

Dead Leaves: Renewable Source of Furfural and Its Derivatives



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Submission: May 8, 2017 Published: June 05, 2017

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Introduction

Furfural is a colour less, sweet smelling, heterocyclic liquid aldehyde, with a ring structure at right [1]. Furfural has the following names: 2-Formylfuran; 2-Furaldehyde; 2-Furancarbal; Cyclic aldehyde; 2-Furaldehyde; 2-Furaldehído; 2-Furaldéhyde; alpha-Furole; Artificial ant oil; Fural; Furaldehyde; Furale to mention but few. According to Ibrahim et al. [1], Furfural was first isolated by Johann Dobereiner in 1821 during the synthesis of formic acid. And in 1840 John Stenhouse produced it from corns, oats, bran and sawdust with dilute sulphuric acid and established its empirical formula ($C_5H_4O_2$). The major producers of furfural are China, South Africa and Dominican Republic.

Furfural and its derivatives are very useful chemicals as fuels, petrochemicals, plastic, solvents and agrochemicals. Furfural has the unique property to dissolve aromatics and other unsaturated olefins hence, major oil companies use furfural as selective solvent in the refining of lubricating oils [2]. Aromatics, polar components, mercaptans are removed from petroleum by means of furfural extraction. Furfural can also be used as decolorizing agent to refine crude wood rosin. It was used to separate C4 and C5 hydrocarbons from butadiene (Isoprene) during the Second World War. It is used as a fungicide and weed killer and in the production of tetrahydrofuran, an important industrial solvent [3].

Methyl furfural is hot in the markets, 98% concentration of this compound is selling at the rate of 23.50 euro for only 25.0g [2]. It is used as food and flavor ingredients. Hydroxymethylfurfural (HMF) is known to be produced from hexose and cellulose [2]. It is used for production of polyurethane and nylon 6,6 monomers. It has been reported by Rosatella et al. [4] that HMF can be used for the production of important molecules such as levulinic acid, 2, 5-furandicarboxylic acid (FDA), 2,5-diformylfuran (DFF), dihydroxymethyl furan and 5-hydroxy-4-keto-2-pentenoic

acid. It is used for the production of plastics and industrial and household chemicals and transport fuel [3]. 2-furan methanol is used in Furan polymers, in making Sealants and Cements, Urea-formaldehyde and Phenolic Resins, as a Solvent, Foundry cores, Flavorings.

These useful compounds can be produced from dead leaves by acid hydrolysis. Hydrolysis of Earleaf acacia (*Acacia auriculiformis*) and *Gmelina arborea* leaves by 3% sulphuric acid have the compositions of furfural and its derivatives presented in Table 1. Some other useful industrial chemical are also produced.

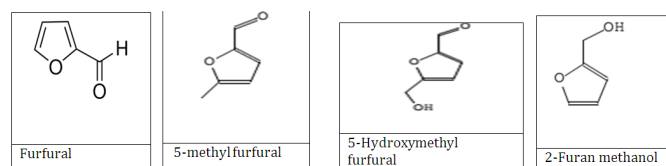


Table 1: Furfural composition in *Acacia auriculiformis* and *Gmelina arborea* leaves.

Compound	<i>Acacia auriculiformis</i>	<i>Gmelina arborea</i>
Furfural	20.87	-
5-methyl 2-furaldehyde	9.21	-
3-furadehyde	5.22	-
5-methyl hydroxyfurfural	-	13.02
5-methylfurfural	-	7.55
2-furan methanol	10.68	22.73
Total	45.98	43.3

Conclusion

Conversion of these dead leaves into useful chemicals like furfural rather than burning is a waste conversion to wealth that

would generate income to rural dwellers, provide employment opportunity, sustainable raw materials for chemical industries and transportation fuels. This process of turning waste into wealth is a green chemistry and engineering and will surely reduce environmental hazards.

References

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DOI: [10.19080/RAPSCI.2017.01.555566](https://doi.org/10.19080/RAPSCI.2017.01.555566)

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