

## Determination of Furan in Alcoholic Beverages

### Scope:

Furan is a low molecular weight volatile compound formed in foods and beverages during cooking and canning<sup>1</sup>. Furan has been found to cause cancer in rodents and is a potential carcinogen for humans. The Food and Drug Administration (FDA) has developed a method for furan analysis in foods and is conducting an expanded survey of different foods and beverages to determine exposure and risk to consumers<sup>2</sup>. As a part of this survey, the FDA approached TTB to help screen and analyze a number of alcoholic beverage samples. The Beverage Alcohol Laboratory has surveyed 37 alcoholic beverages for furan using a modified and optimized FDA method for alcohol beverage analysis<sup>2,3</sup>. The details of the method and our findings are reported below.

### Method:

A five mL test portion of the beverage is transferred to a head space sampling vial, fortified with the internal standard (*d4*-furan), and analyzed by gas chromatography/mass spectrometry (GC/MS) in the Selected Ion Monitoring (SIM) mode. Furan is quantified by using a standard additions curve, where the concentration of furan in the fortified test portions is plotted versus the furan/*d4*-furan response factors, which are calculated using the response ratio of *m/z* 68 for furan divided by *m/z* 72 for *d4*-furan. The method was validated for wines, beers, and distilled spirits with the following parameters: an average accuracy of 8%, precision of 7%, limit of detection (LOD) - 0.2 ppb, and limit of quantitation (LOQ) - 0.7 ppb.

### Findings:

Total of 37 commercial samples (8 beers, 14 wines, and 15 distilled spirits) were analyzed for furan. The furan concentrations are expressed in ppb ( $\mu\text{g/L}$ ) and summarized below. Samples with the estimated furan levels between the LOQ and LOD are reported as < 0.7 ppb, and the estimates below 0.2 ppb are indicated as ND. The beers appear to have slightly elevated levels of furan compared to the wines and distilled spirits; however, none of the analyzed samples demonstrated unusually high levels of furan.

<b>Product</b>	<b>Furan Conc. (ppb)</b>
Tequila 1	< 0.7
Cognac 1	2.1
Bourbon Whisky 1	ND
Tennessee Whisky 1	1.9
Brandy 1	0.7

Bourbon Whisky 2	< 0.7
Brandy 2	< 0.7
Gin 1	ND
Rum 1	< 0.7
Bourbon Whisky 3	ND
Brandy 3	< 0.7
Rum 2	< 0.7
Rum 3	< 0.7
Vodka 1	ND
Vodka 2	ND

Red Wine 1	0.9
Rose Wine 1	< 0.7
Red Wine 2	< 0.7
Red Wine 3	0.8
Red Wine 4	2.6
White Wine 1	1.7
White Wine 2	< 0.7
Red Wine 5	0.8
Sake 1	< 0.7
White Wine 3	0.7
Rose Wine 2	< 0.7
White Wine 4	2.4
Red Wine 6	0.8
Champagne 1	< 0.7

Beer 1	< 0.7
Beer 2	1.8
Beer 3	< 0.7
Beer 4	2.4
Beer 5	< 0.7
Beer 6	2.2
Beer 7	1.6
Beer 8	4.0

References:

1. Hasnip S, Crews C, Castle L. *Some factors affecting the formation of furan in heated foods*. Food Additives And Contaminants 23 (3): 219-227 Mar 2006.
2. *Determination of Furan in Foods*. <http://www.cfsan.fda.gov/~dms/furan.html>

3. Becalski A, Forsyth D, Casey V, Et Al. *Development And Validation Of A Headspace Method For Determination Of Furan In Food*. *Food Additives And Contaminants* 22 (6): 535-540 Jun 2005.