# Methods of Characterizing Nanoparticle Compositions

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## ABSTRACT

Researchers at the University of California Davis have developed a method to spatially characterize and chemically analyze nanoparticles from biological and environmental samples for enhanced disease diagnosis and pollutant detection.

## FULL DESCRIPTION

This technology provides a novel approach to characterize nanoparticles such as extracellular vesicles (EVs) and nanoplastics by depositing biological and environmental liquid samples onto coated surfaces, allowing the liquid to evaporate, and analyzing the resulting spatial dispersion patterns. By capturing spatial fingerprints and applying spectroscopic techniques including MALDI mass spectrometry imaging, researchers can identify chemical compositions, nanoparticle size, and heterogeneity. The method supports rapid, minimally invasive diagnostics from biological fluids and environmental samples and enables the creation of searchable databases correlating spatial fingerprints with diseases or pollutants.

## APPLICATIONS

- Early diagnostic tools for cancers, especially ovarian cancer, using liquid biopsies.
- Biomarker discovery and disease classification in precision medicine.
- Environmental monitoring and detection of nanoparticulate pollutants in water and waste samples.
- Pharmaceutical research for extracellular vesicle characterization and drug delivery systems.
- Clinical research tools for studying extracellular vesicles and their role in health and disease.
- Development of spectral fingerprint databases to improve diagnostic automation and accuracy.
- Advanced analytical services in nanotechnology and materials science laboratories.

## FEATURES/BENEFITS

- Enables spatially resolved molecular profiling of nanoparticles at single-vesicle resolution.
- Delivers non-invasive, rapid, cost-effective sampling directly from unprocessed biological fluids or environmental samples.
- Improves diagnostic sensitivity by separating and dispersing particles via capillary-flow-driven transport.
- Customizes sample preparation by supporting multiple surfaces and coatings.
- Integrates spatial fingerprinting with mass spectrometry and spectroscopic readouts for more comprehensive characterization.
- Builds disease- and pollutant-associated fingerprint databases to support diagnostic and environmental comparison.
- Replaces invasive, expensive, slow workflows (e.g., biopsies and imaging) with faster, lower-burden sampling and analysis.
- Improves early-stage cancer detection (including ovarian cancer) by distinguishing disease-linked lipidomic nanoparticle signatures.
- Differentiates and classifies heterogeneous extracellular vesicle populations that are difficult to resolve with bulk methods.
- Detects nanoparticulate pollutants in environmental samples with high sensitivity.
- Eliminates reliance on sample amplification or labeling for nanoparticle profiling.
- Accelerates high-throughput, multiplexed profiling of complex nanoparticle mixtures.
- Standardizes comparisons across patient or environmental samples by applying a consistent spatial-fingerprint framework.

## PATENT STATUS

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## OTHER INFORMATION

### KEYWORDS

analytical, biological fluid, disease detection, extracellular vesicles, nanoparticles, lipids, MALDI-MSI, nanoplastics, ovarian cancer, spatial fingerprint, spectroscopic imaging

### CATEGORIZED AS

- **Biotechnology**
  - Health
- **Medical**
  - Diagnostics
  - Disease: Cancer
- **Nanotechnology**
  - NanoBio
- **Sensors & Instrumentation**
  - Analytical

### RELATED CASES

2025-565-0

Patent Pending

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