# The study of protein-based biodegradable films prepared from lizardfish Saurida wanieso viscera（ワニエソの内臓からの生分解性フィルムに関する研究）

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# 博士学位論文内容要旨
# Abstract

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In order to obtain successfully the eco-friendly and non-toxic materials for food packaging, bio-based polymeric films are more concerned as an alternative approach for conventional petroleum-based materials. Protein-based film, one of the natural polymer-based film materials, is an outstanding candidate compared to other biological materials, including polysaccharides and lipids. Generally, proteins are abundantly available from sustainable animal resources; they are also biodegradable, and exhibit film-formation with suitable mechanical as well as barrier properties, and are of high nutritional value. Viscera is previously unsuitable for human consumption and are often discarded, although to some extent it is by-products. Thus, in this context, utilization of fish viscera as the main protein component in yielding biodegradable films might mark the new approach for the potential biomaterial. This is not only the production of value-added products in food packaging industry but also the effective solution for reducing pollution.

The results showed that protein-based films prepared from lizardfish viscera (stomach and intestines) could be achieved at pH 2, 3, 4 and 13, indicating their utility as new bioresource for food packaging in the context of environmental protection. All protein-based films from lizardfish viscera could completely block UV light transmission. The protein-based films at pH 3 and 4 were mechanically strong and

slightly deformable. Moreover, obtained protein-films prepared at pH 4, that is near neutral pH showed the potential in sustainable biomaterials in food packaging.

The heat treatment of film-forming solutions could affect the tensile strength and showed dominant hydrophobic interaction. Therefore, the positive impact of protein-based film properties prepared from lizardfish viscera by heating was found and these films could be used as biodegradable films and become potential biomaterials in food preservation and packaging.

Furthermore, high and low molecular weight chitosan, the bioactive polysaccharide, incorporation with viscera protein could improve mechanical and functional properties for biodegradable film. The incorporation with low and high MW of chitosan, the increase of tensile performance was observed for blend films. The blend films between polysaccharide-protein were improved to be more stable and functional. Therefore, these blend biodegradable films could be used as biodegradable films and applied in food packaging industry.

Next work was the application of biodegradable films on Bigeye tuna (*Thunnus obesus)* slices to examine protection by resulted films in reality. Tuna slices could be preserved by chitosan films and blend films through 6 days based on sensory, chemical and microbial properties, in comparison with unwrapped tuna and protein film-wrapped tuna. The blend films could not show the antimicrobial effect as the same as LDPE in preservation of tuna slices; however, it could be observed when comparing with unwrapping control samples. Therefore, the biodegradable blend films from viscera and chitosan showed good properties in remaining the safety and quality for Bigeye tuna slices through 8 day of storage (4 $^{o}$C).