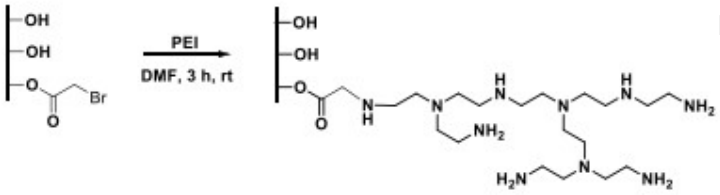


I

It will be appreciated that in alternative embodiments a different reactant may be used to esterify the cellulose in a similar reaction, such as other halogenated acyl halides, suitably chloroacetyl chloride, chloroacetyl bromide, and bromoacetyl chloride; or halogen propionyl or butyryl halide.

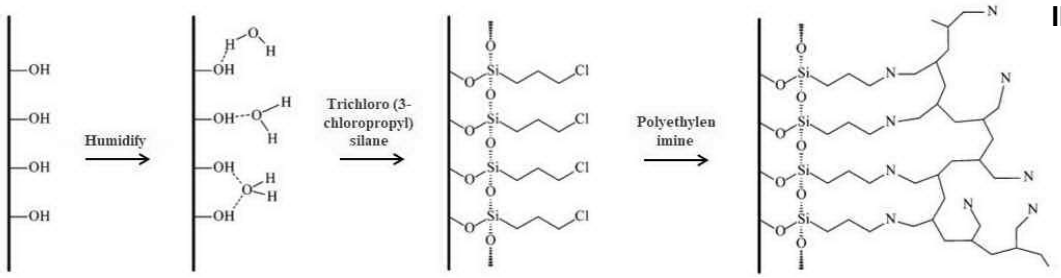
The bromoacetylated form of the lignocellulose is further reacted with a polyamine also in the presence of DMF at room temperature in order to achieve a highly substituted lignocellulose derivative. In the present embodiment of the invention, the amine utilised in the second step of the reaction is a branched polyethyleneimine (PEI) according to the following reaction scheme II:



II

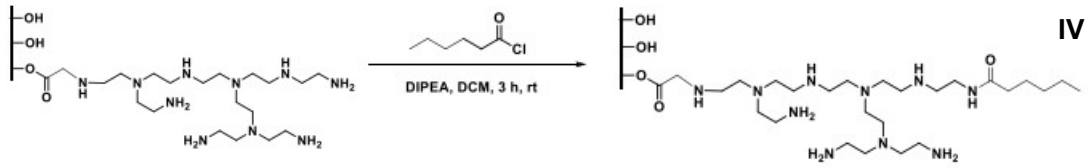
It will be appreciated that straight chain (linear) PEI may also be used, as well as other polyamines, such as polypropyleneimine (PPI), poly(allylamine), poly(vinylamine), poly(N-methylvinylamine), polylysine, poly(4-aminostyrene), poly(diallyldimethylammonium chloride), polyhexamethylene guanidine, polyhexanide, poly(methylene co-guanidine), or poly(acrylamide-co-diallyldimethylammonium chloride).

In another embodiment the particulate, support material is a silica gel. In this embodiment, the silica surface is hydrated then activated by reaction with Trichloro(3-chloropropyl)silane in hexane solvent. The product is dried, and then the polyamine is covalently bound, by reacting in a methanol solvent according to the following reaction scheme III.



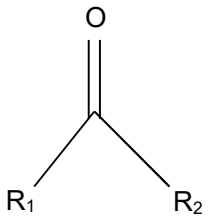
III

The substituted, particulate solid support product is further reacted in a third step with, for example, an acylating agent, suitably an acyl or aryl acid halide. In the present embodiment of the invention, hexanoyl choride is used in the acyl substitution of primary amines within the PEI group bonded to the solid support. The hexanoyl chloride is dissolved in dichoromethane (DCM) and the reaction is carried out also at room temperature in the presence of the base and catalyst diisopropylethylamine (DIPEA), as set out in the following reaction scheme IV, the hydrophobic group is linked to the polyamine via an amide bond:



IV

It will be appreciated that in alternative embodiments of the invention the acylating agent may comprise a compound of the formula:



Wherein:

R_1 is a C2-C22 branched, linear or cyclic alkyl; or an aryl group

R_2 is a halide.

Typically R_1 is selected from a C2-C22, suitably a C4-C8, linear saturated or unsaturated alkyl group, most suitably selected from a butyl, hexyl or octyl group. Optionally R_1 is selected from an isopropyl, isobutyl or isohexyl group. R_1 may comprise a cycloalkyl selected from a cyclobutyl or cyclohexyl group. Where R_1 is an aryl, typically the aryl is selected from a phenol or benzyl group.

R_2 is typically selected from a chloride or a bromide.

Alternatively the polyamine covalently bound to a granular solid support material may be modified by covalent addition of a C2-C22 hydrophobic group by one of the following reactions: