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Polyphenolic-polysaccharide conjugates from flowers and fruits of single-seeded hawthorn (*Crataegus monogyna* Jacq.): Chemical profiles and mechanisms of anticoagulant activity

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Polyphenolic-polysaccharide conjugates from flowers and fruits of single-seeded hawthorn (*Crataegus monogyna* Jacq.): chemical profiles and mechanisms of anticoagulant activity.

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### Abstract

The polyphenolic-polysaccharide conjugates were isolated from flowers and fruits of medicinal plant *Crataegus monogyna* Jacq. (Lindm.) by the alkaline extraction, followed by neutralization, partitioning with organic solvents and dialysis against water. The isolates from flowers as well as from fruits were homogenous macromolecular compounds, with a molecular weight over  $760 \times 10^3$  g/mol and  $970 \times 10^3$  g/mol, respectively, what was assessed in HPGPC analysis. Both products were characterized spectrophotometrically, and by GLC-MS, FT-IR and NMR techniques. They were composed of polyphenolic matrices containing some flavonoid units and of polysaccharide structures rich in galacturonic acid with low esterification degree. Moreover, galactose, glucose, rhamnose and arabinose residues, with different proportions of monosaccharides were present, depending on the type of the starting plant material. Both plant preparations were able to prolong the plasma coagulation process *in vitro* tests, even at the concentration of 31.25  $\mu$ g/mL. However, they differed in the mechanisms of the activity, where only the product isolated from flowers of *C. monogyna* was highly selective in its action. It was mainly the non-direct inhibitor of factor Xa, mediated by antithrombin, where such mechanism of activity is typical for highly sulphated glycosaminoglycans.

**Keywords:** *Crataegus monogyna*; Anticoagulant activity; Factor Xa inhibitor

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