

Sustainable Composites in Marine and Architecture: Bio-Resins, Recycled Foams, and Lifecycle Advantages Over Aluminium and Concrete

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ABSTRACT – DK Composites Sdn. Bhd. is driving sustainable innovation in composite manufacturing for marine, architectural, and rail applications, offering solutions that significantly reduce environmental impact while delivering superior performance. Our research demonstrates that FRP composites provide compelling advantages over traditional aluminium and concrete, including 40-60% lower lifecycle emissions, 30% longer service life, and complete reparability - key benefits for sustainability-focused industries. We present significant advancements in material technology, these being (i) bio-resin systems (soy/epoxy hybrids) reducing fossil fuel dependence and (ii) recycled PET foam cores diverting plastic waste while maintaining structural integrity and fiberglass reinforcement with improved production efficiency. While current solutions achieve partial recyclability (PET cores), we are actively developing (i) closed-loop recycling processes for fiberglass components and (ii) alternative natural fiber reinforcements for future product lines. These innovations support critical industry requirements in terms of corrosion-resistant marine applications, LEED-compliant architectural solutions and lightweight infrastructure with reduced carbon footprint. Our findings demonstrate that DK Composites' sustainable approach delivers both environmental benefits and long-term economic value, with 25% reduction in carbon footprint versus conventional composites and cost premiums recoverable within 3-5 years through reduced maintenance.