish, which is the principal edible component.

A study of crawfish operations located near mining districts in several U.S. states found that concentrations of lead, cadmium and zinc were typically higher in samples from sites heavily affected by mining. Based on this and previous studies, human consumption of crawfish from such locations could potentially be restricted based on current criteria for the metals.

Purging

In some countries, crawfish are purged for one or two days to empty the gut, improve the outer appearance and yield a fresher odor and taste when cooked, thereby increasing market value. A second benefit is that the purging process can reduce microbial surface contamination, which can result in a picked product with reduced microbial content and extended shelf life.

Purging is most commonly performed in flow-through systems, but spray systems have gained in popularity. Three purging systems were compared in a study: two flow-through treatments using high and low water flow rates, and a water spray treatment. Results indicated that crawfish purged equally well in the systems.

Under the spray treatment, water quality was better, with lower total ammonia nitrogen and ammonia than in both the flow-through systems. A visual examination of crawfish veins revealed that approximately 90 percent showed complete evacuation after 48 hours of purging. The remaining 10 percent showed almost complete evacuation. Mortality rates among the treatments were not significantly different.

Yield

A study that compared the tail meat of red swamp crawfish (*P. clarkii)* and white river crawfish (*P. acutus)* showed no difference in texture and flavor. However, the study indicated that consumers may prefer the swamp crawfish and its more pronounced red meat color over the greenish color of the white river crawfish. Females of *P. clarkii* produced 4 percent more abdominal muscle than males in both total weight and percentage yields. For *P. acutus*, females had 2 percent more muscle tissue.

A study on freshwater crawfish (*Austropotamobius pallipes)* showed that females produced 1.4 percent more abdominal meat than males. A 1 percent difference in yield is significant when typical yields only range 12 to 18 percent of live weight. Tail meat yields vary by season and crawfish species, sex and size.

Processing alternatives

In some geographic areas, the picked tail meat of *P. clarkii* is packed with adhering hepatopancreas, an important flavor ingredient in many prepared dishes. However, collagenolytic enzymes from the hepatopancreas can degrade the texture of the meat within 20 hours of iced storage.

To curtail this effect, crawfish in one study were placed in boiling water and removed every two minutes after the water returned to a boil. A proteolytic enzyme analysis showed that only minimal inactivation occurred after three minutes of boiling. Moderate inactivation occurred at five minutes of boiling, and all enzymes were inactivated with over five minutes of boiling.

Research on the effectiveness of a two-phase (flotation and filtration) separation of claw meat from (*Cherax destructor)* crawfish using dense media was initiated to recover meat that could be used in value-added commodities. The media used were 10 percent brine, 30 percent glucose syrup and a 30:70 ratio of glucose syrup to 2, 5 and 10 percent brine, with specific gravities ranging 1.08-1.16.

Extraction recovery of food-grade mince ranged 33.3-43.5 percent which compared favorably with the 33.2 percent recovery with the hand-picked control. Compared to the control, the meat recovered from the two phases was significantly firmer in texture, lower in moisture and less bright in color. The meat salt content reflected the salt concentration of the recovery medium.

Freezing, storage

Freezing crawfish tail meat toughens its texture, as noted with many seafood products. The mechanism for the toughening is not well understood, but denaturation and aggregation of proteins appear to be the primary causes. This may be due to mechanical damage associated with the rate of freezing and related ice crystal formation and ion concentration effects, or interaction with chemical components such as formaldehyde or lipid oxidation products.

A study in which crawfish tail meat was frozen by one of three processes – packaged and conventionally still frozen, packaged and cryogenically frozen, and individually cryogenically frozen before packaging – showed differences in texture, retained moisture and lipid oxidation (Table 1). Between six and 16 weeks of frozen storage, toughness remained the same in all treatments. After 16 weeks of frozen storage, toughness declined. Both quick-frozen samples were more tender than conventionally frozen samples, retained more moisture and exhibited less lipid oxidation.

Flick, Main effects of freezing, Table 1

Attribute	Conventionally Frozen	Packaged Quick Frozen	Individually Quick Frozen
Moisture (%)	77.8	78.2	78.9
Retained moisture (%)	51.8	53.2	55.9
Kramer shear (kg/g)	4.39	3.92	3.53
Thiobarbituric acid (mg/kg)	0.47	0.35	0.31

Table 1. Main effects of freezing on chemical and physical attributes in whole crawfish.

In further research, antioxidant dips in tocopherols or propyl gallate were applied to red crawfish (*Cherax quadricarinatus)* that were subsequently stored at minus-20 degrees-C for up to six months. Samples treated with the antioxidants exhibited lower oxidation than the untreated samples, but the differences were small.

Shell-on tails of male, non-spawning female and spawning female Australian red claw crawfish were aerobically stored at 2 degrees-C for a maximum of 10 days to monitor the quality of the meat under retail conditions. Lipid oxidation increased during the first and fifth days of storage but there were no significant differences between the three groups.

The 91.7 percent cooking yield of the spawning females at day 10 was significantly lower than that of the males (96.3 percent) or nonspawning females (97.8 percent), and the shear force of the spawning females' muscle was also higher. Sensory panel judgments of tenderness and juiciness were significantly correlated with shear force and cooking yield, so the spawning females presented lower overall acceptability than the male and nonspawning female samples.

Editor's Note: This is the first part of a two-part series on commercial crawfish aquaculture. ***Part 2*** *(https://www.aquaculturealliance.org/advocate/solutions-to-microbiological-challenges-in-crawfish-processing/?__hstc=236403678.c4258ae16d67a892489fc82b10ae1244.1681007317373.1681007317373.1681007317373.1&__hssc=236403678.1.1681007317374&__hst microbial contamination and explore research on post-processing treatments to minimize negative effects.*

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Author

GEORGE J. FLICK, JR., PH.D.

Food Science and Technology Department
Virginia Tech/Virginia Sea Grant (0418)
Blacksburg, Virginia 24061 USA

flickg@vt.edu (mailto:flickg@vt.edu)