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BIO-BASED COMPOSITES FOR LIGHTWEIGHT DRONES: FROM NATURAL FIBERS TO SUSTAINABLE AEROSPACE MATERIALS

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Abstract: This review examines natural fiber-reinforced biocomposites as sustainable alternatives for lightweight drone components. Flax, hemp, jute, and cellulose combined with bio-based polymers offer potential advantages in weight reduction and renewable material use. Mechanical performance, moisture sensitivity, processing methods, and possible UAV applications are discussed.

• Introduction

Conventional drone composites rely mainly on synthetic fibers and petroleum-derived polymers. Natural fiber-reinforced biocompo-sites offer renewable alternatives for selected lightweight components, although durability and mechanical limitations remain. A literature-based review comparing natural fibers (flax, hemp, jute, cellulose), bio-based polymer matrices (PLA, PHA), manufacturing methods, mechanical properties, and potential UAV applications.

• Material and method

A literature-based review comparing natural fibers (flax, hemp, jute, cellulose), bio-based polymer matrices (PLA, PHA), manufacturing methods, mechanical properties, and potential UAV applications.

• Results and discussions

Natural fibers: Flax and hemp offer favorable strength-to-weight characteristics, while jute and cellulose provide accessible renewable reinforcement materials.

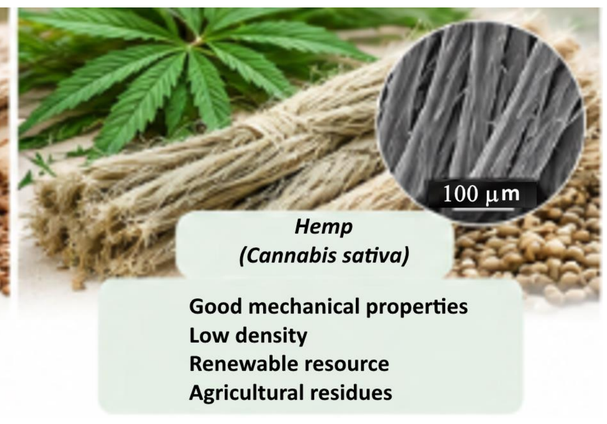
Bio-based polymers: PLA and PHA can serve as polymer matrices, although thermal resistance, moisture sensitivity, and processing conditions require consideration.

UAV applications: Potential uses include protective covers, fairings, interior panels, and selected lightly loaded components. Structural applications require further validation.

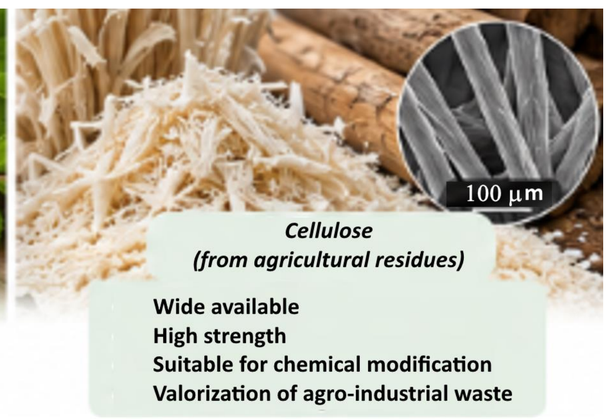
• Results and discussions (continue)

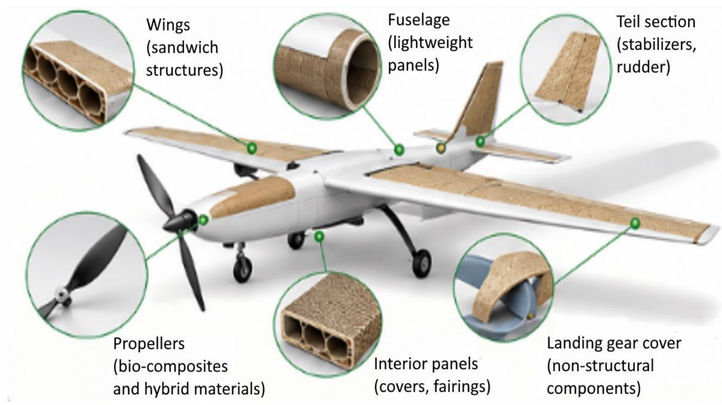
Limitations: Fiber variability, moisture absorption, long-term durability, and manufacturing consistency remain technical constraints.

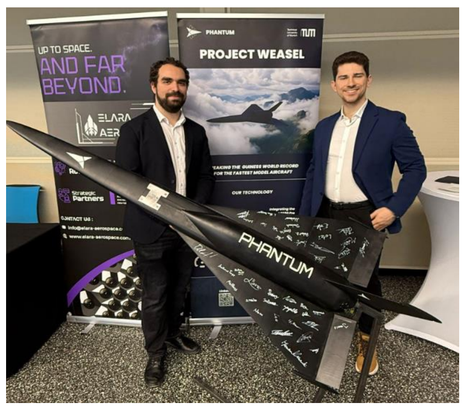












• Conclusions

Natural fiber-reinforced biocomposites are potential alternatives for selected lightweight drone components. Their practical adoption depends on mechanical performance, environmental durability, and validated manufacturing processes.