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Microplastic Free Microcapsules to Encapsulate Health-promoting Limonene Oil

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DESCRIPTION

Microcapsules and microparticles are small, spherical systems used to encapsulate active ingredients, offering a controlled and sustained release of various substances. While both serve as carriers for drugs, chemicals, or other bioactive compounds, they differ in their structure and function. Microcapsules contain a core-shell structure, where the core holds the active material, and the outer shell controls the release, while microparticles are solid or porous particles with active ingredients dispersed throughout the matrix. These delivery systems have diverse applications, ranging from pharmaceuticals and agriculture to cosmetics and food technology. Microcapsules typically have a distinct core and shell structure. The core contains the active substance, which can be liquid, solid, or gaseous, while the shell is composed of polymers or other materials designed to protect the core from environmental degradation or premature release. The thickness and composition of the shell determine the release rate of the active ingredient, which can be tailored for immediate or controlled release. Microparticles, on the other hand, do not have a core-shell structure. Instead, the active ingredient is uniformly dispersed throughout the particle matrix. Microparticles can be porous or non-porous, depending on their intended use. Porous microparticles allow for faster release, while non-porous particles can provide a more controlled and sustained release. Biodegradable polymers like Poly Lactic Acids (PLAs) are often used to create microparticles for drug delivery, as they break down into non-toxic byproducts over time. Lipid-based microparticles are often employed in food and pharmaceutical industries for encapsulating flavors, vitamins, and drugs, offering enhanced bioavailability and stability. Microparticles made from inorganic materials, such as silica or calcium phosphate, are used in applications like bone regeneration and dental care due to their biocompatibility. Microcapsules and microparticles are also classified by their size, ranging from nanometers to millimeters. Submicron particles are typically referred to as nanoparticles, while larger ones fall into the microparticle category. Microcapsules and microparticles are widely used in drug delivery systems due to their ability to provide controlled and sustained release of medications. This controlled release can enhance the therapeutic effect, reduce side effects, and improve patient compliance by reducing the frequency of doses. One of the key benefits of these systems is their ability to protect sensitive drugs from degradation in the body. Drugs like proteins, peptides, and vaccines, which are often unstable in the bloodstream, can be encapsulated within microcapsules or microparticles to protect them until they reach their target site. For instance, PLGA-based microparticles have been used to deliver drugs such as insulin, allowing for prolonged release and maintaining consistent blood sugar levels in diabetic patients. These microparticles gradually degrade, releasing the drug over an extended period. Additionally, in cancer therapy, microparticles can be designed to deliver chemotherapeutic agents directly to tumors, minimizing damage to healthy tissues and reducing side effects.

CONCLUSION

Microcapsules and microparticles have emerged as versatile delivery systems with applications across multiple industries. Their ability to protect and control the release of active ingredients makes them invaluable in fields like pharmaceuticals, agriculture, and cosmetics. As research continues to advance, these systems will likely play an even more prominent role in improving drug delivery, enhancing product stability, and optimizing environmental sustainability.

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CONFLICT OF INTEREST

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