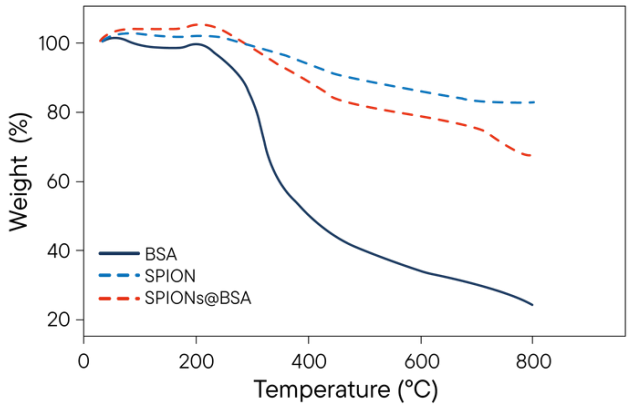
Thermal Analysis of Protein–Nanoparticle Assemblies

STA L82 Analysis of Hybrid Protein–Nanoparticle Systems

Bovine serum albumin (BSA)-based nanoparticle assemblies are promising materials for drug delivery, biomedical imaging and functional nanocomposites. In this study, the LINSEIS STA L82 was used to investigate the thermal degradation behavior of BSA, superparamagnetic iron oxide nanoparticles (SPIONs), and their supraparticle assemblies. The measurements enable quantitative determination of the organic and inorganic fractions within the hybrid material.

Measurement Setup

- Instrument: LINSEIS STA L82
- Material: BSA, SPIONs, SPIONs@BSA
- Temperature Range: 30–800 °C
- Atmosphere: Nitrogen
- Measurement: Simultaneous Thermal Analysis (TGA)
- Application: Protein–Nanoparticle Hybrid Materials



The thermogravimetric analysis clearly differentiates the thermal behavior of the individual components and the hybrid assemblies.
Key observations include:

- Distinct degradation of the BSA fraction
- High thermal stability of the SPIONs
- Hybrid behavior for SPIONs@BSA assemblies
- Quantified composition of 72.9 wt.% SPIONs and 27.1 wt.% BSA

The results demonstrate reliable quantitative analysis of hybrid protein–nanoparticle systems.

Interpretation

The observed behavior can be attributed to:

- Organic decomposition of BSA
- Thermally stable iron oxide nanoparticles
- Combined degradation behavior of hybrid assemblies
- Reliable determination of inorganic content

This results in:

- Accurate composition analysis
- Verification of nanoparticle loading
- Improved quality control

Industrial Relevance

Simultaneous Thermal Analysis supports:

- Drug delivery materials
- Magnetic nanoparticles
- Biomedical nanomaterials
- Functional nanocomposites
- Protein-based carrier systems

Conclusion

The LINSEIS STA L82 enables reliable quantitative characterization of hybrid protein–nanoparticle materials. The measurements accurately determine the organic and inorganic fractions, providing valuable information for material development, process optimization and quality assurance.

Source:
Yu, X., Liu, X., Ding, W., Wang, J., Ruan, G.
Spontaneous and instant formation of highly stable protein–nanoparticle supraparticle co-assemblies driven by hydrophobic interaction.
Nanoscale Advances, 2019, 1, 4137–4147.
*Adapted from thermogravimetric measurements performed using a LINSEIS STA PT 1000, now available as the LINSEIS STA L82.