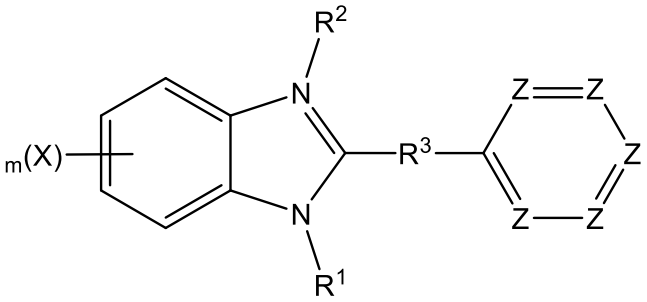
CLAIMS

What is claimed is:

1. A composition, comprising: a compound or salt thereof of formula (I), methanesulfonic acid~~an acid~~, and sulfolane~~a polar aprotic solvent~~;



(I)

wherein

X is independently hydrogen, halogen, or a substituted or unsubstituted C_{1-5} alkyl group, and m is 1, 2, 3, or 4;

R^1 is hydrogen, a substituted or unsubstituted C_1-C_{12} alkyl group, or a substituted or unsubstituted ~~C_4-~~C_6 aryl group;

R^2 is absent, hydrogen, a substituted or unsubstituted C_1-C_{12} alkyl group, or a substituted or unsubstituted C_6 aryl group;

R^3 is a bond or CHR^4;

R^4 is hydrogen, halogen, NR^5R^6, or OR^5;

wherein R^5 and R^6 are each independently hydrogen, a substituted or unsubstituted C_1-C_{12} alkyl group, or a substituted or unsubstituted C_4-C_6 aryl group; and

Z is independently nitrogen, CX, or N^+R^5;

wherein:

a concentration of the compound or salt of formula (I) in the composition is 1 wt% to 50 wt%;

a concentration of the methanesulfonic acid~~acid~~ in the composition is 5 wt% to 60 wt%; and

a concentration of the ~~polar aprotic solvent~~sulfolane in the composition is 0.001 wt% to 30 wt%.

2. The composition of claim 1, further comprising water.

3. The composition of any one of claims 1-2, wherein

X is independently hydrogen or halogen;

R^1 is hydrogen;

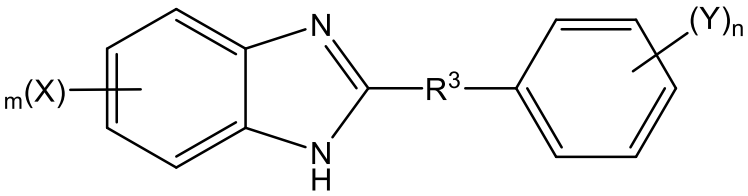
R^2 is absent; and

R^3 is CHR^4.

4. The composition of any one of claims 1-3, wherein at least one Z is nitrogen.

5. The composition of any one of claims 1-4, wherein R^3 is a bond and at least one Z is nitrogen.

6. The composition of claim 1, wherein the compound or salt thereof is of formula (II)



(II)

wherein

Y is independently hydrogen, halogen, or a C_{1-5} alkyl group; and n is 1, 2, 3, 4, or 5.

~~7. The composition of any one of claims 1-6, wherein the acid is a strong inorganic acid, a strong organic acid, or any combination thereof.~~

~~8. The composition of any one of claims 1-7, wherein the acid is selected from sulfuric acid, hydrochloric acid, nitric acid, methanesulfonic acid, phosphoric acid, sulfamic acid, aminomethylphosphonic acid, p-toluenesulfonic acid, and any combination thereof.~~

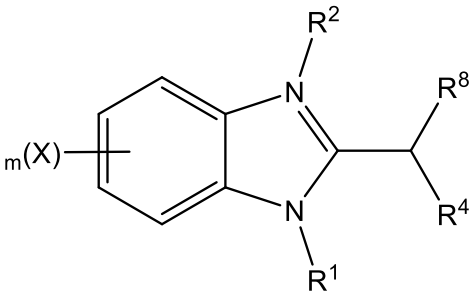
~~9. The composition of any one of claims 1-8, wherein the polar aprotic solvent is selected from acetonitrile, *N,N*-dimethylformamide, acetone, dimethylsulfoxide, sulfolane, N-methylpyrrolidinone, methylsulfonylmethane, chlorobenzene, o-dichlorobenzene, nitromethane, an ionic liquid, and any combination thereof.~~

~~10~~7. The composition of any one of claims 1-~~9~~6, wherein the composition is homogenous liquid.

~~11~~8. The composition of any one of claims 1-~~10~~7, further comprising a high temperature stable phase transfer catalyst.

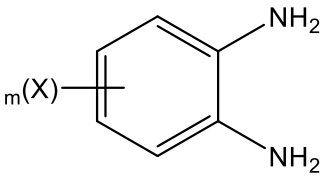
~~12~~9. The composition of claim ~~11~~8, wherein the high temperature stable phase transfer catalyst is selected from the group consisting of an alkyl guanidinium salt, an aryl guanidinium salt, an alkyl phosphonium salt, an aryl phosphonium salt, a peralkylated phosphazenium salt, and any combination thereof.

~~13~~10. A process for making a compound or salt thereof of formula (V), comprising:

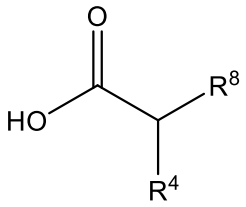


(V)

heating a mixture comprising a compound or salt thereof of formula (III), a compound or salt thereof of formula (IV), methanesulfonic acid~~an acid~~, ~~a polar aprotic solvent~~sulfolane, and a high temperature stable phase transfer catalyst,



(III)



(IV)

wherein

X is independently hydrogen, halogen, or a C_{1-5} alkyl group, and m is 1, 2, 3, or 4;

R^1 is hydrogen, a substituted or unsubstituted C_1-C_{12} alkyl group, a substituted or unsubstituted ~~C_4-~~C_6 aryl group;

R^2 is absent, hydrogen, a substituted or unsubstituted C_1-C_{12} alkyl group, a substituted or unsubstituted ~~C_4-~~C_6 aryl group;

R^4 is hydrogen, halogen, NR^5R^6, or OR^5;

wherein R^5 and R^6 are each independently hydrogen, a substituted or unsubstituted C_1-C_{12} alkyl group or a substituted or unsubstituted C_4-C_6 aryl group; and

R^8 is hydrogen, halogen, a substituted or unsubstituted C_1-C_{12} alkyl group, a substituted or unsubstituted C_5-C_6 heteroaryl group, a substituted or unsubstituted C_4-C_6 aryl group, or a substituted or unsubstituted C_3-C_{12} cycloalkyl group.

~~14. The process of claim 13, wherein the acid is a strong inorganic acid, a strong organic acid, or any combination thereof.~~

~~15. The process of any one of claims 13-14, wherein the acid is selected from sulfuric acid, hydrochloric acid, nitric acid, methanesulfonic acid, phosphoric acid, hydrobromic acid, formic acid, acetic acid, propionic acid, oxalic acid, malic acid, citric acid, aminomethylphosphonic acid, p-toluenesulfonic acid, sulfamic acid and any combination thereof.~~

~~16. The process of any one of claims 13-15, wherein the polar aprotic solvent is selected from acetonitrile, *N,N*-dimethylformamide, acetone, dimethylsulfoxide, sulfolane, N-methylpyrrolidinone, methylsulfonylmethane, chlorobenzene, o-dichlorobenzene, nitromethane, an ionic liquid, and any combination thereof.~~

~~17~~11. The process of ~~any one of~~ claim~~s 13-16~~10, wherein the high temperature stable phase transfer catalyst is selected from the group consisting of an alkyl guanidinium salt, an aryl guanidinium salt, an alkyl phosphonium salt, an aryl phosphonium salt, a peralkylated phosphazenium salt, and any combination thereof.

~~18~~12. The process of any one of claims ~~13-17~~10-11, wherein the mixture is heated to a temperature of from 80 °C to 160 °C.

~~19~~13. The process of any one of claims ~~13~~10-~~12~~~~18~~, wherein the mixture is heated for a period of time ranging from 30 minutes to 12 hours.

~~20~~14. The process of any one of claims ~~13-19~~10-13, wherein the mixture comprises an actives concentration of from 1 to 50% by weight.

~~21~~15. The process of any one of claims ~~13-20~~10-14, further comprising adding to the mixture a carboxylic acid.

~~22~~16. Use of a composition according to any one of claims 1-~~12-~~9 for inhibiting corrosion.

~~23~~17. A composition comprising the compound or salt thereof of formula (V) prepared according to the process of any one of claims ~~13-21~~10-15, methanesulfonic acid, sulfolane, and a high temperature stable phase transfer catalyst, wherein:

a concentration of the compound or salt of formula (V) in the composition is 1 wt% to 50 wt%;

a concentration of methanesulfonic acid in the composition is 5 wt% to 60 wt%; and

a concentration of sulfolane in the composition is 0.001 wt% to 30 wt%.

~~24~~18. A method of inhibiting corrosion, comprising:

adding a composition according to any one of claims 1-~~12-~~9 to an industrial water system comprising a metallic surface.