

Bioactive Sulfated Polysaccharides from Invertebrates

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Sulfated polysaccharides have been found in a variety of marine animals, plants and microorganisms. Carragenans and fucoidan are the typical examples of sulfated polysaccharides extracted from red seaweed and brown algae. Tecogalan sodium, a sulfated polysaccharide isolated from the bacterium *Arthrobacter*, acts as an angiogenesis inhibitor by inhibiting the binding of basic fibroblast growth factor to its cellular receptors. Sulfated polysaccharides have also show a potent inhibitory activity against several different viruses. We isolated three sulfated polysaccharides from African giant snail, clam, and eel skin, respectively. First, acharan sulfate (AS) isolated from the body of the giant African snail *Achatina fulica* is a glycosaminoglycan (GAG), having the structure $\rightarrow 4)$ -2-acetamido-2-deoxy- α -D-glucopyranose(1 \rightarrow 4)-2-sulfo- α -L-idopyranosyluronic acid (1 \rightarrow). This GAG represents 3-5% of the dry weight of this snail's soft body tissues. AS demonstrates anti-tumor activities probably due to inhibition of angiogenesis and immunomodulatory activity. It also showed antithrombotic activity by preventing blood clot formed by thrombin *in vivo*. Second, we found a new type of D-galactan sulfate with β -(1 \rightarrow 3) glycosidic linkage from *Meretrix petechialis* (clam). The anti-HIV activity of the polysaccharides has been evaluated by the inhibition of syncytia formation. The fusion index and percent fusion inhibition of sulfated galactan were 0.34 and 56% at 200 μ g/mL. Third, dermatan sulfate was isolated from eel skin (*Anguilla japonica*) by actinase and endonuclease digestions followed by β -elimination reaction and DEAE-Sephacel chromatography. The content of IdoA2S α 1 \rightarrow 4GalNAc4S sequence in eel skin, which is known to be a binding site to heparin cofactor II, was two times higher than that of dermatan sulfate from porcine skin. The anti-IIa (thrombin) activity of eel skin dermatan sulfate mediated through heparin cofactor II (HCII) was 26units/mg, whereas dermatan sulfate from porcine skin shows 23.2 units/mg. These results suggest that invertebrates are the good sources of new types of sulfated polysaccharides having diverse biological activities.