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Bioactive polymer of plant origin – Prospective therapeutic agent

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The caffeic cid-derived polyether, namely poly[oxy-1-carboxy-2-(3,4-dihydroxyphenyl) ethylene] or poly[3-(3,4-dihydroxyphenyl) glyceric acid] (PDPGA) was isolated and identified in the water-soluble, high-molecular weight fractions obtained from extracts of different species of Boraginaceae family. According to data of 13C, 1H NMR, APT, 2D 1H/13C HSQC, 1D NOE and 2D DOSY experiments the polyoxyethylene chain is the backbone of the polymer molecule. 3,4-Dihydroxyphenyl and carboxyl groups are regular substituents at two carbon atoms in the chain. The repeating unit of this regular polymer is 3-(3, 4-dihydroxyphenyl) glyceric acid residue. Most of the carboxylic groups of PDPGA from *Anchusa italica* and *Symphytum grandiflorum* unlike the polymer of *S. asperum, S. caucasicum* and *S. officinale* are methylated. The 2D DOSY experiment gave the similar diffusion coefficient for the methylated and non-methylated signals of PDPGA. Both sets of signals fell in the same horizontal. This would imply a similar molecular weight for methylated and non-methylated polymers.Then basic monomeric moiety of this polymer, 3-(3, 4-dihydroxyphenyl) glyceric acid (DPGA) was synthesized via Sharpless asymmetric dihydroxylation of *trans*-caffeic acid derivatives using an osmium catalyst. Besides, it is well known that epoxides are valuable synthons in organic synthesis and have been introduced into pharmaceutical applications. Subsequently, the building block for the production of derivatives of PDPGA, methyl 3-(3,4-dimethoxyphenyl)glycidate was synthesized based on the Darzen reaction or by oxidation of *trans*-caffeic acid with oxone in order to produce in future derivatives of synthetic analogue of natural polymer through ring-opening polymerization of 2,3-disubstituted oxirane. PDPGA is endowed with intriguing pharmacological properties as anti-complementary, antioxidant, anti-inflammatory, burn and wound healing and anticancer properties. *S. caucasicum* PDPGA and DPGA exerted anti-cancer efficacy *in vitro* and *in vivo*. However, our results showed that anticancer efficacy of PDPGA is more effective compared to its synthetic monomer. Overall, this study identifies *S. caucasicum* PDPGA as a potent agent against PCA without any toxicity, and supports its clinical application.

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