SHORT COMMUNICATIONS

SMALL DIAMETER VASCULAR GRAFT: DEVELOPMENT AND MODIFICATION

CHANDRA P. SHARMA
Biosurface Technology Division, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum 695 012, India.

DEVELOPING a small diameter (< 5mm) vascular graft involves not only developing, a suitable material which is nontoxic, noninflammatory, nondegradable, sterilizable with matching mechanical compliances and fabricable, but also creating a physicochemical surface acceptable to the biological environment while in contact with blood for a prolonged period.

The polymer which we choose for our purpose is polyether urethane urea based on its good blood compatible properties. The synthesis of this polymer was done in our Laboratory via solution polymerization[1]. To a solution of 5g of the poly (propyleneglycol) M.W.~1000, in a mixture of 10ml of dimethylsulfoxide and 10ml of 4-methylpentanone-2, was added 2 mole, equivalents of methylene *bis* (4-phenylisocyanate). The reaction mixture was stirred and heated at 100–115° C for 1.5 hr. The mixture was then cooled to 25° C and a 1 mole. equivalent of ethylenediamine added with vigorous stirring. The complete reaction was done under N_2 atmosphere. The viscous solution was slowly warmed to 50–60° C for 1 hr and then poured into distilled water to precipitate the polymer. The polymer was washed and dried in a vacuum oven at 60° C. The yield was essentially quantitative ~90%. The reaction is shown in figure 1. Inherent viscosity (DMF solvent) is ~0.5 g/dl at 30° C at concentration 0.5g% and the polymer melts at 310° C.

The IR spectra of the polymer film casted from 20g% solution in dimethylformamide was taken,, which showed characteristic peaks at 3200–3400 cm^{-1}, 1100–1125 cm^{-1} and 1380 cm^{-1} for -NH stretching, C-O-C stretching and -CH_3 symmetrically bending respectively.

The polymer was dissolved (20g%) in dimethyl formamide. Several glass rods, of proper diameter were chosen, and washed chromic acid cleaning mixture, then rinsed with copious amounts of distilled water. These clean glass rods were then rotated vertically with appropriate speed in polymer solution and then in distilled water. Polymer gets coated on glass rods. These glass rods were then dried in hot air oven at 60° C for ~30 min. The procedure was repeated several times (usually three times) to get appropriate thickness ~0.2mm. They were left overnight in distilled water and next day the graft could be removed easily from glass rods. This was the basic methodology of fabricating our vascular grafts. They are then dried again formally at 60° C for 30 min. in hot air oven. These grafts have good tensile stress ~ 100 kg/cm^2 and % elongation ~160% for a gauge length of 25.4 mm and crosshead speed 20 mm/min. Pore size ~70 ± 20μ and number of pores on the surface 5000 ± 1000/sq cm.

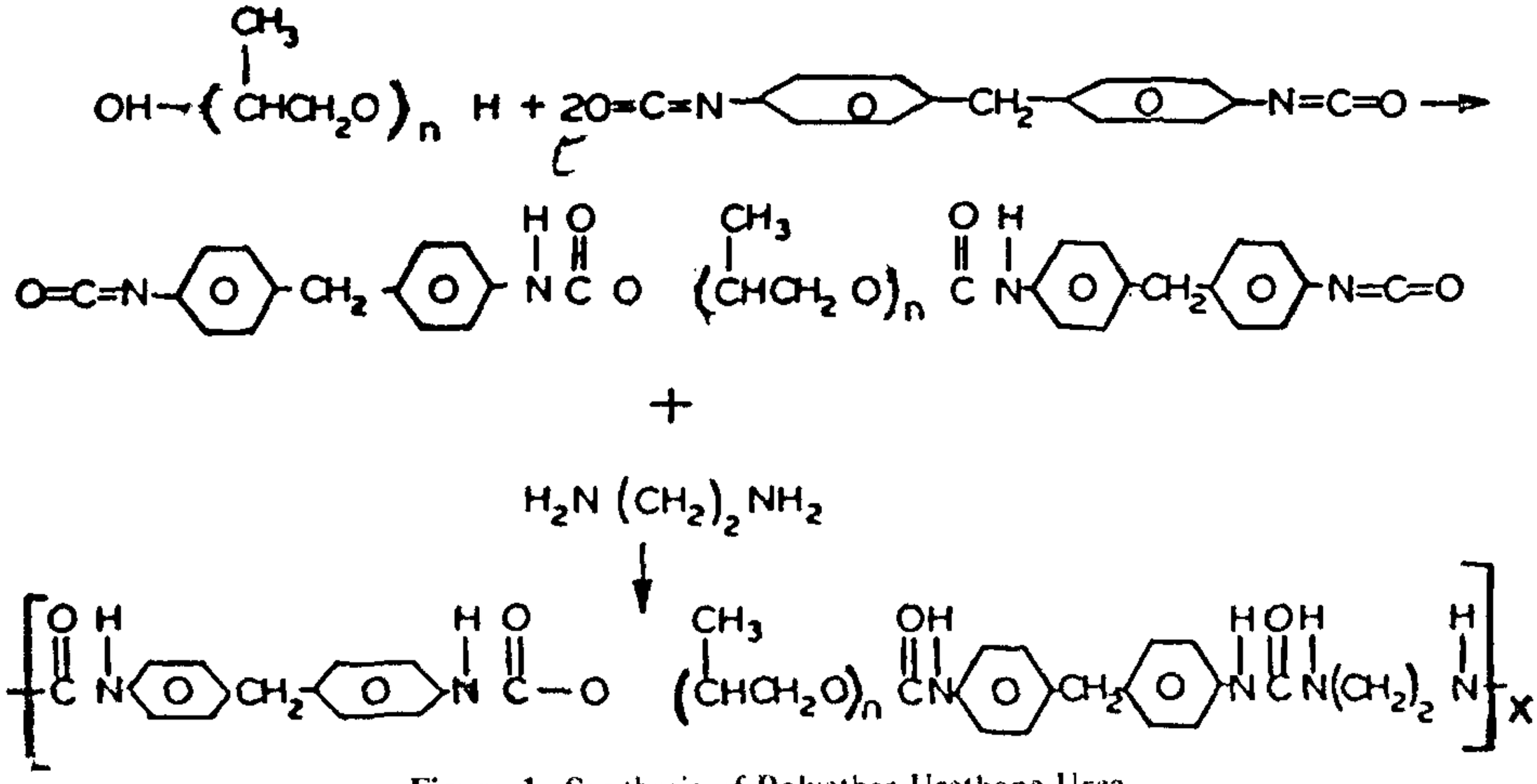

Figure 1. Synthesis of Polyether-Urethane-Urea.

Since, albuminated surfaces are found to be blood compatible[2], the surface of these grafts was modified by coating with albumin in such a way that it does not leach off. To do so, we first exposed our grafts to albumin solution in phosphate buffer, pH 7.4 (50 mg%) for about 2½ hr taking care of air/water interface as described elsewhere[2]. These grafts were then rinsed in distilled water vigorously and then irradiated[3] for about two and half hr to ^{60}Co source (0.25 MHz/hr). After irradiation the grafts were again exposed in albumin solution (50 mg%) as before for two and one half hours, rinsed again and exposed to glutaraldehyde (2.5%) for one hour in clean room and stored in 0.5% glutaraldehyde until used.

Such albuminated grafts showed negligible platelet adhesion[3] (1.25 ± 0.6 in the vision field microscopically compared to ~4.0 Bare grafts) and found uniform on the basis of contact angle observations[3] (of water contact angle $\sim 67.0 \pm 2.0$). Details of the platelet adhesion and contact angle techniques have been described elsewhere[2].

These grafts (diameter 4.5–5.00 mm) are currently being tried as replacement for iliac artery in mongrel dogs and the early results appear promising.

Further attempts are being made to expose such grafts for about an hour to albumin again. So that, more albumin molecules may get immobilised through the process of glutaraldehyde coupling[4]. In this case *in vivo* test for prolonged period may prove to be superior. Since the uppermost layer of albumin is least affected conformationally compared to the natural protein. More studies related to the platelet adhesion and changes due to conformational variations of albumin during grafting with irradiation time is being reported elsewhere[3].

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BIOASSAY OF HERBICIDAL ACTIVITY WITH PIGMENT CONTENT AND CO_2 FIXATION

P. S. DUBEY
School of Studies in Botany, Vikram University, Ujjain 456 010, India.

THE primary site of action of different herbicides could generally be located in photosynthesis, respiration or nucleic acid metabolism[1]. The present study is aimed to evaluate the effect of four herbicides, with different primary sites of action, on the photosynthesis.

Vicia faba was grown in green house at $20 \pm 2°$ C with a 14 hr photoperiod. The pots, with one-month old plants were supplied with cobex (N, N 3-diethyl 2,4 dinitro-6-trifluromethyl-1,3 benzene diamine), dalapon (2,2-dichloropropionic acid), 2,4-D (2,4-dichlorophenoxyacetic acid) and simazine (2 chloro-4, 6-*bis* (ethylamino)-*s*-triazine), at a concentration of 50 ppm on w/w basis. The duration of the treatment was 5 days, 2 days, 6 hr and 1 hr. Leaching by water was avoided during the treatment. These potted plants were placed in chambers where $^{14}CO_2$ was generated by reacting Ca $^{14}CO_3$ (30 microcurie) and 10 ml of 1N HCl. The material of middle leaves (5 g) was crushed with 10 ml of distilled water and 1 ml of the aliquot was counted for ^{14}C. The pigment concentration was determined according to Arnon[2], Duxbury and Yentsch[3].

The data indicate that irrespective of tne mode of action, the pigment contents in leaves got lowered with all the herbicides experimented. Though the primary site of action of triazines is in photosynthesis, simazine induced the loss of pigments in *V. faba* even at one hour treatment. But cobex, with the primary site located in nucleic acid metabolism, and 2,4–D, a hormone type of weed killer, too affected the pigment contents. The small loss in pigments with dalapon (five days treatment) points towards a weaker secondary effect. The pigment contents and the corresponding fixation of carbon dioxide prove that the herbicides, not primarily designed to affect photosynthesis also affect it. However, this reduction, whether due to destruction or inhibition of their biosynthesis is not known. In susceptible varieties the killing action is thus supplemented by low photo-synthetic activity and ultimate starvation.

In other studies[4,5] the chlorophylls have been used as indicators of residual toxicity; the data obtained here confirm the use of pigment content in the evaluation of the new cultivars against the herbicides.

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