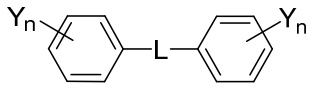
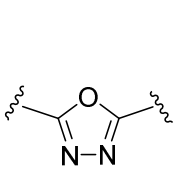
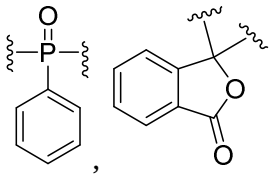
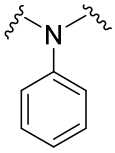
CLAIMS

1. A mesoporous polymeric material comprising one or more cyclodextrins crosslinked with at least an equimolar amount of one or more aryl fluorides, wherein the aryl fluoride is an aryl fluoride of formula (I):



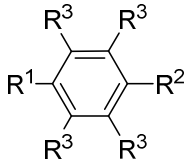
(I)

wherein L is Aryl, -$S(O)_2$-, -C(O)-, bond,  ,  , or 

and

wherein each Y is independently H, F, CF_3, SO_3H, or NO_2, with the proviso that n=0-5 and at least 2 of Y are F; or

an aryl fluoride of formula (II):



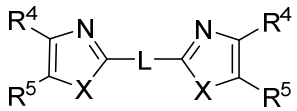
(II)

wherein R^1 is F or CN;

R^2 is F, CN, or NO_2; and

wherein each R^3 is independently H, F, or Cl, with the proviso at least 2 of R^1, R^2, or R^3 is F; or

an aryl fluoride of formula (III):



(III)

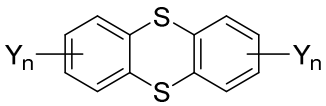
wherein L is Aryl;

X is O or S;

each R^4 is independently F or CF_3; and

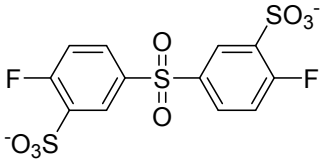
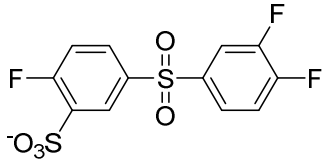
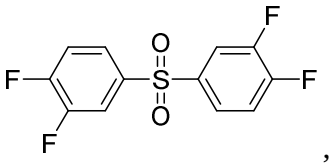
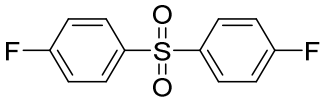
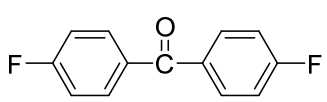
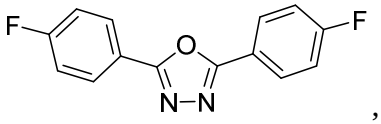
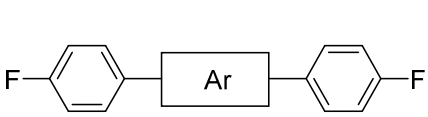
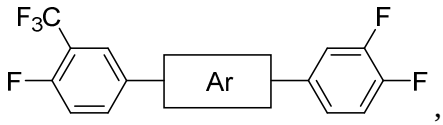
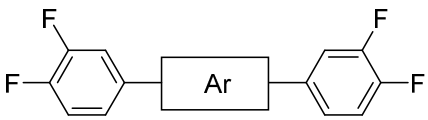
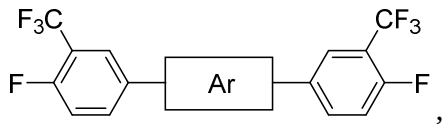
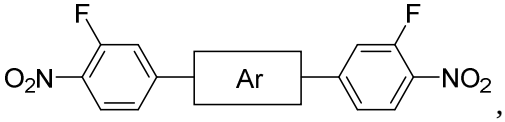
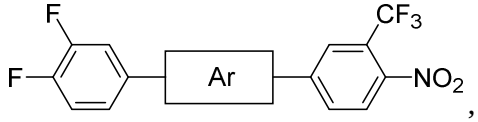
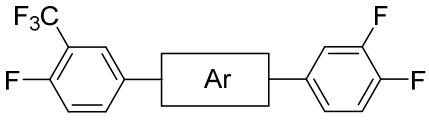
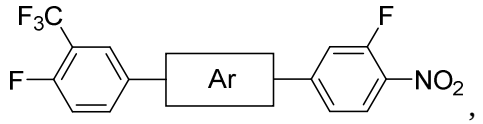
each R^5 is independently F or NO_2, with the proviso that at least 2 of R^4 and R^5 are F; or

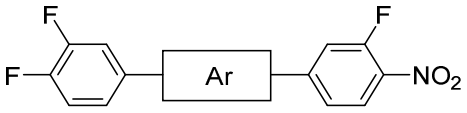
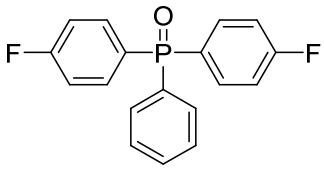
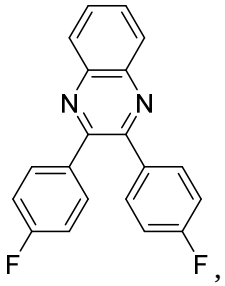
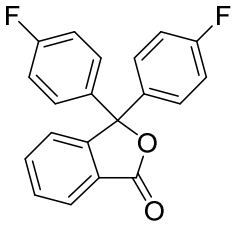
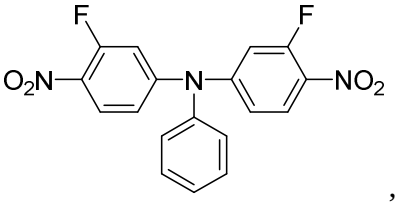
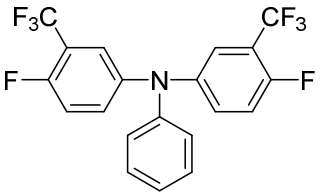
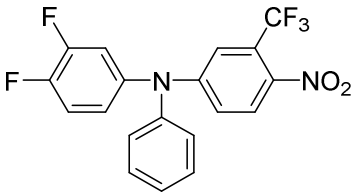
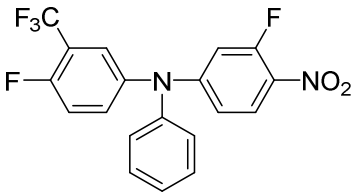
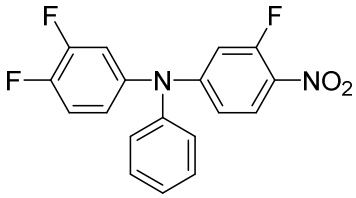
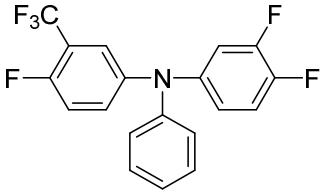
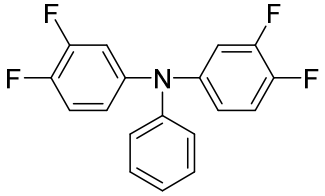
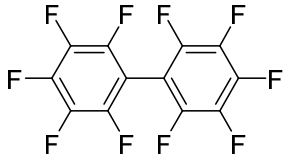
an aryl fluoride of formula (IV):



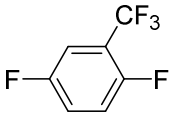
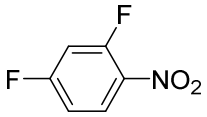
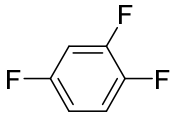
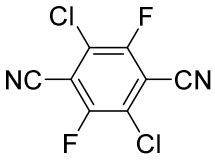
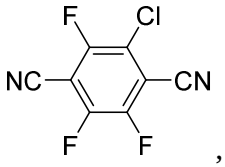
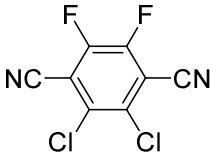
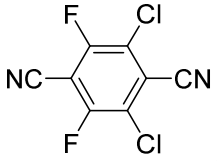
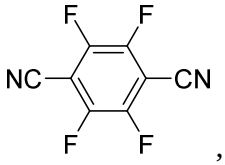
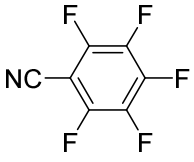
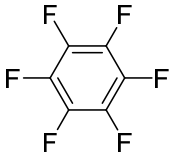
wherein each Y is independently H, F, Cl, CF_3, SO_3H, or NO_2, with the proviso that n=0-5 and at least 2 of Y are F.

2. The mesoporous polymeric material of claim 1, wherein the aryl fluorides of formula (I) are selected from the group consisting of:

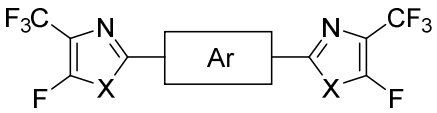

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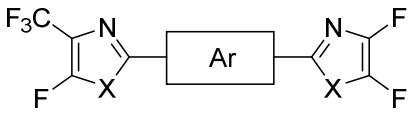












and
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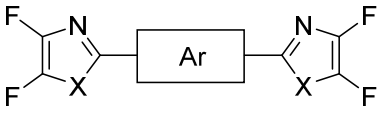
the aryl fluorides of formula (II) are selected from the group consisting of:

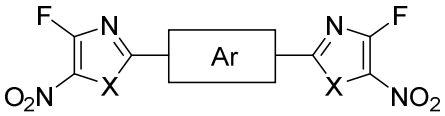










and
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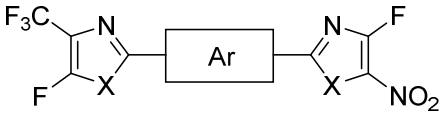
the aryl fluorides of formula (III) are selected from the group consisting of:

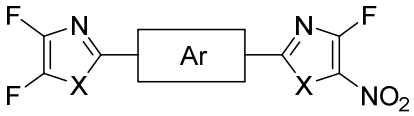


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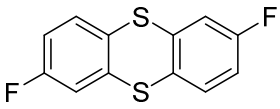
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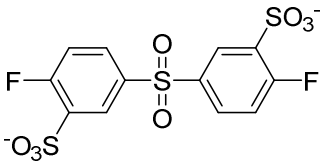
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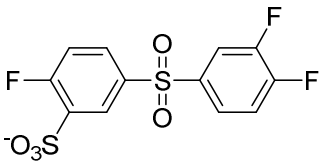
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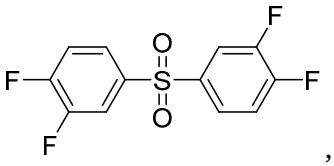
the aryl fluoride of formula (IV) is 

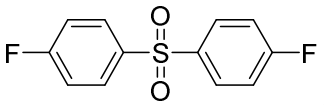
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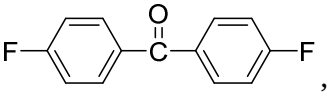
3. The mesoporous polymeric material of claim 1, wherein the aryl fluoride is an aryl fluoride of formula (I) and is selected from the group consisting of:

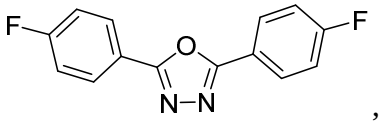


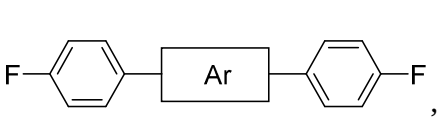
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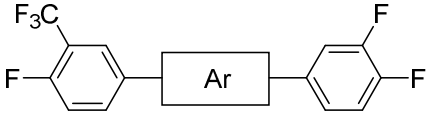
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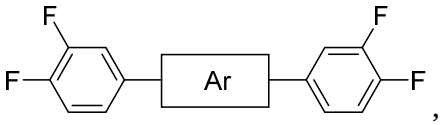
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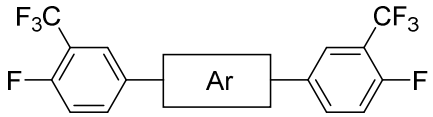
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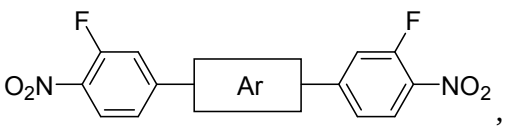
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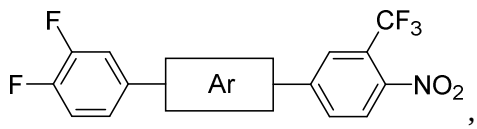
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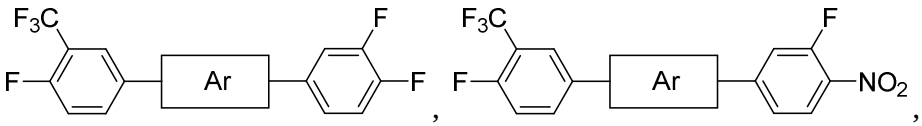
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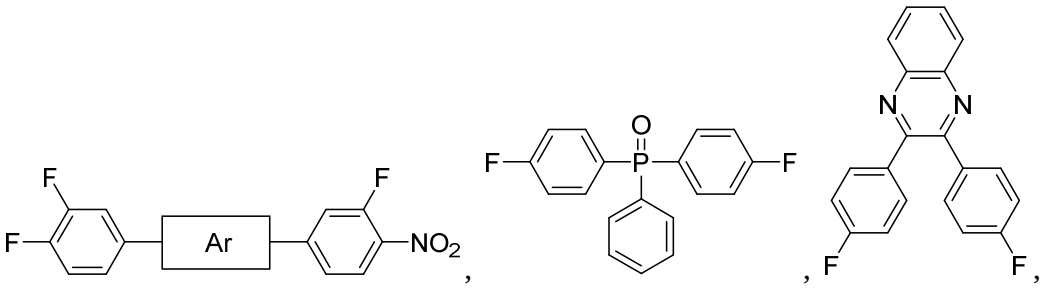
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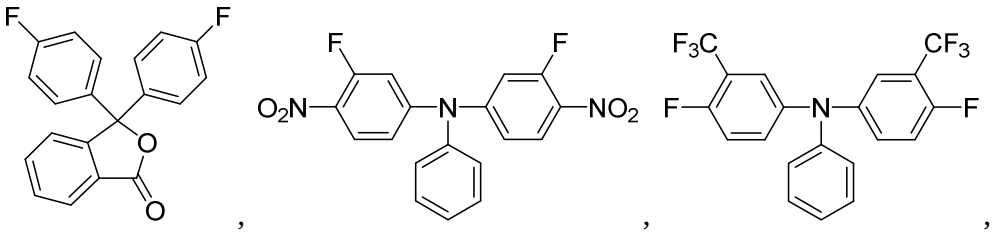
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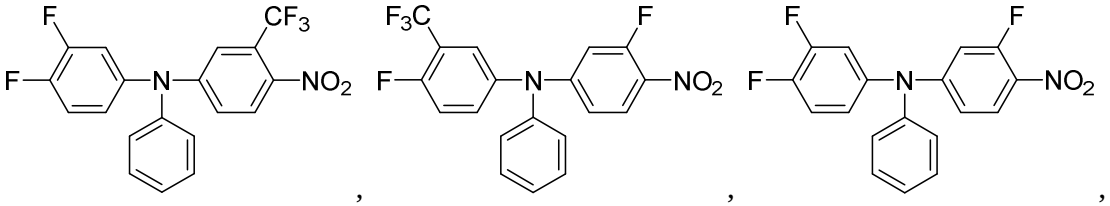
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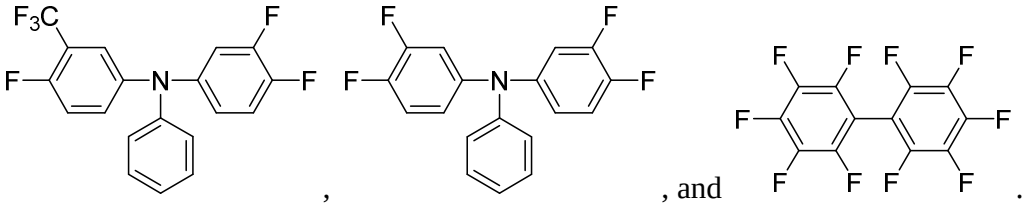
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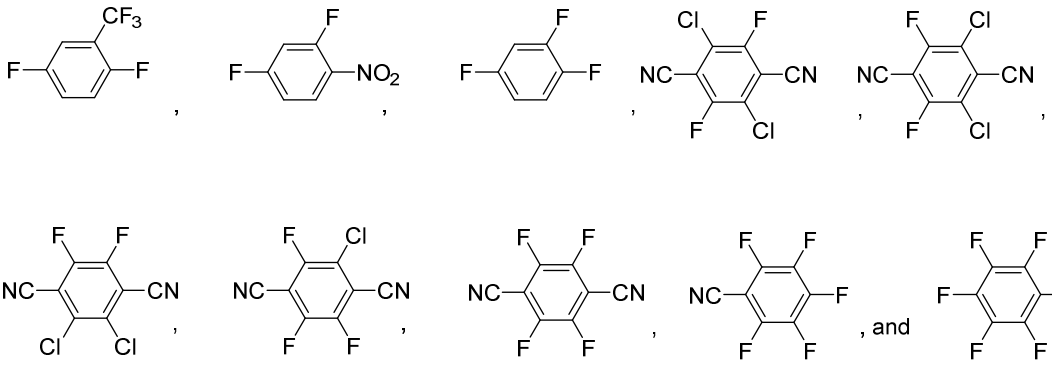
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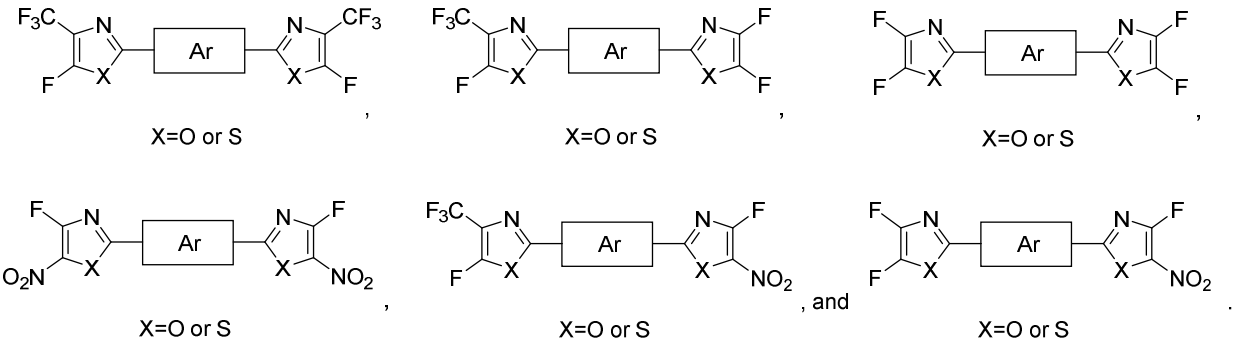
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4. The mesoporous polymeric material of claim 1, wherein the aryl fluoride is an aryl fluoride of formula (II), and is selected from the group consisting of:



5. The mesoporous polymeric material of claim 1, wherein the aryl fluoride is an aryl fluoride of formula (III), and is selected from the group consisting of:



6. The mesoporous polymeric material of claim 1, wherein the molar ratio of cyclodextrin to aryl fluoride ranges from about 1:1 to about 1:X, wherein X is three times the average number of glucose subunits in the cyclodextrin.

7. The mesoporous polymeric material of claim 6, wherein the molar ratio of cyclodextrin to aryl fluoride is about 1:6.

8. The mesoporous polymeric material of claim 1, wherein the cyclodextrin is selected from the group consisting of α-, β-, γ-cyclodextrin, and combinations thereof.

9. The mesoporous polymeric material of claim 1, wherein the cyclodextrin is β-cyclodextrin.

10. The mesoporous polymeric material of claim 2, wherein the cyclodextrin is β-cyclodextrin.

11. The mesoporous polymeric material of claim 3, wherein the cyclodextrin is β-cyclodextrin.

12. The mesoporous polymeric material of claim 4, wherein the cyclodextrin is β-cyclodextrin.

13. The mesoporous polymeric material of claim 5, wherein the cyclodextrin is β-cyclodextrin.

14. The mesoporous polymeric material of claim 9, wherein the aryl fluoride is an aryl fluoride of formula (I), and the molar ratio of β-cyclodextrin to aryl fluoride is about 1:3.

15. The mesoporous polymeric material of claim 9, wherein the aryl fluoride is an aryl fluoride of formula (II), and the molar ratio of β-cyclodextrin to aryl fluoride is about 1:3.

16. The mesoporous polymeric material of claim 9, wherein the aryl fluoride is an aryl fluoride of formula (III), and the molar ratio of β-cyclodextrin to aryl fluoride is about 1:3.

17. A composition comprising the mesoporous polymeric material of claim 1 covalently bonded to a support.

18. The composition of claim 17, wherein the support is a cellulosic substrate.

19. The composition of claim 18, wherein the cellulosic substrate comprises cotton.

20. The composition of claim 19, wherein the cellulosic substrate is in the form of a fabric.

21. A method of purifying a fluid sample comprising one or more pollutants, the method comprising contacting the fluid sample with the mesoporous polymeric material of claim 1, whereby at least 50 wt. % of the total amount of the one or more pollutants in the fluid sample is adsorbed by the mesoporous polymeric material.

22. The method of claim 21, wherein the fluid sample flows across, around, or through the mesoporous polymeric material.

23. The method of claim 21, wherein the fluid sample is contacted with the mesoporous polymeric material under static conditions for an incubation period and after the incubation period the fluid sample is separated from the mesoporous polymeric material.

24. The method of claim 21, wherein the fluid sample is drinking water, wastewater, ground water, aqueous extract from contaminated soil, or landfill leachate.

25. The method of claim 21, wherein the fluid sample is in the vapor phase.

26. The method of claim 25, wherein the fluid sample comprises one or more volatile organic compounds and air.

27. A method of removing one or more compounds from a fluid sample or determining the presence or absence of one or more compounds in a fluid sample comprising: a) contacting the sample with the mesoporous polymeric material of claim 1 for an incubation period; b) separating the mesoporous polymeric material after the incubation period from the sample; and c) heating the porous polymeric material separated in step b), or contacting the porous polymeric material separated in step b) with a solvent, thereby releasing at least a portion of the compounds from the porous polymeric material; and d1) optionally isolating at least a portion of the compounds released in step c); or d2) determining the presence or absence of the compounds released in step c), wherein the presence of one or more compounds correlates to the presence of the one or more compounds in the sample.

28. The method of claim 27, wherein said determining is carried out by gas chromatography, liquid chromatography, supercritical fluid chromatography, or mass spectrometry.

29. The method of claim 27, wherein the sample is a food and the compounds are volatile organic compounds.

30. The method of claim 27, wherein the sample is a perfume or fragrance and the compounds are volatile organic compounds.