Utilizing a Rounded Hexagonal Prism Shade Cover to Decrease Evaporation Rates

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The material use of shade balls has become an area of concern in recent years. The water used in the production of shade balls and other water covers often offsets the water that is retained in reservoirs. Because of this, shade covers may offset benefits in many large-scale situations. This issue presents a need for innovation in order for shade covers to maintain viability. In this study, an alternative modular (rounded hexagonal prism) cover was constructed and compared to widely used spheres and flat hexagons in a series of tests. Controlled experiments were conducted to compare evaporation rates, tessellation behavior, and aerodynamic drag among these geometries. Twelve identical containers were subject to uniform heating conditions, and mass loss was measured at 12-hour intervals over 156 hours. This was used to measure the evaporation rates based on the shade cover present. The same conditions were also applied to view if tessellation patterns would naturally form amongst the shapes present. Computational fluid dynamics (CFD) simulations were performed to estimate drag coefficients under identical airflow conditions as well. The improved aerodynamic profile reduces the drag coefficient from 1.024 to 0.908 compared to spherical covers. This suggests a reduced need for water ballast, further decreasing the overall water footprint. Material use was also mitigated, reducing surface area from 5026.5 mm^2 to 3561.6 mm^2 compared to spherical covers. Rounded hexagonal prisms were also able to tessellate just as the hexagons, while preventing overlapping due to a spherical side profile. These findings indicate that rounded hexagonal prism covers may offer a more affordable, sustainable, and scalable solution for mitigating reservoir evaporation.

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