

CLAIMS

1. A method of characterizing a population of at least one microorganism, which comprises, the characterization of the population of at least one microorganism and,
 - 5 before the characterization, the preparation of a characterization zone of an analysis plate in order to carry out the characterization, the said preparation comprising the following steps in succession:
 - a step of providing the analysis plate for the characterization by means of the matrix-assisted laser desorption-ionization mass spectrometry (MALDI)
 - 10 technique, wherein an antimicrobial agent has been deposited on an analysis zone of the analysis plate to form a functionalized analysis zone;
 - a step of depositing the population of at least one microorganism onto said functionalized analysis zone;
 - an incubation step of preserving the analysis plate under conditions and for
 - 15 a sufficient time to allow the antimicrobial agent and the microorganism that is present to interact; and
 - a step of depositing a matrix that is suitable for the MALDI technique onto the said functionalized analysis zone to form the characterisation zone, in which the characterization zone then undergoes at least one ionization step by bombarding the
 - 20 characterisation zone with a laser beam in accordance with the MALDI technique, the said characterizing comprising:
 - identifying a family, genus, or, species of the population of at least one microorganism deposited on the characterization zone by carrying out a first analysis by MALDI type mass spectrometry corresponding to a first step of ionizing the
 - 25 characterization zone, and by using a first calibration for the first analysis; and
 - determining possible presence on the characterization zone of a population of a microorganism that is resistant to the antimicrobial agent by carrying out a second analysis by mass spectrometry using a MALDI-TOF technique corresponding to a second step of ionizing the same characterization zone, and by using a second
 - 30 calibration for the second analysis.

2. The method of characterizing according to claim 1, characterized in that the population of at least one microorganism to be deposited onto the functionalized analysis zone consist of only one type of microorganism.
- 5 3. The method of characterizing according to claim 1 or claim 2, characterized in that the deposited population of microorganism(s) is prepared without a prior step of contact with an antimicrobial agent.
- 10 4. The method of characterizing according to any one of claims 1 to 3, characterized in that the population of microorganism(s) is obtained after a step of concentration, enrichment and/or purification and/or corresponding to a colony or to a fraction of a colony obtained after growth on a suitable medium.
- 15 5. The method of characterizing according to claim 4, characterized in that the suitable medium is a gel medium.
- 20 6. The method of characterizing according to any one of claims 1 to 5, characterized in that the antimicrobial agent is selected in a manner such as to allow a resistance due to production of beta-lactamase, to be identified.
- 25 7. The method of characterizing according to claim 6, characterized in that the antimicrobial agent is selected in a manner such as to allow a resistance due to production of carbapenemase, to be identified.
- 30 8. The method of characterizing according to any one of claims 1 to 7, characterized in that the antimicrobial agent is an antibiotic.
9. The method of characterizing according to claim 8, characterized in that the antimicrobial agent is an antibiotic selected from a group consisting of penicillins, cephalosporins, cephamycins, carbapenems, monobactams and in particular from ampicillin, amoxicillin, ticarcillin, piperacillin, cefalotin, cefuroxime, cefoxitin, cefixime, cefotaxime, ceftazidime, ceftriaxone, cefpodoxime, cefepime, aztreonam, ertapenem, imipenem, meropenem, and faropenem.

10. The method of characterizing according to any one of claims 1 to 9, characterized in that the method comprises a functionalization step consisting of depositing an aqueous solution of the antimicrobial agent onto the analysis zone, followed by drying to form the functionalized analysis zone.

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11. The method of characterizing according to claim 10, characterized in that the functionalized analysis zone(s) carry(ies) a single type of antimicrobial agent.

12. The method of characterizing according to any one of claims 1 to 11, characterized in that the analysis by mass spectrometry using the MALDI-TOF technique in order to conclude whether a population of a microorganism that is resistant to the antimicrobial agent is present on the characterization zone consists in verifying the presence of the antimicrobial agent and/or of a degradation product of the antimicrobial agent.

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13. The method of characterizing according to any one of claims 1 to 12, characterized in that identifying the family, genus, or species of the population of the at least one microorganism and determining whether the possible presence of the antimicrobial agent concerns the same microorganism.

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14. The method of characterizing according to any one of claims 1 to 13, characterized in that identifying the population of the at least one microorganism corresponds to identification of the species of the at least one microorganism.

15. An analysis plate intended to receive a population of at least one microorganism to be characterized on an analysis zone by mass spectrometry using the MALDI technique, the analysis plate being characterized in that it comprises an antimicrobial agent that has been deposited on said analysis zone of the analysis plate, forming a functionalized analysis zone.

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16. The analysis plate according to claim 15, characterized in that the antimicrobial agent that has been deposited on the functionalized analysis zone is in the form of a solid deposit.

17. The analysis plate according to claim 15 or 16, characterized in that the functionalized analysis zone is obtained by depositing an aqueous solution of the antimicrobial agent, followed by drying.
- 5 18. The analysis plate according to any one of claims 15 to 17, characterized in that the antimicrobial agent is immobilized on the functionalized analysis zone by electrostatic, ionic, covalent, affinity bonding or by means of an adhesive agent.
19. The analysis plate according to claim 18, characterized in that the adhesive agent
10 is selected from polymers that are soluble in water.
20. The analysis plate according to any one of claims 15 to 19, characterized in that the analysis plate is formed from a polymer, said polymer being covered with a layer of stainless steel.
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21. The analysis plate according to claim 20, characterized in that the polymer is polypropylene, which contains a conductive material.
22. The analysis plate according to claim 21, characterized in that the conductive
20 material is carbon black.
23. The analysis plate according to any one of claims 15 to 22, characterized in that the analysis plate comprises a plurality of the functionalized analysis zone, each carrying a type of antimicrobial agent.
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24. The analysis plate according to any one of claims 15 to 23, characterized in that the analysis plate comprises at least a first functionalized analysis zone carrying a first antimicrobial agent and a second functionalized analysis zone, which is distinct from the first functionalized analysis zone, carrying a second antimicrobial agent that
30 is distinct from the first antimicrobial agent.
25. The analysis plate according to any one of claims 15 to 24, characterized in that the or each functionalized analysis zone carries a single antimicrobial agent.

26. The analysis plate according to any one of claims 15 to 25, characterized in that the analysis plate comprises at least one reference analysis zone intended to subsequently receive a population of a reference microorganism, and in that the surface of the reference analysis zone is free from antimicrobial agent.

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27. The analysis plate according to any one of claims 15 to 26, characterized in that the analysis plate is packaged in a hermetically sealed packaging.