

## Marine-derived polysaccharides to promote angiogenesis and neovascularisation

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The marine ecosystem is the largest aquatic ecosystem which covers more than 70% of earth's surface and accounts for 90% of habitable space on earth. Marine organisms are known for having special properties, such as resistance to fluctuating temperature and environmental conditions along with various other medicinal properties that make the marine-derived products beneficial for use in the treatment of different forms of cancer, Parkinson's disease and various other diseases. Sometimes the vitamins and minerals obtained from natural sources might not be of adequate amounts but marine organisms may have an abundance of those vitamins or minerals. Apart from that, they also have various properties that can improve the health conditions of patients with comorbidities or deficiencies. One such example would be fucoidan, a sulphated polysaccharide consisting of sulphated L- fucose extracted from the cell walls of brown algae. People with ischaemic diseases where there is insufficient supply of blood and oxygen to organs have benefitted from fucoidan as it promotes vascularisation and angiogenesis.

Fucoidan can bind to adhesion protein, growth factor, and cytokinin and can induce migration, proliferation and differentiation which form the basis of angiogenesis. On the other hand, sulphated polysaccharides, such as dextran, pentosan polysulphate, heparan sulphate and carrageenan are known to exhibit anti-angiogenic properties, such as inhibition of new vessel formation, endothelial cell proliferation and extracellular matrix adhesion. This is the preliminary stage of angiogenesis which later increases the oxygen transport in the cells. They also inhibit neovascularisation, hence they can be used to block the growth of tumour cells and increase the effectiveness of chemotherapy. In contrast, fucoidan when tested in vitro, is shown to promote neovascularisation in embryonic cells. Fucoidan can help in regulating biological activity which consists of angiogenic processes like heparin binding to proteases and cytokinins. Fucoidan also enhances endothelial progenitor cell functions and also affects many biological activities like coagulation, inflammation, fertilisation and infection. When fucoidan injections were given to patients with ischaemia, they were observed to have significantly increased angiogenesis and oxygen level in the ischaemia affected organs. Fucoidan has an affinity to ligate to the endothelium which can further trigger signalling events. Hence, this proves that fucoidan is a vital drug that can promote angiogenesis and the revascularisation of ischaemic tissues.

*Keywords: Marine-derived, Fucoidan, Sulphated polysaccharide, Angiogenesis, Neovascularisation*

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