Ethanol from lignin

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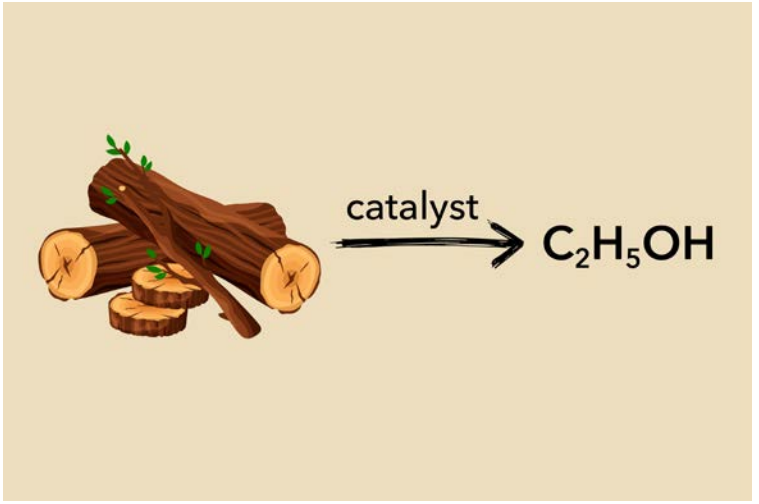

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The process uses a ruthenium–cobalt catalyst and involves three reactions to produce ethanol from lignin, carbon dioxide and hydrogen. Lignin is an industrial waste product but it is rarely used in the chemical industry and large amounts of it are burnt as a low-grade fuel. Industry has not previously used lignin to produce new compounds because depolymerising it usually forms mixtures of products that are difficult to separate.

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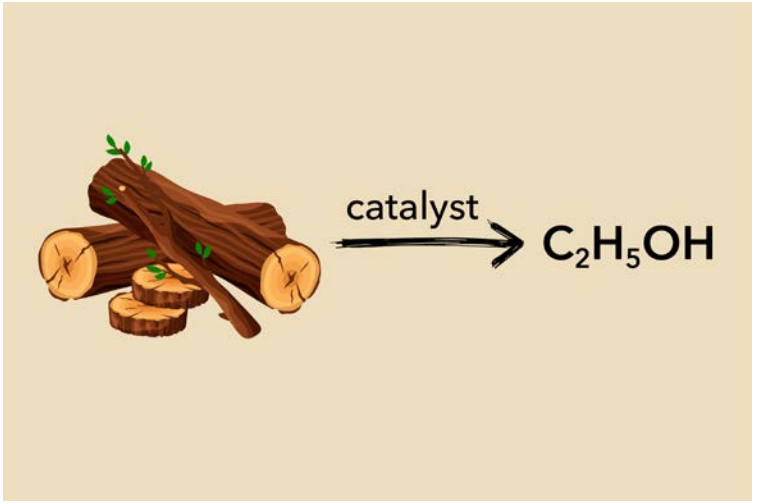

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1. **What is a catalyst?**
2. **Describe how fractional distillation can separate a mixture of products.**
3. **Suggest advantages of making ethanol from lignin instead of ethene hydration or fermentation.**