

Fucoidan Research Update

Toxicological evaluation of fucoidan extracted from *Laminaria japonica* in Wistar rats.

Food Chem Toxicol. 2005 Mar;43(3):421-6.

However, there is no detailed report investigating the toxicity of fucoidan. In this study, the acute and subchronic (6 months) toxicity of varying levels of fucoidan extracted from *Laminaria japonica* was investigated in Wistar rats after oral administration. The results showed that no significant toxicological changes were observed when 300 mg/kg body weight per day fucoidan was administered to rats. But when the dose was increased to 900 and 2500 mg/kg body weight per day, the clotting time was significantly prolonged. Besides this, no other signs of toxicity were observed. Based on these results, it can be concluded that the no adverse effect level of fucoidan from *L. japonica* is 300 mg/kg body weight per day.

Immunomodulating activity of arabinogalactan and fucoidan in vitro.

J Med Food. 2005 Winter;8(4):446-53.

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Many polysaccharides obtained from natural sources are considered to be biological response modifiers and have been shown to enhance various immune responses. Here, we investigated the immunomodulating effects of arabinogalactan and fucoidan in vitro. Mouse spleen lymphocytes became cytotoxic to tumor cells after culture with arabinogalactan and fucoidan at concentrations of 10-100 microg/mL. These data suggest that arabinogalactan and fucoidan are activators of lymphocytes and macrophages. This property may contribute to their effectiveness in the immunoprevention of cancer.

Use of sulfated fucans as anticoagulant and antithrombotic agents: future perspectives.

Curr Pharm Des. 2004;10(9):967-81.

Sulfated alpha-L-fucans from brown algae (also known as fucoidan) have complex and heterogeneous structures but recent studies revealed the occurrence of ordered repeat units in the sulfated fucans from several species. Even in these cases, the presence of highly branched portions and the complex distributions of sulfate and acetyl groups highlight the heterogeneity of algal fucans. Another source of sulfated alpha-L-fucans (and their parental compounds sulfated alpha-L-galactans and fucosylated chondroitin sulfate) is marine invertebrates. The invertebrate polysaccharides have simple, ordered structures, which differ in the specific patterns of sulfation and/or position of the glycosidic linkages within their repeating units. The algal and invertebrate sulfated fucans have potent anticoagulant activity, mediated by antithrombin and/or heparin

cofactor II. As most of the studies were carried out with algal fucans it was not easy to trace a structure versus activity relationship. This aspect was clarified as studies were extended to invertebrate polysaccharides. These definitively established that regular, linear sulfated alpha-L-fucans and sulfated alpha-L-galactans express anticoagulant activity, which is not simply a function of charge density, but depends critically on the pattern of sulfation and monosaccharide composition. Sulfated alpha-L-fucans and fucosylated chondroitin sulfate also express antithrombotic activity when tested on in vivo models of venous and arterial thrombosis in experimental animals. These polysaccharides constitute potential therapeutic compounds as alternative to heparin and may help to design structure-based drugs with specific activity on each type of thrombosis episode and few side effects. They can also serve as research reagents to investigate and distinguish among a variety of interrelated events, such as coagulation, bleeding, thrombosis and platelet aggregation.

Anticoagulant activity of fucoidan from brown algae *Fucus evanescens* of the Okhotsk Sea.

Bull Exp Biol Med. 2003 Nov;136(5):471-3.

In vitro and in vivo experiments showed that anticoagulant activity of sulfated polysaccharide from *Fucus evanescens* (brown algae of the Okhotsk Sea) was similar to that of heparin. Anticoagulant properties of fucoidan are determined by thrombin inhibition mediated via plasma antithrombin III.

Immunostimulating and anticoagulating activity of fucoidan from brown algae *Fucus evanescens* of Okhotskoe sea

Antibiot Khimioter. 2003;48(4):11-3.

Fucoidan --nontoxic sulfated polysaccharide was isolated from brown algae *Fucus evanescens* in Okhotskoe Sea. Chemical analysis of the compound was performed, it was shown that fucoidan is freely soluble in water and acid solutions. Immunotropic and anticoagulating properties of the compound were evaluated in comparison with heparin. It was demonstrated that fucoidan in wide range of doses stimulated phagocytic and bactericidal activity at leucocytes of mice peritoneal exudate. Heparin on the contrary demonstrated depressive effect on these functions at high dose. It was shown that fucoidan has dose-dependent anticoagulating activity in vitro and in vivo comparable with heparin activity. The results of investigation demonstrated possibility of fucoidan application as immunomodulating and anticoagulating agent of plant origin.