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**Plants have convergently evolved to use “zips” (chemically labile ester linkages) in their lignin polymers**

Monolignol ferulate conjugates are naturally incorporated into plant lignins.

**The Science**

With a sensitive analytical method for diagnostically detecting incorporation of chemically labile ester bonds introduced into lignin polymers by augmenting the prototypical monomers with monolignol ferulate conjugates (“zip monomers”), we reexamined the lignin of three plants known to produce such conjugates in their extractives and found that these plants also used monolignol ferulate conjugates in their lignification. This discovery prompted a survey of a set of plants representing spermatophytes or “seed plants,” including 13 gymnosperms and 54 angiosperms.

**The Impact**

These findings provide evidence that “zip-lignins” – lignins derived, in part, from monolignol ferulate conjugates – have developed naturally via convergent evolution in diverse angiosperm lineages. Identifying plant lines with increased zip-lignin content, which are likely to be more easily and economically deconstructed, could provide superior sources of biomass for conversion to biofuels and bioproducts.

**Summary**

Angiosperms represent most of the terrestrial plants and are the primary research focus for the conversion of biomass to liquid fuels and co-products. Lignin limits our access to fibers and represents a large fraction of the chemical energy stored in plant cell walls. Recently, the incorporation of monolignol ferulates into lignin polymers was accomplished via the engineering of an exotic transferase into commercially relevant poplar. We report that various angiosperm species might have convergently evolved to natively produce lignins that incorporate monolignol ferulate conjugates. We show that this activity may be accomplished by a BAHD feruloyl–coenzyme A monolignol transferase, OsFMT1 (AT5), in rice and its orthologs in other grasses.

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**Publications**

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**Related Links**

http://advances.sciencemag.org/content/2/10/e1600393

https://www.glbrc.org/news/designer-lignin-biofuels-researchers-reproduced-evolutionary-path

**PM Recommendation for SC Web Publication**

[Yes or No]