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Brama australis gel obtention and rheological characterization

Fernando A. Osorio[a*], Jennifer Crisostomo[a], Sergio Baeza [a], Silvia Matiacevich[a], Javier Enrione[a], Olivier Skurtys[a], Ruben Bustos [a]

[a]*Dpto. Ciencia y Tecnología Alimentos, Facultad Tecnológica, Universidad de Santiago de Chile-USACH Av.Ecuador Nº 3769, Estación Central, Santiago, Chile. fernando.osorio@usach.cl*

Abstract

Gelatine from marine sources has been looked upon as a possible alternative to bovine and porcine gelatine. Common problems connected with fish gelatine from cold water species, such as those from Chilean coast, are low gelling and melting temperature and low gel modulus. Squeezing flow technique was applied to obtain rheological parameters as function of moisture content, temperature dependence of extensional viscosity, etc. This work studied effects of pH and concentration on the extensional viscosity of *brama australis* fish gelatine gels using lubricated squeezing flow method and obtained that biaxial extensional viscosity increases with increasing Brama australis fish gelatine concentration.

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Keywords: squeezing flow; brama australis; fish gelatin; extensional viscosity

1. Introduction

Gelatine from marine sources (fish skin, bone and fins) has been looked upon as a possible alternative to bovine and porcine gelatine, especially since the outbreak of the BSE (mad cow disease) in the 80s. The commercial interest in fish gelatine has this far, however, been relatively low. This is due to different physical properties compared to mammalian gelatine. Common problems connected with fish gelatine from cold water species, such as those from Chilean coast, are low gelling and melting temperature and low gel modulus.

Several authors have used the squeezing flow technique to study rheological properties of foods [1]. This technique has been applied to products such as cheese, mayonnaise, tomato paste, wheat dough, yogurt and mustard, among others [2]. During the formation of foams, bubble boundaries expand biaxially and shrink in thickness in a manner similar to squeezing films; some phenomena occurring

* Corresponding author. Tel.: +56-2-718 0550; fax: +56-2-682 3536.
E-mail address: fernando.osorio@usach.cl

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during food intake can be modelled using squeeze flow: chewing between teeth and/or gums resembles a compression between (irregular) plates [3]. The squeezing flow technique has been applied to obtain rheological parameters such as power law model parameters, extensional viscosity, extensional viscosity as function of the moisture content, temperature dependence of extensional viscosity, etc. [2].

The lubricated squeezing flow viscometry technique is one of the basic types of biaxial extensional flow. The usual geometry to carry out the test consists of a bottom fixed plate where the sample is placed, and an upper plate operated at a constant downward speed. Samples are lubricated with a low viscosity fluid [4]. The following assumptions are made in lubricated squeezing flow viscometry [2]: a) perfect slip at the surface walls; b) negligible end effects; c) incompressible material; and d) constant temperature. The objective of this work was to study effects of pH and concentration on the extensional viscosity of *brama australis* fish gelatine gels using lubricated squeezing flow method.

Nomenclature

A_o	Sample Area, m^2
D	Distance traveled by plunger into the sample, m
D_o	Sample Diameter, m
F	Force of compression, N
h	Sample height at time t, m
h_o	Initial sample height, m
t	Time of compression, s
V	Compression speed, m s^{-1}

Greek Symbols

ε_b	Shear rate, s^{-1}
η_b	Extensional Viscosity, Pa s
σ	Biaxial Stress, Pa

2. Materials & Methods

Brama australis fish was obtained from the local market. The procedure by Nagai & Suzuki [5] was applied to *Brama australis* (skin) to prepare collagen. Moisture, proteins and ash analyses were performed to samples obtained in the laboratory according to the AOAC [6]. Lipids analyses were performed according Bligh & Dyer method [7].

Samples of *Brama australis* fish gelatine powder, produced in our laboratory, were prepared at 7; 9 and 11 % (w/v) at different pH values (4; 5.5; 7; 8.5 and 10). *Brama australis* fish gelatine powder was added to distilled water at room temperature and dissolved by increasing the controlled water bath temperature to 40°C while stirring. When the sample reached 40°C either a NaOH solution (0.5M) or HCl solution (0.5M) was added drop by drop until the desired pH, controlled by a pH-meter (Cole Parmer,