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Valorization of Fish Processing Wastes through Recovery of Collagen and Collagen Peptides

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Majority of the global fish catch is utilized for human consumption, besides a considerable portion (20%) being discarded as post harvest losses. Fish going for human consumption are generally processed as fillets or minced meat depending on the convenience. Post processing of fish leads to generation of 50-60% of processing wastes in the form of skins, bones, fins, scales and even swimbladder, which are valuable sources of collagen.

Our study mainly focuses on the utilization of the processing wastes, mainly fish skin that constitutes 30% of the total weight of a puffer fish (*Odonus niger*) was used for the extraction of collagen using different organic acids along with proteolytic enzymes. Acetic acid with pepsin gave 11% yield. Collagen derived from skin was Type I collagen with typical (α1)2α2 chains having a denaturation temperature (Td) of 27-28°C. Collagen films were formed using different chemical and biological crosslinking agents and their mechanical and functional properties were examined. Tensile strength (6.40 MPa) and stiffness (325MPa) were high in collagen-transglutaminase (TG) films, where elongation (18%) and swelling rate (9.6%) were high in collagen-sorbitol films. Water solubility was low in collagen –glutaraldehyde film (6.4%). FTIR spectra clearly showed the interaction of collagen with crosslinking agents through shifts of amide peaks. SEM analysis indicated the formation of smooth and compact surfaces using TG and rough surfaces using k-carrageneen (KG). *In-vitro* degradation was minimal in collagen-TG films and hence, was considered the best collagen films for biomedical applications.

Recently, our studies are focussed on the extraction of collagen peptides directly from the fish skins by utilizing exogenous enzymes viz. trypsin, papain and alcalase. Collagen hydrolysates were first prepared using 1% enzyme at optimal conditions specific for the respective enzymes, and peptides of required molecular weight cut off (MWCO) were prepared using Tangenital Flow Filtration (TFF). Anti-oxidative, anti-hypertensive and anti-microbial properties of the collagen peptides were examined. Collagen peptides derived using alcalase and having MWCO > 30Kda only possessed anti-bacterial effect against pathogen, *Escherichia coli*. Anti-oxidative activities such as DPPH radical scavenging activity (92%), hydroxyl radical scavenging activity (95%), metal chelating ability (76%) were high in 1 Kda collagen peptides. The *in-vitro* bio-accessibility and bio-functional properties of collagen peptides hydrolyzed at different temperatures were examined through gastrointestinal simulated digestion studies. Results showed that bio-accessibility of collagen peptides hydrolyzed at 50°C was higher (54%) after gastric and pancreatic digestion, while those hydrolysed at 5°C exhibited good anti-oxidative property (90%). FTIR spectra showed major shifts in amide A, I and II peaks confirming the difference. To use collagen peptides as functional ingredients, peptides were microencapsulated with suitable stabilizers and their functional characteristics were examined. Mannitol at 20% yielded good microencapsulated spray dried collagen peptide powder than trehalose and maltodextrin. Cytotoxicity effect of collagen peptide powder was examined through mice experiments conducted following oral administration for 7 days. Histopathological examination showed no cytotoxicity was observed in intestinal villi, intestinal crypts, tunica serosa and sub-mucosal glands of small and large intestinal enterocytes. Our studies are continued further to examine the anti-osteoporetic properties of collagen peptides as a cure for osteoporosis.

Biography:

R. Jeya Shakila is Professor and Chair (04.01.2016 onwards) School of Harvest and Post Harvest Technology Fisheries College and Research Institute Tamil Nadu Fisheries University, Professor (26.06.2013 to 03.01.2016) Dept. of Fish Quality Assurance and Management Fisheries College and Research Institute Tamil Nadu Fisheries University Tamilnadu, India, Associate Professor (26.06.2007 to 25.06.2013) Department of Fish Processing Technology Fisheries College and Research Institute Tamil Nadu Veterinary & Animal Science University

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