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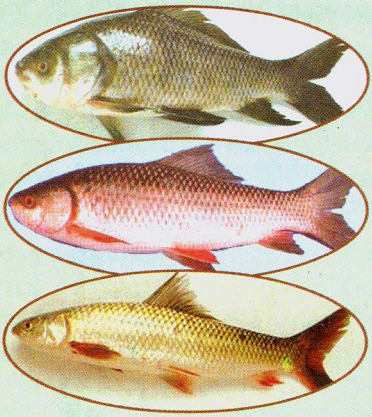
MYOFIBRILLAR PROTEIN CONCENTRATE (SURIMI) FROM FRESHWATER MAJOR CARPS



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Myofibrillar Protein Concentrate (Surimi)
From Freshwater Major Carps

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MYOFIBRILLAR PROTEIN CONCENTRATE (SURIMI) FROM FRESHWATER MAJOR CARPS

Fish is the best source of high quality animal protein readily available to the masses throughout the world and its demand is always on the increase. Capture fisheries contributed enormously to total fish production in the late 80's but its share is continuously dwindled over the years due to various reasons. The stagnating growth rate in marine fish production associated with favourable environmental factors gave a new thrust to aquaculture production. In India, fish contributed to a major share of the total freshwater production. Among the different fishes, major carp viz., rohu (*Labeo rohita*), catla (*Catla catla*) and mrigal (*Cirrhinus mrigala*) account for more than 85% of the production.

In the context of changing consumer demand for alternate or value added products, popularization of mince-based products assumes significance. Surimi or myofibrillar protein concentrate is the mechanically deboned minced fish, washed to remove blood, fat, soluble proteins and other odouriferous substances and stabilised by the addition of cryoprotectants. The absence of any flavour permits its utilisation as a vehicle for desired flavour addition in the production of analogue products. Any lean white fish, in general, is found to be suitable for the preparation of mince and mince based products.

Composition of major carps

Fish is a protein-rich food with high water content. The average moisture content for fresh rohu, catla and mrigal flesh are in the range of 79 -81% (Table 1). The average protein content in major carps ranged from 16-19%. Fat plays a crucial role in the development and storage of products from fish meat. The major carps in general belong to low to medium fatty fishes. The ash content and hence the mineral content of the fish showed only a marginal variation (Table 1). However, calculating on dry weight basis, it showed a clear variation in the ash content between the fish species but comparable with other species.

Table 1. Proximate composition of major carps

	Rohu	Catla	Mrigal
Moisture, %	79.26	80.72	77.82
Crude protein,%	18.41	16.98	19.25
Fat, %	1.01	1.12	1.25
Carbohydrate,%	0.85	1.12	1.12
Ash, %	1.02	1.17	1.56
Calorie value	86.13	82.48	92.73

Values are average of triplicate analysis

The proteins soluble in high ionic strength buffers reflect the actual content of structural or myofibrillar proteins. The water-soluble nitrogen fraction (Table 2) constitutes about 21% of total nitrogen, in general and in major carps the content of water soluble proteins ranged between 18 to 26g per 100g meat. The salt soluble fraction, reflect the actual content of structural proteins, i.e. the myofibrillar proteins, which are of significance as far as the production of surimi and fabricated seafood products are concerned. The actual salt soluble fraction (SSN) constituted 51-55% of total nitrogen with rohu showing moderately higher myofibrillar content followed by catla and mrigal (Table 2).

Table 2. Comparison of different protein fractions* of major carps

	Rohu	Catla	Mrigal
Water soluble nitrogen fraction	21.69	19.81	21.42
Salt soluble nitrogen fraction	58.31	50.94	54.36
Non protein nitrogen fraction	12.88	13.84	9.36
Alkali soluble nitrogen fraction	1.69	10.89	8.35
Stroma nitrogen fraction	2.37	2.63	2.82

* Per cent of total nitrogen

Values are average of triplicate analysis

Surimi or myofibrillar protein concentrate

Surimi is washed, refined fish mince, stabilised by cryoprotectants for a good frozen shelf life and to protect the functional properties of proteins. It has a great potential as a protein ingredient with specific properties, which make them suitable for the preparation of a number of fabricated food products.

Surimi is usually prepared from low fat white fish meat with good rheological and textural characteristics. Though, generally most of the fishes are suitable for the preparation of surimi, fish with low fat content is often preferred because of its storage characteristics. The nature of actomyosin, the principal component responsible for the functional properties of mince, decides the suitability of a particular species of fish for preparation of surimi. An elaborate processing schedule is necessary to get the desired quality washed mince and the washing process depends on the quality of mince from a particular fish. Since surimi preparation is species specific, establishing the exact correlation between washing methods and rheological characteristics becomes the task of the process.

Processing yield

The yield (Table 3) of dressed fish is 66% for rohu and about 35% machine-separated minced flesh is prepared based on the round weight. The yields for catla and rohu are 62% and 30% respectively for dressed fish and mince, while for mrigal a yield of 65% and 34% respectively is recorded.

Table 3. Yield of mince and surimi from major carps

	Rohu	Catla	Mrigal
Round fish	100.00	100.00	100.00
Dressed fish	65.60	61.88	65.08
Mince	35.40	30.71	34.36
Leached meat	24.53	23.54	24.12
Surimi	25.53	24.09	25.66

Each value is an average of three experiments

Water washing

The meat is separated from the skin-on fillets by passing through the perforated drum (5 mm) and rubber belt of a meat picking machine. The minced fish meat is agitated with four volumes of water containing 0.2% NaCl, for 10 minutes and filtered using two layer nylon mesh (mesh 26). The 1:4 meat to water, single wash exchange yielded 24%, 23% and 24% washed mince for rohu, catla and mrigal respectively. Cryoprotectants (4% sucrose, 4% sorbitol and 0.2% tripolyphosphate) are added to the washed mince and a final yield of 25.5%, 24% and 25.6% is obtained for rohu, catla and mrigal, respectively (Table 3). The proximate composition of the surimi from all the three fishes is given in Table 4. The protein content, compared to the composition of fish meal,

showed a reduction but major portion of it (almost 100%) is myofibrillar protein, suitable for product development.

Table 4. Proximate composition (% wet weight) of surimi from major carps*

Samples	Moisture (%)	Protein (%)	Fat (%)	Ash (%)
Rohu	77.30	15.13	0.57	2.57
Catla	77.52	14.59	0.31	1.70
Mrigal	76.80	14.57	0.41	1.85

* Surimi is composed of washed mince mixed with 4% sucrose, 4% sorbitol and 0.2% tripolyphosphate.

Gelling characteristics

The unwashed mince itself is found to have good elastic characteristics and gelling properties. The rheological properties (gel strength and compressibility) of the washed meat, however, increased as a result of washing. The compressibility of the cooked gel also increased by about 47%. In the case of catla, washing increased the gel strength and compressibility by more than 100% (Table 5). The compressibility data were significantly different from each other. Washed mrigal meat behaved almost similar to that of washed catla meat as far as gel strength is concerned, while the compressibility increased almost three times.

Table 5. Effect of washing on the rheological properties of major carps

	Rohu		Catla		Mrigal	
	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed
Folding test*	AA	AA	AA	AA	AA	AA
Gel strength, (g x cm)	190 ± 10	211 ± 6.0	211 ± 14.5	422 ± 14.7	246 ± 5.0	522 ± 12.0
Compressibility, (g)	159 ± 5.0	232 ± 22.0	100 ± 10.5	242 ± 14.2	85 ± 3.0	256 ± 9.0

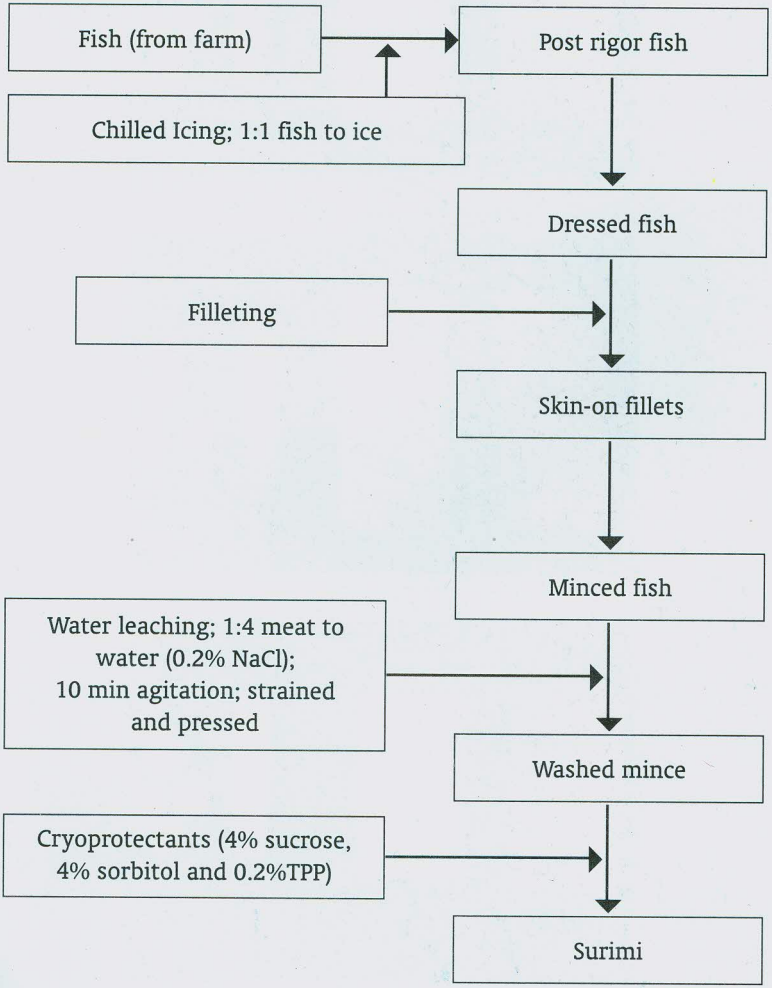
Values are mean of three determinations with standard deviation.

* Folding test grading - AA-no crack after folding twice

Thus, there is considerable loss in water extractable protein, with a marginal loss of myofibrillar potein during washing of fish meat. The elasticity of the gel, the gel strength and the compressibility of the fish meat show an increase as a result of washing. Mrigal had comparatively higher gel strength followed by catla and rohu. There are no interfering

substances like TMA in the meat of freshwater fish. Sufficient quality improvement as seen by colour, flavour and textural improvements of mince and kamaboko produced, is noticed in single wash itself. Hence, a single washing with mince to water (containing 0.2% NaCl) ratio of 1:4 is recommended for the processing of rohu, catla and mrigal mince for the preparation of surimi.

Flow Chart



Mince, surimi and kamaboka gel from major carps