



SYNTHESIS OF CARBON-BASED NANOMATERIALS FROM BIOMASS *A McIntire-Stennis Supported Project*

Concrete is in nearly every manmade structure – its key ingredient, cement, producing 4.2 billion tons annually. However, 8% of global carbon emissions come from cement manufacturing. To combat this, biomass-based graphene products fabricated using lignin, a wood by-product, as the raw material, can be used to enhance the property ingredients in concrete to improve its strength, stiffness, and durability. Graphene materials have become a promising candidate in many fields of material science due to its mechanical, thermal, and electrical properties.

Researchers in this project developed a patented process to produce high-value graphene nanomaterials using lignin, a wood-by product with an annual production of 70 million tons worldwide, as a raw material. The process will eliminate the need for hazardous chemical processes by mixing biomass-graphene to concrete and utilize a waste stream of the paper industry.



COLLABORATION

Collaborators include the USDA Forest Products Laboratory.

IMPACTS



The project aims to **reduce cement usage** and the cost of concrete products by 20%.



The sustainable concrete product has a **competitive price of \$0.10 per gram**.



A potential result of **\$2.1 billion in sales**.

ABOUT MCINTIRE-STENNIS

The McIntire-Stennis program, a unique federal-state partnership, cultivates and delivers forestry and natural resource innovations for a better future. By advancing research and education that increases the understanding of emerging challenges and fosters the development of relevant solutions, the McIntire-Stennis program has ensured healthy resilient forests and communities and an exceptional natural resources workforce since 1962.

