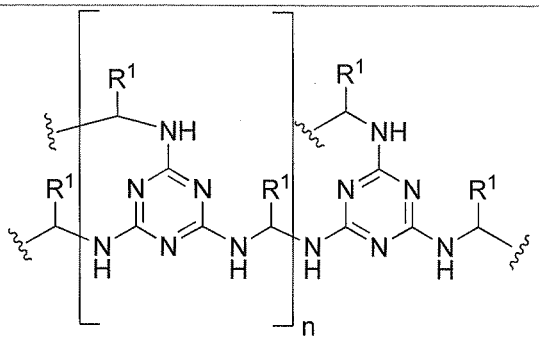
Claims

1. A melamine-aldehyde polymer when used to reduce the amount of a metal in a liquid sample, wherein the polymer has pores with a volume in the range of about 1.5 to 5 cm^3/g and wherein the melamine-aldehyde polymer is represented by the structure shown below



wherein n is a whole number greater than 2 and R^1 can be hydrogen, alkyl, cycloalkyl, alkenyl, cycloalkenyl, alkynyl, aryl, aralkyl, heterocycloalkyl, or heteroaryl.

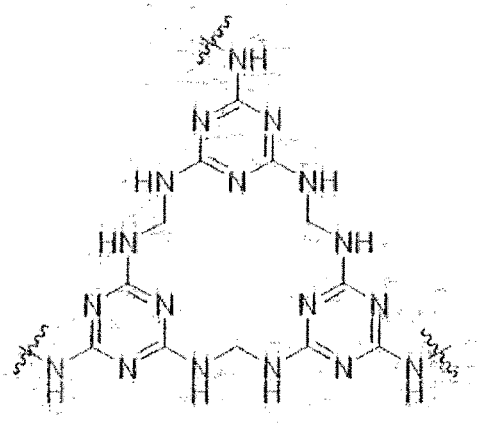
2. The polymer of claim 1, wherein the polymer has pore sizes in the range of about 2 nm to about 40 nm.

3. The polymer of claim 1, wherein the polymer has a BET surface area greater than about 400 m^2/g.

4. The polymer of any one of claims 1, wherein the aldehyde is formaldehyde.

5. The polymer of claim 4, wherein the polymer comprises melamine and formaladehyde in a molar ratio of about 1:1.5 to about 1:2.

6. The polymer of claim 4, wherein the polymer is represented by the structure shown below



~~6.~~7. The polymer of claim 1, wherein the polymer is disposed onto a carrier suitable for water treatment or incorporated into a filtration device suitable for water treatment or disposed onto a carrier and incorporated into a filtration device suitable for water treatment.

~~7.~~8. A method of reducing the amount of a metal in a liquid sample, the method comprising the step of:

a. contacting the liquid sample with a polymer according to claim 1 thereby forming a polymer metal complex and a purified liquid sample,

wherein the amount of the metal in the purified liquid sample is lower than the amount of metal in the liquid sample.

~~8.~~9. The polymer metal complex of claim ~~8~~7, wherein the polymer metal complex has a weight-weight ratio of 0.001:1 to 1:1.

~~9.~~10. The method of claim ~~8~~7, further comprising the step of:

b. separating the purified liquid sample and the polymer metal complex.

~~10.~~11. The method of claim ~~8~~7, wherein the metal is a heavy metal.

~~11.~~12. The method of claim ~~8~~7 or ~~9~~8, wherein the metal is lead, copper, cadmium, palladium, or combinations thereof.

~~12.~~13. The method of claim ~~8~~7, wherein the contacting occurs for at least 5 seconds.

~~13.~~14. The method of claim ~~8~~7, wherein the contacting occurs at a pH greater than about 4.

~~14.~~15. The method of claim ~~8~~7, wherein the amount of metal in the liquid sample is in an amount between 50 ppb to about 300,000 ppb.

~~15.~~16. The method of claim ~~8~~7, wherein the amount of the metal in the purified liquid sample is reduced to an amount below about 50 ppb.

~~16.~~17. The method of claim ~~8~~7, wherein the amount of the metal in the liquid sample is reduced by about 60% to about 99.99% after the step of contacting the liquid sample with the polymer according to claim 1.

~~17.~~18. The method of claim ~~8~~7, wherein the amount of sodium, potassium, or calcium in the liquid sample is reduced by less than about 5% after the step of contacting the liquid sample with the polymer according to claim 1.

~~18.~~19. The method of claim ~~8~~7, wherein the polymer is disposed onto a carrier suitable for liquid treatment or incorporated into a filtration device suitable for liquid treatment or disposed onto a carrier and incorporated into a filtration device suitable for liquid treatment.

~~19.~~20. The method of claim ~~8~~7, further comprising the steps of:

c. contacting the polymer metal complex with an acid thereby forming a protonated polymer; and
d. contacting the protonated polymer with a base thereby regenerating the polymer according to claim 1.

~~20.~~21. The method of any one of claims ~~8~~7-20~~19~~, wherein the liquid sample is water.

~~21.~~22. A method for preparing a polymer according to claim 1, the method comprising the step of contacting melamine with an aldehyde thereby forming the polymer according to claim 1, wherein the step of contacting occurs at a temperature greater than 100° C and a pressure greater than 100 kPa in an acid digestion bomb.

~~22.~~23. The method of claim 22~~21~~, wherein the step of contacting occurs in a solvent which is a polar aprotic solvent.

~~23.~~24. The method of claim of 23~~22~~, wherein the aldehyde is formaldehyde or a formaldehyde equivalent.

~~24.~~25. The method of claim 22~~21~~, wherein the ratio molar of melamine to aldehyde is about 1:1.5 to about 1:2.

~~25. Use of a melamine-aldehyde polymer to reduce the amount of a metal in a liquid sample, wherein the polymer has pores with a volume in the range of about 1.5 to 5 cm^3/g.~~