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Standardization and Reproducibility

A standardized compounding process refers to a consistent and well-defined set of procedures and practices that compounding pharmacies follow. According to United States Pharmacopeia (USP)1, this practice is essential for maintaining the safety, quality, and effectiveness of compounded medications as well as ensuring compliance with compounding requirements.

The primary aim of standardization is to ensure reproducibility, which means that the resulting product consistently exhibits the same composition, quality, and attributes every time it is made, regardless of the person performing the compounding2. Automated equipment in pharmaceutical compounding ensures consistent processes by minimizing variations from individual compounders.

These systems follow set protocols during each process, controlling factors like speed and technique to maintain quality3.

For instance, mixing is a routine yet vital compounding procedure aiming to attain safe and effective treatment. It directly influences stability and precise dosing through particle distribution. Regulating variable mixing parameters, such as time and speed, facilitates the attainment of consistent homogeneity, thus consistency in dosage.

Another example is the melting process where variables such as heat and time play a pivotal role. Although time can be easily controlled, temperature elevation is more complex to standardize due to being a result of heat application. This situation could occur by temperature fluctuations that might not be uniform throughout the formulation due to factors like application method, distance from the heat source, or triggering an exothermic reaction. Consequently, when dealing with thermo-sensitive active pharmaceutical ingredients (APIs), there's a risk of substance decomposition, causing dosage variation.

There is an additional process that is often disregarded but holds a crucial role in both dosing precision and compounding stability: Deaeration.

Omitted Parameter: Air Entrapment

Air entrapment is a fundamental aspect often overlooked when aiming to minimize air exposure, yet it holds considerable importance in achieving standardized compounding and ensuring safe and effective medication practices. Since the volume occupied by the air trapped in the formulation is uneven and unknown, it disrupts the homogeneous particle distribution in the base.

This disruption can result in dosage inconsistencies, especially in cases of low API concentrations. Such variations can particularly affect volume-dependent dosage forms like transdermal hormone treatments due to density changes, or suppositories/vaginal inserts, impacting API displacement.

Furthermore, the medium containing both air and water creates an optimal environment for microbial proliferation, accelerating compound degradation.

The influence of air entrapment in the formulation extends beyond physical factors. The interaction between oxidative molecules present in trapped air and emulsifiers can also trigger chemical instabilities.

For example, the interaction between air and emulsifiers may cause an alteration in the texture of the emulsion/gel4. The final pH of the formulation can be altered due to the impact of air on fluid flow patterns, or the interaction of CO_2 from the air with water in compounding5.

This reaction leads to the formation of carbonic acid, a weak acidic molecule.

All-in-One Solution: FagronLab™ PM140

FagronLab™ PM140 has been innovated to optimize and streamline the compounding of semi-solid preparations. By combining mixing, melting, and deaeration into a single step, and effectively managing their variable parameters, this device achieves enhanced process standardization and reproducible formulation. The standardized mixing allows for greater stability of emulsions, therefore eliminating formulation issues such as creaming, sedimentation, flocculation, and coalescence. An adequate homogenization also ensures correct rheological properties, such as the formulation’s viscosity and flow.

Single-Step Process in High Speed

The working mechanism relies on a planetary motion that the mixing jar (PM jar) simultaneously spins and rotates through opposite directions, oriented at a 40° angle.

The particles' kinetic energy generated by this movement, is subsequently converted into heat energy, leading to an elevation in temperature within the closed PM jar. This inherent and uniform heat generation restricts the temperature increase to a maximum of 45°C.

This controlled thermal effect enables the melting of materials like suppositories and gelatin bases, possessing melting points lower than 45°C, in around 15 minutes when the process is started at room temperature.

Consequently, the mixing and deaeration are combined with the melting process and the compound is prepared in a single step.

Quick, Easy and Time-Saving

The FagronLab™ PM140, operating at a consistent high mixing speed of 2800 rpm, effectively removes entrapped air from semi-solid preparations within just around 30 seconds, and homogeneous mixing from 60 seconds to 3 minutes.

Constant mixing speed and predetermined time setting reduce variable parameters in the compounding process, providing an easy, quick, and standardized preparation. It is sufficient to just set the time and start operation.

FagronLab™ PM140 offers not only quick formulation preparation and easy usage, but also reduces post-preparation cleaning time due to its operation without the mixing blades. This feature contributes to resource conservation by reducing water usage during cleaning. Furthermore, thanks to its benchtop compact design, the device occupies minimal space within the laboratory, allowing it to fit into smaller areas, including cabinets.

References

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