TITLE: Solvent nuclear magnetic resonance for noninvasive inspection of particle-containing products

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Field
Pharmaceutical
Food

Technology
NMR
Pharmaceutical
Food
Nanoparticles
Quality Control
Counterfeit detection

Advantages
Non-destructive

Status
Available for licensing

Patent Status
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External Reference
Taraban, Marc B., et al.; "Noninvasice detection of nanoparticle clustering by water proton NMR," Transl. Mater. Res., 2017, vol. 4, 025002.

Taraban, Marc B., et al.; "Water Proton NMR: A Tool for Protein Aggregation Characterization," Anal. Chem., 2017, pp. 5494-5502, vol. 89; DOI:

Summary
This patented technology uses solvent nuclear magnetic resonance (NMR) as a noninvasive method for quality control testing of particle products in both pharmaceuticals and non-pharmaceuticals. This technique is rapid, sensitive, and does not require the destruction of the sample. Traditional analytical techniques are not always suitable for inspecting nanoparticle products by end-users due to their complexity and intrusiveness.

Market
The noninvasive quality control of particle products using solvent NMR has a wide range of potential applications in both pharmaceutical and non-pharmaceutical markets.

As particle size decreases they exhibit a greater propensity to cluster, which can be challenging to detect and measure. However, using solvent NMR, it is possible to obtain detailed information about the physicochemical properties of materials at the molecular level. By measuring the transverse relaxation rate (R2) of NMR signals, differences between particle-containing products can be detected and quantified. This method is particularly useful for nanoparticle products, where clustering and other complex behaviors can affect product safety, efficacy, and quality.

In the pharmaceutical industry, the method can be used to ensure the quality and safety of various products, including but not limited to iron-containing drugs, protein-based therapeutics, and drug delivery systems. The ability to accurately determine the extent of clustering in particle-containing pharmaceutical products can ensure that the final product meets regulatory standards and is safe for use. This method is also well suited for research and development purposes where a better understanding of the behavior and properties of particles in different formulations is required.

The technology also has application in identifying counterfeit drugs. Counterfeit drugs are a growing concern in the pharmaceutical industry, posing significant risks to patient safety and public health. The ability to use solvent NMR to detect differences between batches of a product can help identify counterfeit drugs produced with a different manufacturing process or containing different excipients.

This noninvasive method also has vast applications in the food industry. It can be used to improve the quality control of various food products, such as soups, sauces, and dressings where poor particle dispersion can affect taste, texture, and shelf life. This can lead to more consistent product quality and a longer shelf life, reducing waste and improving customer satisfaction.

Technology
Nuclear Magnetic Resonance (NMR) is a powerful analytical technique that can provide detailed information about the physicochemical properties of materials at the molecular level. In particular, the transverse relaxation rate (R2) of NMR signals can be used to measure differences between particle-containing products. The interactions that cause relaxation can be due to a variety of factors, including dipole-dipole interactions, chemical exchange, and molecular motion.

In particle-containing products, the R2 value can be affected by a number of factors, including the size, shape, composition, and distribution of the particles in the sample.

The chemical composition of the particles can also affect the R2 value, particularly if the

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particles contain paramagnetic ions or other species that interact strongly with nuclear spins. In addition, the distribution of particles within the sample can affect the R2 value, with higher concentrations of particles leading to faster relaxation due to increased dipole-dipole interactions.

By measuring the R2 values of different particle-containing products, it is possible to detect subtle differences in their physicochemical properties. For example, variations in the size or composition of particles can be detected and quantified using NMR relaxation measurements. This information can be used to optimize product formulations or manufacturing processes, or to identify differences between batches of a product that may affect its performance or stability.

Compared to traditional analytical techniques, which can be intrusive and time-consuming, solvent NMR is rapid, sensitive, and non-destructive. It's particularly useful for nanoparticle products, where clustering and other complex behaviors can affect product safety, efficacy, and quality. By using solvent NMR to detect differences between batches of a product, manufacturers can improve their quality control processes, reduce waste, and ensure that products meet regulatory standards.

Technology Status

The technology is available for license.

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