UNIVERSITI PUTRA MALAYSIA

USE OF ALKALINE PROCESS FOR THE EXTRACTION OF GELATIN FROM THE RIVER JELLYFISH, Acromitus hardenbergi Stiasny, 1934

WAN NUR ATIKAH BINTI OMAR

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This project report is submitted in partial fulfillment of the requirements for the degree of Bachelor of Agriculture (Aquaculture)

DEPARTMENT OF AQUACULTURE

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CERTIFICATION OF APPROVAL

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This is to certify that I have examined the final project report and all corrections have been made as recommended by the panel of examiners. This report complies with the recommended format stipulated in the AKU 4999 project guidelines, Department of Aquaculture, Faculty of Agriculture, Universiti Putra Malaysia.

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ABSTRACT

The aim of this study was to investigate the effect of pre-treatments time and extraction temperatures by characterizing the jellyfish gelatin obtained using gelatin yield, proximate composition, amino acid composition, organoleptic characterizations and micrograph using scanning electron microscopy. Gelatin was extracted from edible jellyfish species, *Acromitus hardenbergi* by alkaline process at different of pre-treatment time (7, 10, 14 and 17 days) and heating temperatures (40ºC and 55ºC). The study indicates that the highest gelatin yield based on wet, dry and protein basis obtained from 14 day pre-treatment using 40ºC extraction temperature were 0.56%, 34.93% and 66.54%, respectively. However, analyses showed no significant differences in yield based on wet, dry and protein basis when compared with jellyfish gelatin obtained at 40ºC using 7 day of pre-treatment. The highest protein content was produced at 55ºC with 7 day of pre-treatments (88.22%). Glycine became the major amino acid in jellyfish gelatin in all treatments. Analyses showed no significant differences in glycine content of jellyfish gelatin extracted at 40ºC using 14 day of pre-treatment and at 55ºC using 7, 14 and 17 days of pre-treatment when compared with porcine gelatin ($P > 0.05$). The highest content of glycine, hydroxyproline and proline were obtained using 55ºC at 7 days of pre-treatment. Colours of jellyfish gelatin in all treatments were significantly different ($P < 0.05$) from each other and colour ranged from white, snowy white, creamy white to brownish. Brownish colour of jellyfish gelatin obtained from 55ºC at 7 days of pre-treatment was almost similar as bovine skin gelatin. Micrograph showed porous components within jellyfish gelatin from 40ºC (7, 10 and 17 pre-treatment days) and 55ºC (14 pre-treatment days) and their morphology were quite similar. The study showed there were complex interaction between temperature and pre-treatment days which affect the biochemical characteristics of jellyfish gelatin. This study indicates that alkaline method can be used to extract gelatin from jellyfish.

ABSTRAK

Tujuan kajian ini adalah untuk mengkaji kesan tempoh pra-rawatan serta suhu pengekstrakan dengan mengklasifikasikan gelatin obor-obor yang diperolehi melalui hasil gelatin, komposisi proksimat, komposisi asid amino, pencirian organolepsis dan mikrograf menggunakan pengimbasan mikroskop elektron. Gelatin telah diekstrak daripada spesies obor-obor yang boleh dimakan, *Acromitus hardenbergi* melalui proses alkali pada tempoh masa pra-rawatan (7, 10, 14 dan 17 hari) dan suhu (40ºC dan 55ºC). Kajian menunjukkan bahawa hasil tertinggi gelatin berdasarkan nilai hasil basah, kering dan protein asas adalah diperolehi daripada 14 hari pra-rawatan menggunakan suhu pengekstrakan 40ºC adalah 0.56%, 34.93% dan 66.54%, mengikut turutan. Walau bagaimanapun, analisis menunjukkan tiada perbezaan ketara pada nilai hasil basah, kering dan protein asas tersebut jika dibandingkan dengan nilai yang diperolehi menggunakan suhu 40ºC melalui 7 hari pra-rawatan. Komposisi protein tertinggi dihasilkan melalui 55ºC pada 7 hari pra-rawatan (88.22%). Glysin merupakan asid amino yang utama dalam gelatin obor-obor pada semua rawatan. Analisis menunjukkan tiada perbezaan ketara dalam kandungan glysin bagi gelatin obor-obor yang diekstrak pada suhu 40ºC menggunakan 14 hari tempoh pra-rawatan, 55ºC menggunakan 7, 14 dan 17 hari pra-rawatan jika dibandingkan dengan gelatin babi ($P > 0.05$). Kandungan tertinggi glysin, hidrosiprolin dan prolin tertinggi diperolehi menggunakan suhu 55ºC pada 7 hari pra-rawatan. Terdapat perbezaan yang ketara pada warna gelatin obor-obor bagi semua rawatan ($P < 0.05$) dan warna tersebut adalah berkala dari putih, putih salji, putih krim kepada perang. Warna perang pada obor-obor gelatin yang diperoleh pada suhu 55ºC menggunakan 7 hari pra-rawatan hampir menyerupai warna gelatin lembu. Mikrograf menunjukkan komponen berliang dalam gelatin obor-obor yang di hasilkan dari suhu 40ºC (7, 10 dan 17 hari pra-rawatan) dan 55ºC (14 hari pra-rawatan) dan morfologi kesemuanya agak sama. Kajian menunjukkan terdapat kesan interaksi yang kompleks disebabkan oleh suhu dan tempoh pra-rawatan yang memberi kesan terhadap klasifikasi biokimia gelatin obor-obor. Kajian ini menunjukkan bahawa proses alkali boleh gunakan untuk mengekstrak gelatin dari obor-obor.

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LIST OF ABBREVIATION AND SYMBOLS

%	percent
µg	microgram
$Ca(OH)_2$	calcium hydroxide
Cu	cuprum
$CuSO_4$	copper sulfate
g	gram
g/L	gram per liter
H_2O	water
HCl	hydrochloric acid
K_2SO_4	potassium sulfate
ml	milliliter
mm	millimeter
ºC	degree centigrade
rpm	rotation per minute
w/v	weight per volume

CHAPTER 1

INTRODUCTION

Gelatin is a gelling protein which has a broad scope of capability and uses (Wasswa *et al*., 2007; Karim and Bhat, 2009). Gelatin can be used in variety of industries either as an ingredient or a processing aid (Wittich, 2005). According to Holzer (1996), gelatin has been utilized in various industries such as food, pharmaceutical and photographic. Recently, its utilization is expanding to new applications such as functional foods (Jellouli *et al.*, 2011).

The extraction of gelatin from marine sources has considerably increased in the last few years since it is a suitable alternative to porcine and bovine gelatins, with promising functional properties (Uriarte-Montoya *et al.*, 2011). Therefore, studies have been focused on the extraction and characterization of gelatins from different marine species (Gómez- Guillén *et al*., 2011; Jongjareonrak *et al.,* 2010).

The study in gelatin from fish raw materials has been conducted lately due to outbreak of "mad cow disease" and increasing demands for non-mammalian gelatin for *halal* food industries (Jamilah and Harvinder, 2002; Karim and Bhat, 2009). However, limited research has been undertaken on gelatin from aquatic invertebrates such as cnidarians.

The river jellyfish (*Acromitus hardenbergii*) is one of the edible species found in Southeast Asia (Kitamura and Omori, 2010). Jellyfish has been commercially exploited and consumed by human as food especially in Chinese cuisine for over thousands of years, probably due to its high nutritive value and pharmacological activity (Hsieh *et al*., 2001; Yu *et al.*, 2006).

Jellyfish could be an abundant source of gelatin (Zhuang *et al.*, 2010a). Nowadays, the utilization of jellyfish is only limited to the processing of salted jellyfish which is the only preservation method to date and it is seriously limiting the utilization of jellyfish resource (Zhuang *et al.*, 2010a, 2010b). Therefore, it is important to develop new processing technologies and high-value products to adequately utilize the abundant jellyfish resource.

There is yet to be any reported information on biomaterial extraction from *Acromitus hardenbergi*. Therefore, the main objective of this research is to extract and characterize gelatin from *Acromitus hardenbergi* using alkaline process. The specific objectives of this research are:

1. To extract gelatin from the bell of *Acromitus hardenbergi* by using $Ca(OH)_2$ solutions at varying time of pre-treatments and heating temperatures.
2. To characterize gelatin obtained by yield of gelatin, proximate composition, amino acid composition, organoleptic characterizations and micrograph by scanning electron microscopy.

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