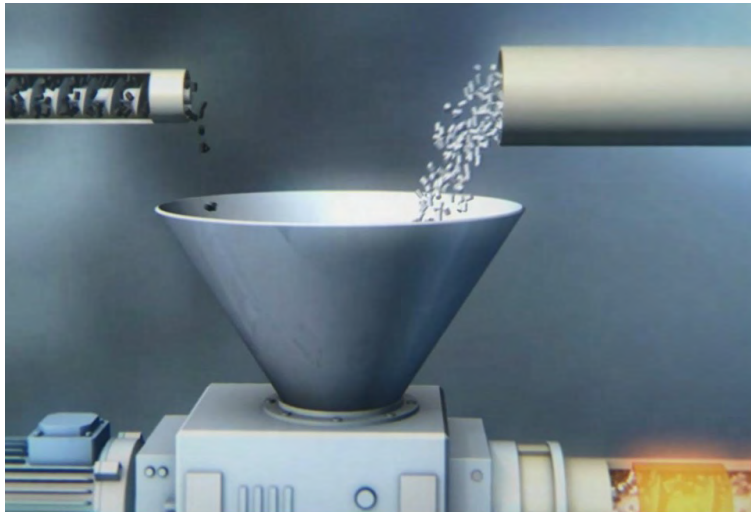
TECHNOLOGY GUIDE

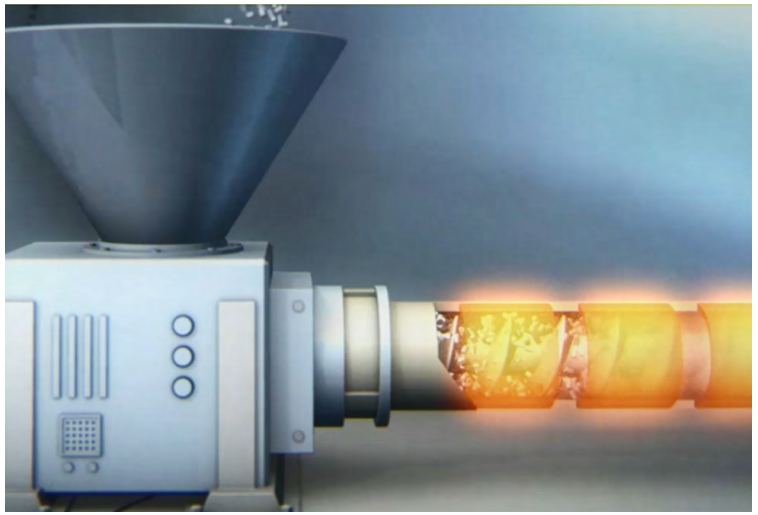
WHAT IS SPIN-DYEING?



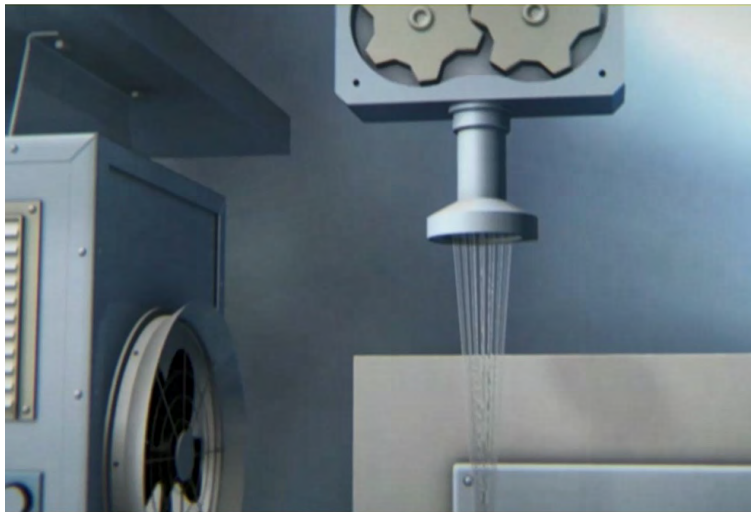
DOSING



EXTRUSION & MELTING



SHAPING INTO FILAMENTS



SPINNING & TEXTURIZING



WHAT IS SPIN-DYEING?

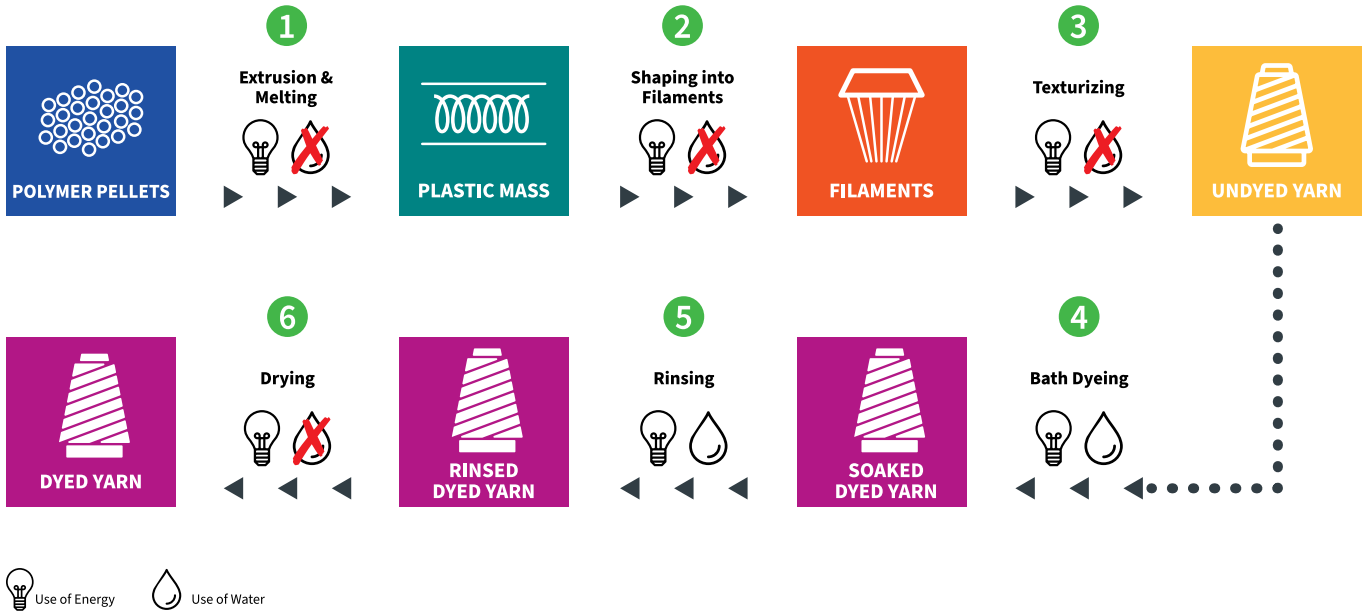
Spin-dyeing, also called dope-dyeing, is a one-in-one dyeing technology for synthetic fibers. It colors the yarn by embedding the required colorant into the melted polymer during fiber manufacturing. The colorant is provided as a color concentrate, or color masterbatch, in pellet form. The necessary quantity of pellets to achieve the targeted color is incorporated into the extruder via a dosing system/feeder. The polymer pellets and color concentrate pellets are then extruded and melted together, shaped into filaments and spun and texturized onto bobbins.



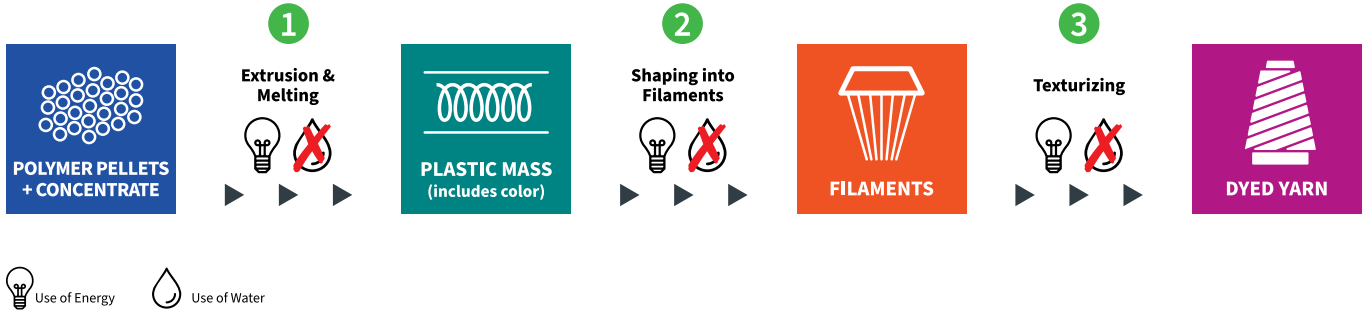
WHICH YARNS CAN BE DYED WITH SPIN-DYEING?

Spin-dyeing can only be used to dye extruded synthetic fibers as the color is added during the manufacturing of yarns with an extrusion process. It is already predominantly used for dyeing polypropylene fibers as the only existing technology for this polymer. It is the dyeing process of choice for polyester and polyamide technical fibers because it generally delivers superior performance. Spin-dyeing is also suitable for dyeing recycled grades and bio-polymers e.g., PLA and PTT.

CLASSIC BATH-DYEING STEPS



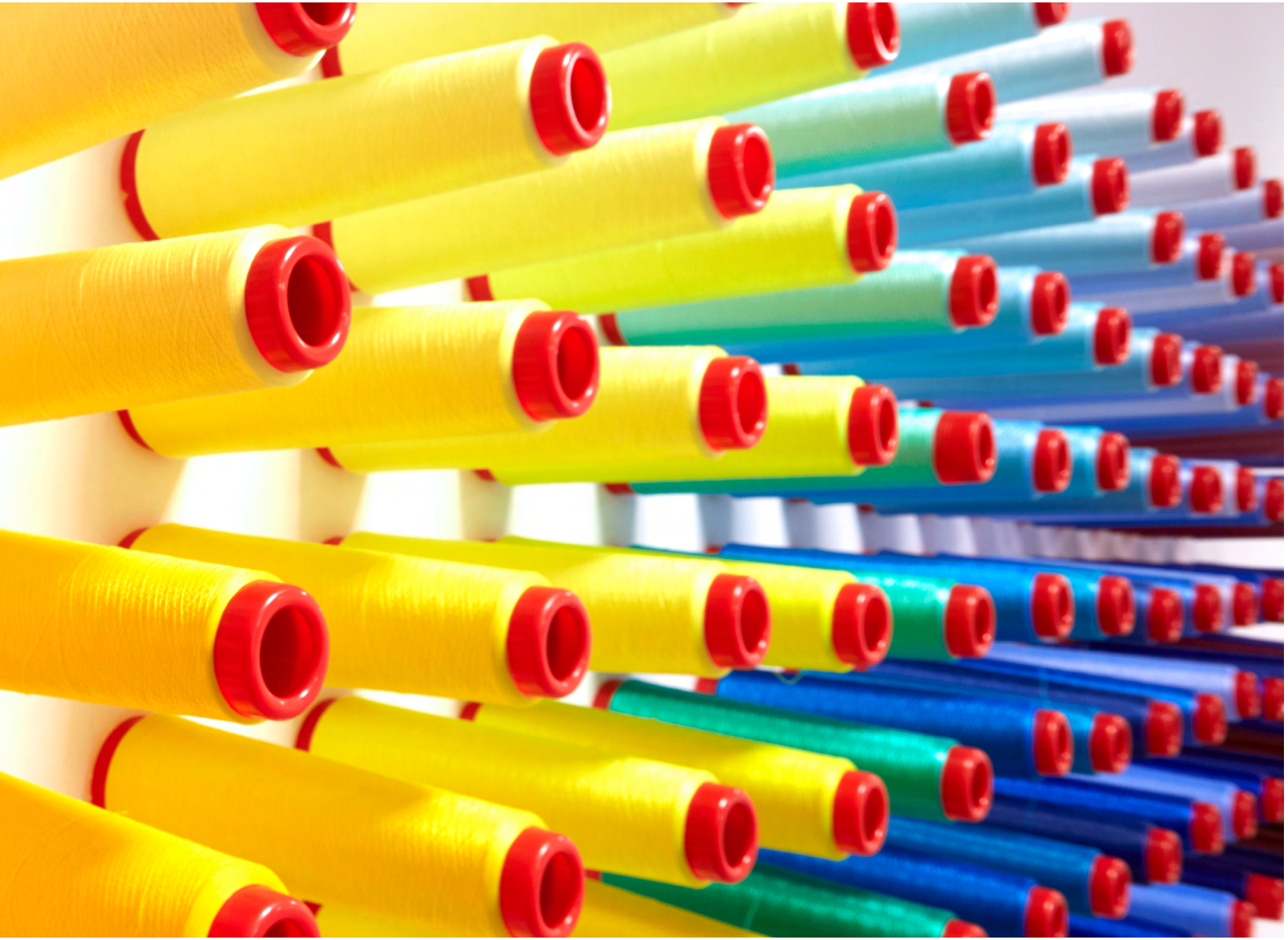
SPIN-DYEING STEPS



WHAT ARE THE ADVANTAGES AND DRAWBACKS?

Compared to the commonly used classic bath-dyeing technology, which is a multi-step process that includes production of the undyed yarn, submersion into water and chemicals under pressure, and rinsing and drying of the dyed yarn, spin-dyeing is a one-in-one dyeing technology that requires no water, fewer steps and less energy. This makes it a more sustainable dyeing technology.

Since dyeing is carried out during yarn extrusion with spin-dyeing technology, color changes must be planned earlier in the process compared to classic bath-dyeing, where the previously produced undyed yarn bobbins are dyed. Spin-dyeing is, therefore, more suited for applications that don't have a rapid color turnover, like standard brand colors or evergreen and technical textiles, as it offers a sustainable dyeing technology alternative to classic bath-dyeing.



HOW DO I SWITCH TECHNOLOGY?

One key element is to equip spinning lines with volumetric or gravimetric dosing units, or with side feed extruders to dose the right amount of color concentrate with the polymer into the extruder. Another key element is to have a Quality Control (QC) color department capable of assessing the in/out specifications for the dyed yarn. This setup already exists when a yarn producer is already integrated downstream with a yarn dyeing mill.



WHAT IS AVIENT'S CONTRIBUTION?

Avient provides high-quality color concentrates specifically formulated for the spin-dyeing of polypropylene, polyester, and polyamide—including recycled grades—as well as biopolymers. We also provide additives to help improve the spinning efficiency and mechanical properties of virgin and recycled polymers, or to enhance properties such as light stabilization, flame retardancy, or antimicrobial effectiveness. These additives can be conveniently combined with color into a single combination concentrate, so that a single concentrate is dosed into the extruder for color and added performance.

We have built a strong expertise in spin-dyeing based on decades of developing concentrates for the textile market and working with fiber producers, local and regional, and textile associations. Companies wishing to switch from bath-dyeing to spin-dyeing can rely on this expertise and Avient's global footprint to make the switch as easy and efficient as possible.