蜻蜓翅膀表面疏水性能耦合机理 Coupling Mechanism of Hydrophobicity of Dragonfly Wing Surface

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摘 要： 利用扫描电子显微镜、傅里叶红外光谱仪和视频光学接触角测量仪对蜻蜓翅膀表面的微观结构、物质成分以及疏水性进行了研究，分析了蜻蜓翅膀表面微观结构、物质成分与翅膀表面疏水性能间的关系。结果表明，蜻蜓翅膀表面分布大量纳米级乳突结构，致使液滴与翅膀表面形成复合接触，增强了翅膀表面的疏水性；翅膀表面覆盖的蜡质层对蜻蜓翅膀表面的疏水性起增强作用。此外，利用Cassie模型建立了蜻蜓翅膀表面疏水方程，并进行了蜻蜓翅膀表面疏水性能的多元耦合机理分析，认为蜻蜓翅膀表面的疏水性能是由其表面物质成分和微观结构共同耦合作用的结果。 By means of scanning electron microscope (SEM), Fourier transform infrared spectroscopy (FT-IR) and optical contact angle measuring instruments, the microstructure, ingredient and hydrophobicity of dragonfly wing surface was investigated. Results show that dragonfly wing surface is covered with large number of papilla, leading to the composite contact between liquid droplet and dragonfly wing surface, which enhances the hydrophobicity of dragonfly wing surface. The waxy layer increases the hydrophobic capacity of dragonfly wing surface. Moreover, the hydrophobic equation of dragonfly wing surface was established through the Cassie model, and the multivariate coupling mechanism of dragonfly wing surface was analyzed. It is the conclusion that the hydrophobicity ascribes to co-coupling of the microstructure and ingredient of dragonfly wing surface.

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