

About the Quality of Chondroitin

Chondroitin is a widely used ingredient that occurs naturally in the body of warm-blooded animals, and forms an important building block of joint cartilage. Dozens of scientific studies with animals and humans have clearly demonstrated that dietary supplementation of chondroitin in combination with Glucosamine, another building block of cartilage, benefits joints. The best-known clinical study is the 4-year one known as the Glucosamine/chondroitin Arthritis Intervention Trial (GAIT), conducted at 16 sites across the United States. This double-blind, placebo-controlled study was sponsored by the government funded National Institute of Health (NIH), and was published in 2005 in the New England Journal of Medicine. This study, which enrolled nearly 1,600 patients, showed that when Glucosamine and Chondroitin were used in combination, they resulted in relief of knee pain in nearly 79% of patients with moderate to severe osteoarthritis; significantly more than either the placebo control group, or patients that were treated with the common NSAID drug Celecoxib (Celebrex).

The chondroitin sulfate offered to manufacturers of dietary supplements varies widely in quality, species of origin, and country of origin. Only through reliable testing by a qualified analytical laboratory can the manufacturer of chondroitin-containing products be certain of its potency. Unfortunately, this expensive ingredient is widely available in adulterated form, and may vary in potency more than perhaps any other ingredient in the largely unregulated health food industry, ranging from less than 10% to greater than 90% purity. Below we discuss this problem and what is being done to correct it.

Origin

Chondroitin sulfate is typically produced from cartilage obtained from cattle, pig, or poultry slaughterhouses, or as a byproduct of the shark fisheries industry. Shark cartilage is most widely used in Europe and Japan, while bovine chondroitin is more popular in the US. The worldwide availability of shark cartilage is rather limited, and much of the presumable marketed shark chondroitin on the market today is actually derived from bovine trachea. This true origin of the chondroitin can only be detected by rather expensive and detailed chemical analyses. Bovine trachea are widely available, and produce chondroitin molecules of smaller size, which can be more easily absorbed by the body. A disadvantage of bovine chondroitin is the common misconception that BSE, the source of mad cow disease, may be present. However, this fear is unfounded, as BSE prions can only occur in proteins, which are absent in good quality chondroitin, due to the complicated extraction processes.

Certificates do not tell the whole story...

Chondroitin sulfate varies widely in price. Cheap chondroitin, commonly referred to as "food grade" chondroitin, is commonly used for animal supplements, as well as in some low cost human supplements. This chondroitin consists mostly of molecules which have similar chemical characteristics to true chondroitin molecules, but are in fact different and not biologically active. While a product may claim, for example, to contain 200 mg per tablet, the actual beneficial chondroitin content could be less than 20 mg. Pharmaceutical grade chondroitin is typically five to ten times as expensive as food grade chondroitin, but should contain 90 - 98% pure chondroitin. Manufacturers of dietary supplements often rely on the "certificate of analysis" (CofA) of specific lots, and it is uncommon to verify the CofA concentration by an independent analytical laboratory. Even when manufacturers do have the source material tested, there may be no guarantee that the results will be accurate. The problem is that the analytical method currently accepted by the US Pharmacopeia (USP), the CPC titration method, is faulty, and can be easily tricked to give false positive results. This procedure treats molecules which are chemically related to chondroitin but are quite useless as true chondroitin. While a more reliable method is already available, it is optional, as it is not yet the "official" USP method.

It is quite possible that a CofA which states that the chondroitin concentration is >90% by USP, may in fact contain little, if any, real chondroitin. According to Dr. Ron Peterson of Shuster Laboratories, a renowned US testing lab, dozens of samples are received every week, mostly of Chinese origin. Shuster Labs is usually requested to analyze these samples for chondroitin following USP, i.e. the faulty CPC titration method. It is quite easy to understand how many producers can still legally claim high quality, i.e. >90% chondroitin, on their certificates for food-grade material.

Enzymatic HPLC

To put a halt to this practice, Dr. David Ji of Analytical Laboratory in Anaheim developed a new analytical method which takes advantage of the ability of certain specialized enzymes to break down chondroitin molecules into smaller parts, which can then be analyzed. Since only true chondroitin molecules are attacked by these enzymes, it is highly specific, and unaffected by the presence of chondroitin-like molecules. An added advantage is that the concentrations of the breakdown products, so-called Type A and Type C molecules, can yield an indication of the origin of the chondroitin, land-based or marine, and based on the known A/C ratio.

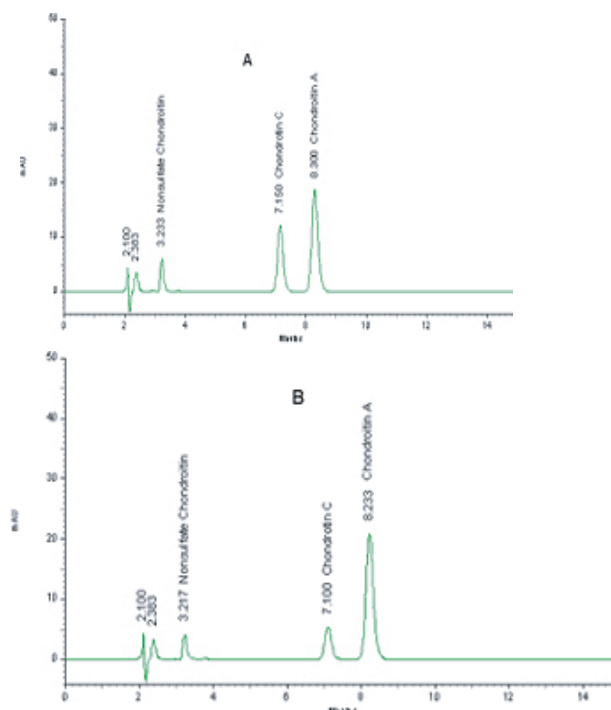


Figure 1: Typical chromatograph of chondroitin from bovine trachea (A) and from shark (B)

In response to a growing concern about the quality of chondroitin in today's supplement products, the enzymatic HPLC method has been proposed to replace the CPC titration method as the official USP method of testing. The method is currently being tested by multiple analytical laboratories, and following the expected positive outcome of this study, it is expected to become the new method of choice in circa 2008. Until that time the manufacturer of chondroitin containing supplements has no choice but to submit samples of the raw material to a qualified laboratory for analysis by enzymatic HPLC. To avoid being misled, consumers should put their trust in brand names and purchase chondroitin-containing human or pet health supplements only from reputable, high quality manufacturers.