Research duo develop new green way to synthesize vanillin from sawdust

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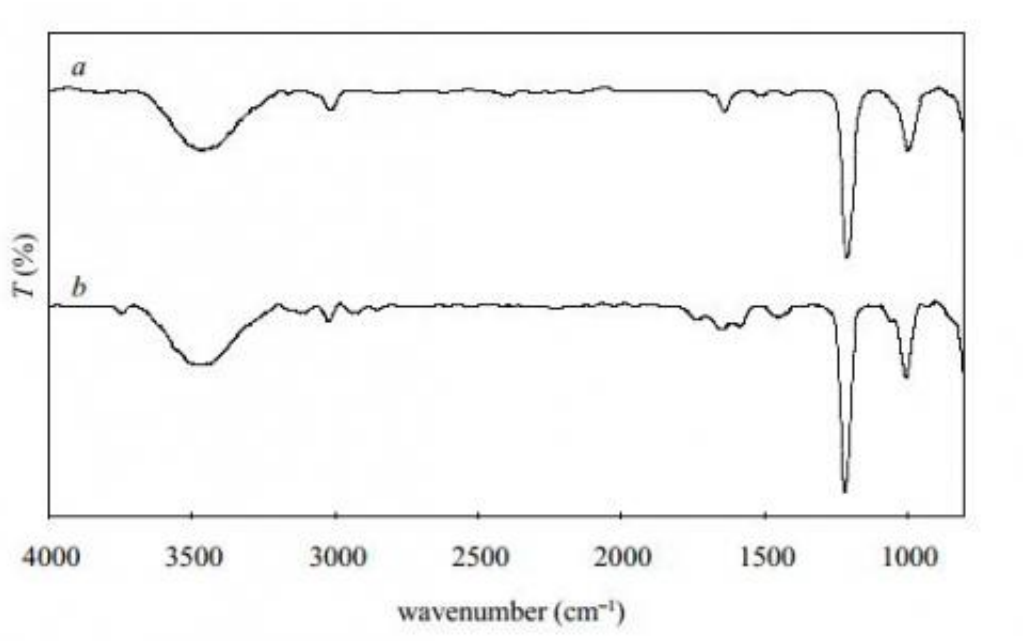

FTIR spectra of the standard vanillin (a) and the oxidation product (b). Credit: arXiv:1306.2442 [physics.chem-ph]

(Phys.org) —Chemical researchers D K Abdullah and Ahmad Shamsuri of University Putra Malaysia have found a way to synthesize vanillin from sawdust in an environmentally friendly way. In their paper they've uploaded to the preprint server *arXiv*, the two describe how they used an ionic liquid to dissolve lignin found in rubber tree sawdust to produce vanillin.

Vanilla is a flavoring found naturally in some orchids—it's the ingredient that gives fudge its kick. Its popularity has grown over the years to the point where demand now far exceeds the amount that can be extracted from the delicate flower pods. For that reason, manufactures have looked for ways to produce it artificially. A method of using lignin found in sawdust was developed and put into use, but soon fell into disfavor due to toxic byproducts. Another method, still in use, was developed based on a petrochemical material called guaiacol, but it's expensive and tied to oil price fluctuations. For that reason, scientists have continued to look for a cheaper, less environmentally hazardous way to use the lignin found in wood products.

In this new effort, the researchers looked to ionic liquids—salts in liquid form. Using them in commercial applications is still relatively new as they are generally quite toxic. Recently, however, developments in chemistry have led to some types that are less reactive and are therefore safer and cleaner to use. Abdullah and Shamsuri thought one of these, 1,3-dimethylimidazolium methylsulphate might be used to help synthesize vanillin.

They started by dissolving lignin in the ionic liquid and then caused oxygen to bubble up through the result. Next, they filtered the liquid separating out the various by-products, one of which was vanillin. To test its purity they performed Fourier transform infrared spectroscopy, high performance liquid chromatography and ultraviolet-visible analyses on the liquid and found it to be suitable for use as food additive.

The two conclude that their process could very easily be scaled up to allow for the commercial production of vanillin in a way that is cheaper than those based on petrochemicals and more environmentally friendly than others that use sawdust.

More information: A Preliminary Study of Oxidation of Lignin from

Rubber Wood to Vanillin in Ionic Liquid Medium, arXiv:1306.2442 [physics.chem-ph] arxiv.org/abs/1306.2442

Abstract

In this study, lignin was oxidised to vanillin by means of oxygen in ionic liquid (1,3-dimethylimidazolium methylsulphate) medium. The parameters of the oxidation reaction that have been investigated were the following: concentration of oxygen (5, 10, 15 and 20 ft3 h-1), reaction time (2, 4, 6, 8 and 10 h) and reaction temperature (25, 40, 60, 80 and 100{deg}C). The Fourier transform infrared spectroscopy, high performance liquid chromatography and ultraviolet-visible analyses were used to characterise the product. The results revealed vanillin as the product obtained via the oxidation reaction. The optimum parameters of vanillin production were 20 ft3 h-1 of oxygen for 10 h at 100{deg}C. In conclusion, 1,3-dimethylimidazolium methylsulphate could be used as an oxidation reaction medium for the production of vanillin from rubber wood lignin.

via ArxivBlog