Claims

1. A polymer material comprising mesopores disposed between melamine-formaldehyde co-polymer nano-particles and wherein micropores extend within the co-polymer nano-particles, wherein the melamine-formaldehyde co-polymer is composed of repeating units of a monomer having a ring structure.

2. The polymer material as claimed in claim 1, wherein the polymer material has a surface area of at least 300 m^2/g.

3. The polymer material as claimed in claim 2, wherein the surface area is at least 600 m^2/g.

4. The polymer material as claimed in claim 3, wherein the surface area is in the range of 600 m^2/g to 1200 m^2/g.

~~5. The polymer material as claimed in any one of the preceding claims, wherein the melamine-formaldehyde co-polymers are composed of repeating units of monomers which have a ring structure.~~

~~6~~5. The polymer material as claimed in claim ~~5~~1, wherein amine functional groups extend around the periphery of each monomer ring structure.

~~7~~6. The polymer material as claimed in claim ~~5~~1 ~~or claim 6~~, wherein in each monomer ring structure, an alkyl bridge extends between a pair of melamine groups.

~~8~~7. The polymer material as claimed in claim ~~7~~6, wherein the alkyl bridge is a methyl.

~~9~~8. The polymer material as claimed in any one of claims ~~5~~1 to ~~8~~7, wherein each monomer ring structure comprises three melamine groups ~~are provided in each monomer ring structure~~.

~~10~~9. The polymer material as claimed in any one of claims 2 to ~~9~~8, wherein the total pore volume of the mesopores and the micropores is in the range of 0.7 cm^3/g to 3.5 cm^3/g.

~~11~~10. The polymer material as claimed in any one of claims 2 to ~~10~~9, wherein the total pore volume of the micropores is in the range of 0.06 cm^3/g to 0.21 cm^3/g.

~~12~~11. The polymer material as claimed in any one of claims 2 to ~~11~~10, wherein the size of said mesopores is in the range of 5 nm to 50 nm.

~~13~~12. The polymer material as claimed in any one of the preceding claims, wherein the size of said mesopores is in the range of 5 nm to 20 nm.

~~14~~13. The polymer material as claimed in any one of claims 2 to ~~13~~12, wherein the size of said micropores is 2 nm or less.

~~15~~14. A sorbent material for adsorbing gas comprising the polymer material as claimed in any one of the preceding claims.

~~16~~15. A sorbent material for adsorbing gas comprising an agglomeration of melamine-formaldehyde co-polymer nano-particles with mesopores extending between said nano-particles and ~~wherein~~ micropores extending within the nano-particles, and wherein the melamine-formaldehyde co-polymer is composed of repeating units of monomers having a ring structure.

~~17~~16. A sorbent material as claimed in claim ~~16~~15, wherein the sorbent material exhibits the ability to adsorb carbon dioxide gas.

~~18~~17. A sorbent material as claimed in claim ~~17~~16, wherein the adsorption capacity of carbon dioxide gas is at least 10 wt% based on the total weight of the sorbent material, measured at 1 atm, 0°C.

~~19~~18. Use of the polymer material as claimed in any one of claims 1 to ~~15~~13 to adsorb a gas.

~~20~~19. The use as claimed in claim ~~19~~18, wherein the gas is carbon dioxide or carbon monoxide.

~~21~~20. A method of removing at least one of carbon dioxide gas and carbon monoxide gas from a gas stream containing said at least one of carbon dioxide gas and carbon monoxide gas, the method comprising the step of contacting the gas stream with a polymer material as claimed in any one of claims 1 to ~~14~~ 13 to adsorb at least one of said carbon dioxide gas and carbon monoxide gas thereon.

~~22~~21. A method of making a ~~polymer material~~melamine formaldehyde co-polymer comprising the step of reacting melamine with formaldehyde in the presence of a non-aqueous polar aprotic solvent.

~~23. The method as claimed in claim 22, wherein the non-aqueous polar solvent is an aprotic solvent.~~

~~24~~22. A method as claimed in claim ~~23~~21, wherein the aprotic solvent is selected from sulfoxides and sulfones.

~~25~~23. The method as claimed in claim ~~24~~21, wherein the aprotic solvent is selected from an aliphatic sulfoxide.

~~26~~24. The method as claimed in claim ~~25~~23, wherein the aliphatic sulfoxide has 2 to 10 carbon atoms.

~~27~~25. The method as claimed in claim ~~26~~24, wherein the aliphatic sulfoxide has 2 to 6 carbon atoms.

~~28~~26. The method as claimed in claim ~~27~~25, wherein the aliphatic sulfoxide is dimethyl sulfoxide.

~~29~~27. The method as claimed in any one of claims ~~22~~21 to ~~28~~26, wherein the reaction step is undertaken at a temperature of between 120°C to 180°C.

~~30~~28. The method as claimed in any one of claims ~~22~~21 to ~~29~~27, wherein the non-aqueous polar solvent is provided in admixture with an aqueous medium.

~~31~~29. The method as claimed in claim ~~30~~28, wherein said aqueous medium is water.

~~32~~30. The method as claimed in claim ~~31~~29, wherein the volume ratio of polar solvent to water is from 1:1 to 3:1.

~~33~~31. The method as claimed in any one of claims ~~22~~21 to ~~32~~30, wherein the molar ratio of formaldehyde to melamine is in a range from 1 to 5.

~~34~~32. The method as claimed in claim ~~33~~31, wherein the molar ratio of formaldehyde to melamine is in a range from 1.5 to 2.5.

~~35~~33. The method as claimed in any one of claims ~~22~~21 to ~~34~~32, wherein said reacting step is undertaken for a period of from 48 hours to 120 hours.

~~36~~34. The method as claimed in any one of claims ~~22~~21 to ~~35~~33, wherein the reaction step is undertaken in a closed pressure reactor.

~~37~~35. The method as claimed in any one of claims ~~22~~21 to ~~35~~34, wherein the reaction step is undertaken in a partially heated reactor.