Injectable thermoresponsive polymer for brachytherapy

Jan Kučka1,2,3, Martin Hrubý2,*, Pavla Poučková1, Ondřej Lebeda1,3 and Marie Zadinová1

1Institute of Biophysics and Informatics, First Faculty of Medicine, Charles University in Prague, Salımovska 1, 120 00 Prague 2, Czech Republic; 2Institute of Macromolecular Chemistry AS CR, v.v.i., Heyrovsky Sq. 2, 162 06 Prague 6, Czech Republic; 3Nuclear Physics Institute AS CR, v.v.i., Husinec-Řež 130, 250 68 Husinec-Řež, Czech Republic; *corresponding author, e-mail: mhruby@centrum.cz

Brachytherapy with radioactive implants is a common method for the local radiotherapy of solid tumours. Pronounced dose-dependent tumour growth reduction was achieved in PC3 human prostate adenocarcinoma bearing mice by single dose of injectable intratumoural brachytherapy with 131I-labeled thermoresponsive polymer [poly(N-isopropyl acrylamide)] (PNIPAA). Two doses of the radionuclide were used, 2 MBq/mouse and 25 MBq/mouse, respectively. The higher dose caused gradual tumour volume reduction, while the lower dose caused tumour growth retardation only. The effects of both doses were statistically significant compared to untreated controls, see Figure 1.

![Figure 1](image-url)

**Figure 1.** Tumour volume as a function of time after application of the radiolabeled polymer; n = 6.

We have chosen 131I as a well-established therapeutic β− emitter (half-life 8.02 d) with reasonable range of β-particles in tissue and appropriate half-life that fits to the local depo lifetime of PNIPAA1. The polymer was administered intratumourally (0.1 ml/animal) as 2 wt-% solution in dimethylsulfoxide in volume activities 20 and 250 MBq/ml, respectively. Although PNIPAA is not chemically biodegradable, it is nontoxic even at high concentrations2. Moreover it is slowly washed out from the application site and eliminated from the body via both hepatobiliary route and renal excretion1.

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