

Explainer: Beyond Sieve Size—Using Particle Shape to Control Your Rootzone

1. Why is this important?

- **The Big Picture:** For years, we've relied on sieve reports to tell us if a mix is "fine" or "coarse," but that only tells us how wide a particle is, not how it actually behaves in the pot.
- **The Discovery:** New research using high-speed "Dynamic Image Analysis" proves that the **shape** of your substrate (how circular, elongated, or "sharp" it is) is what actually dictates how particles pack together and how much air-filled pore space you'll have for your roots.
- **The Bottom Line:** By choosing components based on their "Shape Class," you can prevent your mix from settling or "slumping" over time, ensuring consistent water drainage and reducing crop losses from poor aeration.

2. Practical Takeaways

- **Use "Cluster 1" Fibers for Air:** If your pots are staying too wet, add wood or coir fibers (Cluster 1). These are **highly elongated and angular**, acting like structural "rebar" that prevents the mix from compacting.
- **Use "Cluster 3" for Stability:** For short-cycle crops or heavy-feeders, materials like **bark, perlite, and black peat** (Cluster 3) are your best bet. Their "round" and "circular" shapes pack predictably like marbles, providing stable water-holding capacity.
- **Watch for "Nesting" in Peat:** Most white peats (Cluster 2) have an "intermediate" shape. If you mix too many fine peats together, the smaller particles will "nest" inside the gaps of the larger ones, choking out your air space.
- **Limit Handling of Fibers:** Avoid over-agitating your wood and coir fibers during the blending process. Excessive mixing can break these long, angular fibers into smaller, rounder bits, effectively turning your "high-air" mix into a "high-water" mix before it even hits the pot.

3. The Visual Evidence

Traditional sieving is a "2D" look at a "3D" problem. This study used the **QicPic device** to snap 80 digital images per second of particles in motion. The most impactful visual shows the difference between a **wood fiber** (which looks like a long, jagged needle) and **composted pine bark** (which looks like a smooth pebble). Even if they both pass through the same size sieve, the needle-shaped fiber creates massive air "tunnels," while the pebble-shaped bark settles tightly, holding more water.

4. Key Data Highlights

- **The "Longer is Pointier" Rule:** Research shows that as particle length increases, circularity and "roundness" drop significantly. To get more air, you must prioritize these **low-circularity** fibers.

- **Shape Consistency: Cluster 3** materials (bark, perlite, black peat) are the most "homogeneous," meaning their shapes don't change much regardless of size. This makes them the most predictable for automated potting lines.
- **Fiber Dominance:** In wood and coir fiber samples, roughly **41% to 51%** of the particles are classified as "extremely" or "very" elongated, which is why they are so effective at opening up a mix.

5. Economic Impact & Considerations

- **Reduced Shrink:** Understanding shape helps you create a "morphological design" for your mix. This prevents the substrate from settling in the pot during shipping, which means fewer "top-offs" and a more professional-looking product at retail.
- **Water Efficiency:** By selecting rounder particles (Cluster 3) for the bottom of the pot and fibrous particles (Cluster 1) for the top, you can technically "design" the water-holding capacity to match your irrigation system, potentially cutting water and fertilizer waste.
- **Chemical Savings:** Better aeration from angular fibers (Cluster 1) reduces the "wet feet" conditions that lead to *Pythium* and *Phytophthora*, potentially lowering your fungicide bill.

6. Going Forward

Before you switch your entire range to a new "alternative" fiber, follow this adoption protocol:

1. **Identify the Shape Class:** Ask your substrate supplier if their material is "fibrous/elongated" (Cluster 1) or "granular/circular" (Cluster 3).
2. **The Squeeze Test:** Take a handful of your current mix and a handful of a 20% wood-fiber trial mix. Squeeze both. The trial mix should "spring back" more readily—this is the **angular fibers** at work.
3. **Bench-Scale Trial:** Run one crop cycle on a single bench using a mix with higher **circularity** (more bark/perlite) vs. one with more **elongation** (more wood fiber) to see which fits your specific watering style.