CLAIMS

The invention claimed is:

1. A system, comprising:

a flow path containing a fluid having at least one adulterant present therein;

at least one integrated computational element configured to optically interact with the fluid and thereby generate optically interacted light; and

at least one detector arranged to receive the optically interacted light and generate an output signal corresponding to a characteristic of the at least one adulterant within the fluid.

2. The system of claim 1, further comprising a signal processor communicably coupled to the at least one detector for receiving the output signal, the signal processor being configured to determine the characteristic of the at least one adulterant.

3. The system of claim 1, further comprising an electromagnetic radiation source configured to emit electromagnetic radiation that optically interacts with the fluid.

4. The system of claim 3, wherein the at least one detector is a first detector and the system further comprises a second detector arranged to detect electromagnetic radiation from the electromagnetic radiation source and thereby generate a compensating signal indicative of electromagnetic radiating deviations.

5. The system of claim 4, further comprising a signal processor communicably coupled to the first and second detectors, the signal processor being configured to receive and computationally combine the output and compensating signals in order to normalize the output signal.

6. The system of claim 3, wherein the electromagnetic radiation optically interacts with the at least one integrated computational element after optically interacting with the fluid.

7. The system of claim 3, wherein the electromagnetic radiation optically interacts with the at least one integrated computational element before optically interacting with the fluid.

8. The system of claim 1, wherein the fluid is a liquid.

9. The system of claim 8, wherein the at least one adulterant comprises at least one of benzene, toluene, ethylbenzene, xylene, volatile organic compounds, naphthalene, styrene, water, sand, and sulfur compounds.

10. The system of claim 1, wherein the fluid is a gas.

11. The system of claim 10, wherein the at least one adulterant comprises at least one of hexane, liquefiable hydrocarbons, water, sulfur compounds.

12. The system of claim 1, wherein the characteristic of the at least one adulterant is the concentration of the at least one adulterant in the fluid.

13. A method of monitoring a quality of a fluid, comprising:

optically interacting at least one integrated computational element with a fluid contained within a flow path, thereby generating optically interacted light, wherein the fluid includes at least one adulterant present therein;

receiving the optically interacted light with at least one detector; and

generating with the at least one detector an output signal corresponding to a characteristic of the at least one adulterant in the fluid.

14. The method of claim 13, further comprising, before generating with the at least one detector an output signal:

measuring a characteristic of the fluid or at least one known adulterant in the fluid with the at least one detector.

15. The method of claim 13, further comprising, after measuring a characteristic of the fluid or at least one known adulterant in the fluid with the at least one detector:

undertaking at least one corrective action when the characteristic of the at least one adulterant surpasses a predetermined range of suitable operation.

16. The method of claim 13, further comprising:

receiving the output signal with a signal processor communicably coupled to the at least one detector; and

determining the characteristic of the at least one adulterant with the signal processor.

17. The method of claim 13, further comprising emitting electromagnetic radiation from an electromagnetic radiation source, the electromagnetic radiation from the electromagnetic radiation source being configured to optically interact with the fluid and the at least one adulterant.

18. The method of claim 17, further comprising reflecting the electromagnetic radiation emitted from the electromagnetic radiation source off of the fluid.

19. The method of claim 13, further comprising transmitting the electromagnetic radiation emitted from the electromagnetic radiation source through the fluid.

20. The method of claim 13, wherein the at least one detector is a first detector, the method further comprising:

receiving and detecting with a second detector at least a portion of the electromagnetic radiation emitted from the electromagnetic radiation source;

generating with the second detector a compensating signal indicative of radiating deviations of the electromagnetic radiation source;

computationally combining the output signal and the compensating signal with a signal processor communicably coupled to the first and second detectors; and

normalizing the output signal.

21. The method of claim 13, wherein containing the fluid within the flow path further comprises flowing the fluid within the flow path.

22. The method of claim 13, wherein undertaking the at least one corrective action comprises adding a treatment substance to the flow path.

23. The method of claim 13, wherein undertaking the at least one corrective action comprises increasing or decreasing a flow rate of the fluid within the flow path.

24. The method of claim 13, wherein undertaking the at least one corrective action comprises shutting off a flow of the fluid within the flow path.

25. The method of claim 13, wherein the characteristic of at least one known adulterant is the concentration of the at least one known adulterant in the fluid.

CLAIMS

The invention claimed is:

1. A system, comprising:

a flow path containing a fluid having at least one adulterant present therein;

at least one integrated computational element configured to optically interact with the fluid and thereby generate optically interacted light; and

at least one detector arranged to receive the optically interacted light and generate an output signal corresponding to a characteristic of the at least one adulterant within the fluid, wherein:

the integrated computational element comprises a plurality of alternating layers of two materials having different indices of refraction,

one of the two materials is selected from the group consisting of silicon, silica, niobium, niobia, germanium, germania, magnesium fluoride, and silicon oxide, and

a portion of the optically interacted light is transmitted through the integrated computational element.

2. The system of claim 1, further comprising a signal processor communicably coupled to the at least one detector for receiving the output signal, the signal processor being configured to determine the characteristic of the at least one adulterant.

3. The system of claim 1, further comprising an electromagnetic radiation source configured to emit electromagnetic radiation that optically interacts with the fluid.

4. The system of claim 3, wherein the at least one detector is a first detector and the system further comprises a second detector arranged to detect electromagnetic radiation from the electromagnetic radiation source and thereby generate a compensating signal indicative of electromagnetic radiating deviations.

5. The system of claim 4, further comprising a signal processor communicably coupled to the first and second detectors, the signal processor being configured to

receive and computationally combine the output and compensating signals in order to normalize the output signal.

6. The system of claim 3, wherein the electromagnetic radiation optically interacts with the at least one integrated computational element after optically interacting with the fluid.

7. The system of claim 3, wherein the electromagnetic radiation optically interacts with the at least one integrated computational element before optically interacting with the fluid.

8. The system of claim 1, wherein the fluid is a liquid.

9. The system of claim 8, wherein the at least one adulterant comprises at least one of benzene, toluene, ethylbenzene, xylene, volatile organic compounds, naphthalene, styrene, water, sand, and sulfur compounds.

10. The system of claim 1, wherein the fluid is a gas.

11. The system of claim 10, wherein the at least one adulterant comprises at least one of hexane, liquefiable hydrocarbons, water, sulfur compounds.

12. The system of claim 1, wherein the characteristic of the at least one adulterant is the concentration of the at least one adulterant in the fluid.

13. A method of monitoring a fluid, comprising:

containing the fluid within a flow path, the fluid including at least one adulterant present therein;

optically interacting at least one integrated computational element with the fluid, thereby generating optically interacted light;

receiving the optically interacted light with at least one detector; and

generating with the at least one detector an output signal corresponding to a characteristic of the at least one adulterant in the fluid, wherein:

the integrated computational element comprises a plurality of alternating layers of two materials having different indices of refraction,

one of the two materials is selected from the group consisting of silicon, silica, niobium, niobia, germanium, germania, magnesium fluoride and silicon oxide, and

generating the optically interacted light includes transmitting a portion of the optically interacted light through the integrated computational element.

14. The method of claim 13, further comprising emitting electromagnetic radiation from an electromagnetic radiation source, the electromagnetic radiation from the electromagnetic radiation source being configured to optically interact with the fluid and the at least one adulterant.

15. The method of claim 14, further comprising reflecting the electromagnetic radiation emitted from the electromagnetic radiation source off of the fluid.

16. The method of claim 14, further comprising transmitting the electromagnetic radiation emitted from the electromagnetic radiation source through the fluid.

17. The method of claim 14, wherein the at least one detector is a first detector, the method further comprising:

receiving and detecting with a second detector at least a portion of the electromagnetic radiation emitted from the electromagnetic radiation source;

generating with the second detector a compensating signal indicative of radiating deviations of the electromagnetic radiation source;

computationally combining the output signal and the compensating signal with a signal processor communicably coupled to the first and second detectors; and

normalizing the output signal.

18. The method of claim 13, further comprising: receiving the output signal with a

signal processor communicably coupled to the at least one detector; and determining the characteristic of the at least one adulterant with the signal processor.

19. A method of monitoring a quality of a fluid, comprising:

optically interacting at least one integrated computational element with a fluid contained within a flow path, thereby generating optically interacted light;

receiving the optically interacted light with at least one detector;

measuring a characteristic of the fluid or at least one known adulterant in the fluid with the at least one detector;

generating an output signal corresponding to the characteristic of the at least one known adulterant; and

undertaking at least one corrective action when the characteristic of the at least one adulterant surpasses a predetermined range of suitable operation, wherein:

the integrated computational element comprises a plurality of alternating layers of two materials having different indices of refraction, one of the two materials is selected from the group consisting of silicon, silica, niobium, niobia, germanium, germania, magnesium fluoride, and silicon oxide, and generating the optically interacted light includes transmitting a portion of the optically interacted light through the integrated computational element.

20. The method of claim 19, wherein containing the fluid within the flow path further comprises flowing the fluid within the flow path.

21. The method of claim 19, wherein undertaking the at least one corrective action comprises adding a treatment substance to the flow path.

22. The method of claim 19, wherein undertaking the at least one corrective action comprises increasing or decreasing a flow rate of the fluid within the flow path.

23. The method of claim 19, wherein undertaking the at least one corrective action comprises shutting off a flow of the fluid within the flow path.

24. The method of claim 19, wherein the characteristic of at least one known adulterant is the concentration of the at least one known adulterant in the fluid.