

Claims

1. One or more aptamers capable of specifically binding to the S1 and/or S2 subunit of the SARS-CoV-2 spike protein, wherein the aptamer(s) comprises:

- (a) a nucleic acid sequence selected from any one of SEQ ID NOs: 4, 8, 9 or 43;
- (b) a nucleic acid sequence selected from any one of SEQ ID NOs: 10, 20, 24 or 44;
- (c) a nucleic acid sequence selected from any one of SEQ ID NOs: 134, 140 or 144;
- (d) a nucleic acid sequence selected from any one of SEQ ID NOs: 146, 150 or 171;
- (e) a nucleic acid sequence selected from any one of SEQ ID NOs: 177, 179, 183, 188, 190 or 191;
- (f) a nucleic acid sequence having at least about 15 consecutive nucleotides of any one of the sequences of (a) to (e); and/or
- (g) a nucleic acid sequence having at least about 85% or more sequence identity with any one of the sequences of (a) to (f).

2. One or more aptamers of claim 1, wherein the aptamers comprise:

- (a) a nucleic acid sequence capable of specifically binding to the S1 subunit of the SARS-CoV-2 spike protein, wherein the sequence is selected from SEQ ID NO: 140;
- (b) a nucleic acid sequence capable of specifically binding to the S2 subunit of the SARS-CoV-2 spike protein, wherein the sequence is a nucleic acid sequence selected from SEQ ID NO: 190;
- (c) a nucleic acid sequence having at least about 25 consecutive nucleotides of the sequences of (a) or (b); and/or
- (d) a nucleic acid sequence having at least about 85% or more sequence identity with any one of the sequences of (a) to (c).

3. At least two or more aptamers of claim 1, comprising:

- (a) a first aptamer comprising a nucleic sequence selected from any one of SEQ ID NOs: 4, 8, 9, 43, 134, 10 or 144 or a sequence having at least about 90% or more sequence identity with any one of SEQ ID NOs: 4, 8, 9, 43, 134, 140 or 144; and
- (b)
 - (i) a second aptamer comprising a nucleic sequence selected from any one of SEQ ID NOs: 4, 8, 9, 43, 134, 140 or 144 or a sequence having at least about 90% or more sequence identity or more with any one of SEQ ID NOs: 4, 8, 9, 43, 134, 140 or 144, wherein the second aptamer is different than the first aptamer; or
 - (ii) a second aptamer comprising a nucleic sequence selected from any one of SEQ ID NOs: 146, 150, 171, 177, 179, 183, 188, 190 or 191 or a sequence

having at least about 90% or more sequence identity with any one of SEQ ID NOs: 146, 150, 171, 177, 179, 183, 188, 190 or 191.

4. The at least two or more aptamers of claim 3, wherein the aptamers comprise:
 - (a) a first aptamer comprising a nucleic sequence selected from SEQ ID NO: 140 or a sequence having at least about 95% or more sequence identity with SEQ ID NO: 140; and
 - (b) a second aptamer comprising a nucleic sequence selected from SEQ ID NO: 190 or a sequence having at least about 85% or more sequence identity with SEQ ID: NO 190.
5. The aptamer(s) of any one of claims 1 to 4, wherein the aptamer is a DNA aptamer.
6. An aptamer that competes for binding to the S1 and/or S2 subunits of the SARS-CoV-2 spike protein with the aptamer(s) of any one of claims 1 to 5.
7. The aptamer(s) of any one of claims 1 to 6, wherein the one or more aptamer(s) comprise a detectable label, optionally wherein the detectable label is selected from a fluorophore, a nanoparticle, a quantum dot, an enzyme, a radioactive isotope, a pre-defined sequence portion, a biotin, a desthiobiotin, a thiol group, an amine group, an azide, an aminoalkyl group, a digoxigenin, an antibody, a catalyst, a colloidal metallic particle, a colloidal non-metallic particle, an organic polymer, a latex particle, a nanofiber, a nanotube, a dendrimer, a protein, and a liposome.
8. A complex comprising one or more aptamers of any preceding claim and a detectable molecule.
9. The complex of claim 8, wherein the complex comprises a S1 and/or S2 subunit of the SARS-Cov-2 spike protein, a monomer of the SARS-CoV-2 spike protein, a trimer of the SARS-CoV-2 spike protein and/or the SARS-Cov-2 virus.
10. A biosensor, assay plate or test strip comprising one or more aptamers as described in any one of claims 1 to 7.
11. Apparatus for detecting the presence, absence or level of SARS-CoV-2 in a sample, the apparatus comprising one or more aptamers as described in any one of claims 1 to 7 optionally wherein the apparatus further comprises a support.

12. A lateral flow device comprising one or more aptamers as described in any one of claims 1 to 7.
13. The lateral flow device of claim 12, wherein the device comprises:
- (a) a first aptamer comprising a nucleic sequence selected from SEQ ID NO: 140 or a sequence having at least about 85% or more sequence identity with SEQ ID NO: 140; and
 - (b) a second aptamer comprising a nucleic sequence selected from SEQ ID NO: 190 or a sequence having at least about 85% or more sequence identity with SEQ ID NO: 190.
14. The device according to claim 13, wherein the first or second aptamer is bound to a solid support, optionally wherein the solid support is a test strip.
15. The device according to claim 14, wherein:
- (i) if the first aptamer is bound to the solid support, the second aptamer is conjugated to a detectable label; or
 - (ii) if the second aptamer is bound to the solid support, the first aptamer is conjugated to a detectable label.
16. The device according to claim 15, wherein the detectable label is a gold or latex nanoparticle or a fluorescent nanoparticle, fluorophore or Quantum Dot.
17. A functionalised electrode or biosensor surface comprising one or more aptamers as described in any one of claims 1 to 7.
18. The functionalised electrode or biosensor of claim 17, wherein the functionalised electrode or biosensor comprises:
- (a) an aptamer comprising a nucleic sequence selected from SEQ ID NO: 10, 20, 24 or 44; or
 - (b) a sequence having at least about 85% or more sequence identity with SEQ ID NO: 10, 20, 24 or 44.
19. The functionalised electrode or biosensor of claim 18, wherein the aptamer is immobilised onto the surface of the electrode, optionally wherein the surface of the electrode is gold.

20. Use of one or more aptamers as described in any one of claims 1 to 7, a complex as described in claim 9 or 10, a biosensor or test strip as described in claim 10, apparatus as described in claim 11, lateral flow device as described in any one of claims 12 to 16 or functionalised electrode or biosensor as described in any one of claims 17 to 19 for detecting, enriching, separating and/or isolating SARS-CoV-2.

21. The use according to claim 20, wherein SARS-CoV-2 is enriched in a sample prior to detecting the presence, absence or amount of the SARS-CoV-2 in the sample.

22. A method of detecting the presence, absence or amount of SARS-CoV-2 in a sample, the method comprising:

- (iii) interacting the sample with one or more aptamer(s) of any one of claims 1 to 7;
and
- (iv) detecting the presence, absence or amount of SARS-CoV-2.

23. The method of claim 22, wherein the sample is obtained from a subject having or suspected of having a COVID-19 infection.

24. The method of claim 23, wherein the sample is saliva, blood, or a nasal swab, optionally wherein the nasal swab is nasopharyngeal, anterior nasal and/or anterior nares.

25. The method of any one of claims 22 to 24, wherein an infecting viral load of SARS-CoV-2 is detected.

26. A kit for detecting, quantifying and/or enriching SARS-CoV-2, the kit comprising one or more aptamers as described in any one of claims 1 to 7.

27. The kit of claim 26, wherein the kit comprises a linker, support and/or detectable molecule.