



FORMULATION OF CHONDROITIN SULFATE NANOPARTICLE WITH CHITOSAN AND KAPPA CARRAGEENAN USING THE IONIC GELATION METHOD

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ABSTRACT

Objective. Chondroitin sulfate is a widely used dietary supplement formulations, effective for the treatment of osteoarthritis. In oral preparations, chondroitin sulfate has low bioavailability. The alternative to improve bioavailability of a drug is by using nanoparticle technology. This study was aimed to formulate and characterize chondroitin sulfate nanoparticles with chitosan as polymer and kappa carrageenan as crosslinker. **Methods.** Nanoparticles were prepared by using ionic gelation method that was based on the electrostatic interaction between opposite charges. **Results.** The results showed that F₁ containing 0.1% chitosan, 0.1% chondroitin sulfate, and 0.05% kappa carrageenan at volume ratio of 10: 1: 1 was the best formula with an average particle size 582.9 nm, polydispersity index value of 0.324, and zeta potential value as much as -0.47 mV.

KEYWORDS: Chondroitin sulfate, Chitosan, Kappa carrageenan, Nanoparticles, Ionic gelation.

INTRODUCTION

Osteoarthritis (OA) is a joint disorder that often occurs in the world.^[1] Therapies commonly used are the nonsteroidal antiinflammatory drugs and preparations containing chondroitin sulfate. Several clinical trials showed that chondroitin sulfate has the ability to slow the progression of osteoarthritis.^[2]

In recent years, much research that utilizes nanoparticle technology for drug delivery systems.^[3] Various studies have also been developed, come to a focus in which pharmaceutical researchers strive to improve the effectiveness of the drug in the right amount. This is because the nanoparticles has many advantages such can penetrate the space between cells that small impenetrable by particles to large size, increasing the bioavailability of drugs.^[4] In addition, the encapsulation process can maintain the stability of the active substance from enzymatic reactions during the first pass effect.^[5]

Natural polymers often used in the manufacture of nanoparticles is chitosan and carrageenan. Chitosan is used very well because it has properties include safe, biodegradable, biocompatible, mucoadhesive, and hydrophilic.^[6] There are studies showing that the combination of chitosan-carrageenan has a promising potential as a carrier in drug delivery systems. Carrageenan types used in these studies is kappa carrageenan.^[7]

The method of making nanoparticles of the most interesting is the ionic gelation method. The principle of this method is the formation of particles based on ionic gelation method.

MATERIAL AND METHOD

Materials

Materials used in this study include Chondroitin sulfate (Bioiberica), Chitosan (Biotech Surindo), Kappa carrageenan (PT. Quadrant), Acetic acid and potassium bromide (merck), and aqua distilled (Brataco).

Methods

The method used in this study consists of several stages as follows:

1. Solubility test

Solubility testing chondroitin sulfate, chitosan, and kappa carrageenan based on the characteristics of each substance. A sample of 500 mg dissolved in the solvent and solubility observed.

2. Raw materials characterization by FTIR

Infrared spectrum of a sample powder of chondroitin sulfate, chitosan, kappa carrageenan, and the combination of chondroitin sulfate / chitosan / kappa carrageenan is measured. Each sample was weighed and crushed together with KBr in the ratio 1: 100. Then placed in a mold and compressed to form pellets. Pellets are placed in the sample container on the FTIR