Lactosylated Polymers for Tissue Engineering

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Abstract

This thesis describes the synthesis of new polymers suitable for the support of in vitro hepatocyte growth. The key design feature of the monomers investigated was the incorporation of a galactose residue, expected to promote the adhesion and proliferation of hepatocytes in vitro, through the regioselective derivation of lactose.

A graft polymerisation strategy was investigated as an alternative to co-polymerization, since it proved difficult to isolate the carbohydrate-derived monomers in sufficient purity. This led to the formation of a glutaraldehyde-crosslinked lactosylated polyamine hydrogel, which was found to perform well in initial cell trials.

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List of Abbreviations

ALG	Ca-alginate gels
Azo88	1,1'-azobis (cyclohexanecarbonitrile)
Boc	*tert*-butoxycarbonyl
CD	cyclodextrin
^{13}C DEPT135	carbon distortionless enhancement by polarization transfer
^{13}C NMR	carbon nuclear magnetic resonance
2D COSY	two-dimensional correlation spectroscopy
DCM	dichloromethane
DIEA	*N*-*N*-di-isopropylethylamine
DMF	*N*,*N*-dimethylformamide
ECMs	extracellular matrices
EDC	1-ethyl-3-(3-dimethylaminopropyl)-carbodiimide
EG	ethylene glycol
ES MS	electron spray mass spectroscopy
FPLC	fast protein liquid chromatography used here for gel filtration chromatography
GC	galactosylated chitosan
HA	hyaluronic acid
HMQC	heteronuclear multiple quantum coherence
^{1}H NMR	proton nuclear magnetic resonance
HPLC	high performance liquid chromatography
IR	infra-red
LCST	lower critical solution temperature
MeOH	methanol
Mw	molecular weight
NVP	*N*-vinyl-2-pyrrolidone
P (……)	poly (……)
PAAc	poly (acrylic acid)
PAAm	poly (acrylamide)

PAN	poly (acrylonitrile)
PBO	poly (butylene oxide)
PCL	poly (caprolactone)
PE	propylene fumarate
PEG	poly (ethylene glycol)
PEMA	poly (ethyl methacrylate)
PEO	poly (ethylene oxide)
PGEMA	poly (glucosylethyl methacrylate)
PHB	poly (hydroxy butyrate)
PHEMA	poly (hydroxyethyl methacrylate)
PHPMA	poly (hydroxypropyl methacrylamide)
PLA	poly (lactic acid)
PLGA	poly (lactic-co-glycolic acid)
PMMA	poly (methyl methacrylate)
PNIPAAm	poly (*N*-isopropyl acrylamide)
PNVP	poly (*N*-vinyl pyrrolidone)
PPO	poly (propyleneoxide)
PS	poly (styrene)
PVA	poly (vinyl alcohol)
PVAc	poly (vinyl acetate)
PVLA	poly (N-*p*-vinylbenzyl-4-*o*-β-D-galactopyranosyl-D-gluconamide)
RGD	arginine-glycine-aspartic acid sequence
RT	room temperature
Sty	styrene
TE	tissue engineering
TEMED	*N,N,N',N'*-tetramethyl-ethylenediamine
TFA	trifluoroacetic acid
UPD	under potential deposition
UV-Vis	ultraviolet-visible
VAc	vinyl acetate
Mc	Molecular wight of the crosslinked gel

TBTU	O-(Benzotriazol-1-yl)-*N,N,N',N'*-tetramethyluronium tetrafluoroborate