

Claims

1. A process for the separation of a nucleic acid from a first nucleic acid-containing composition, comprising the steps of:

- a) providing the first nucleic acid-containing composition in a first phase;
- b) providing a nucleic acid binding molecule which is either (a) a cationic molecule which is an amine, amidine or other amine-derived cation, or (b) a minor groove nucleic acid-binding molecule in a second phase;
- c) allowing contact to be maintained between the first phase and the second phase for a sufficient time for nucleic acids in the first nucleic acid-containing composition to bind to the nucleic acid-binding molecule;
- d) separating the first phase from the second phase; and
- e) treating the second phase to dissociate bound nucleic acids from the nucleic acid-binding molecule by contact with a dissociation composition comprising a polyoxometalate or an oxalate molecule to produce a second nucleic acid-containing composition.

2. The process of claim 1, wherein:

- (a) the cationic molecule is a cationic polymer, optionally wherein the cationic polymer is polyethyleneimine, poly-lysine, poly-arginine, an amidine-containing polymer, or a guanidino polymer (e.g. the cationic polymer is polyethyleneimine); or
- (b) the cationic molecule is an amine, optionally wherein the amine comprises diethylaminoethyl (DEAE), trimethylammonium (QMA) or diethyl-(2-hydroxypropyl)aminoethyl (QAE) groups immobilised to a solid support.

3. The process of claim 1, wherein the nucleic acid binding molecule is a minor groove nucleic acid-binding molecule, optionally wherein:

- (a) the minor groove nucleic acid-binding molecule is a molecule carrying one or more groups selected from amidino, amido, or guanidino, which binds the minor groove of DNA, optionally wherein the minor groove nucleic acid-binding molecule contains an amidino group; or
- (b) the minor groove nucleic acid-binding molecule is an antibiotic, an antimicrobial agent, or an anti-cancer agent, optionally wherein the minor groove nucleic acid-binding molecule is an antibiotic, or a derivative thereof, for example:

- (a) the antibiotic is streptomycin, or a derivative thereof; or

(b) the antibiotic is netropsin, DAPI, tetracycline, Hoechst 33258, Neomycin, or an isoquinoline alkaloid such as palmatine, coralyne or berberine.

4. The process of claim 1, wherein the minor groove nucleic acid-binding molecule is a sequence-specific binding agent capable of preferentially binding to a target sequence.

5. The process of any preceding claim, wherein the dissociation composition comprises a polyoxometalate ion or an oxalate.

6. The process of claim 5, wherein the dissociation composition comprises a polyoxometalate, optionally wherein the polyoxometalate is an oxide of a transition metal (e.g. the polyoxometalate is an oxide of tungsten, molybdenum, niobium, tantalum or vanadium, optionally wherein the polyoxometalate is a vanadate, such as a polymer of NaVO_3).

7. The process of claim 6, wherein the polyoxometalate is a mixture of species formed on dissolution of the polyoxometalate in alkaline solution followed by acidification, optionally wherein:

(a) the final the pH of the solution is from 5 to 6; or

(b) the concentration of the polyoxometalate in the solution is from 0.01 mM to 500

mM.

8. The process of claim 5, wherein the dissociation composition comprises an oxalate, optionally wherein:

(a) the oxalate is $(\text{NH}_4)_2\text{C}_2\text{O}_4$; and/or

(b) the concentration of oxalate is from 0.01 to 50 mM.

9. The process of any preceding claim, wherein the first phase is a liquid phase.

10. The process of any preceding claim, further comprising washing the first phase after separation from the second phase.

11. The process of any preceding claim, wherein the second phase is a solid phase, optionally wherein the nucleic acid binding molecule is immobilised to a solid support.

12. The process of any one of claims 1 to 11, wherein the second phase is a liquid phase.

13. The process of any preceding claim, wherein:

(i) no solvent or alcohol is required to further purify the dissociated nucleic acids; and/or

(ii) the first nucleic acid-containing composition comprises materials other than nucleic acids; and/or

(iii) the first nucleic acid-containing composition is derived from a biological sample; and/or

(iv) the second nucleic acid-containing composition is substantially pure; and/or

(v) the process further comprises collecting the second nucleic acid-containing composition; and/or

(vi) the process further comprises amplifying one or more of the nucleic acids present in the second nucleic acid-containing composition; and/or

(vii) the process further comprises amplifying one or more of the nucleic acids present in the second nucleic acid-containing composition, and detecting the presence of a specific nucleic acid or of nucleic acids generally.

14. A device for the separation of a nucleic acid from a first nucleic acid-containing composition configured for use in the process of any one of claims 1 to 13.

15. A kit comprising a first composition comprising a nucleic acid binding molecule which is either (a) a cationic molecule which is an amine, amidine or other amine-derived cation, or (b) a minor groove nucleic acid-binding molecule; and a second composition comprising a polyoxometalate or an oxalate, wherein addition of the second composition to nucleic acids bound to the nucleic acid binding molecule results in disassociation of the nucleic acids from the nucleic acid binding molecule, optionally wherein:

(a) the nucleic acid binding molecule is immobilised on a solid support; and/or

(b) the kit further comprises buffers and reagents for isolating a nucleic acid and/or further comprising buffers and reagents for amplification and/or detection; and/or

(c) the kit further comprises a device for isolating and/or amplifying and/or detecting a nucleic acid.