BC Centre for Disease Control
An agency of the Provincial Health Services Authority

Environmental Health Services

Food Issue

Notes from the Field

Food safety evaluation of bitters (infused alcohol) recipe

Request received from:	Regional Health Authority
Date of request:	March 25, 2014
Issue (brief description):	Evaluate bitters recipe for food safety risk

Disclaimer: The information provided in this document is based on the judgement of BCCDC's Environmental Health Services Food Safety Specialists and represents our knowledge at the time of the request.
It has not been peer-reviewed and is not comprehensive.

Summary of search information

1. Internet sources: wiki for bitters http://en.wikipedia.org/wiki/Bitters
2. PubMed search terms: "botulism" AND "alcohol"
3. Other: reviewed entry in Encyclopedia of Food Sciences

Background information

Bitters is a term applied to an alcoholic beverage prepared from an infusion of herbs, spices or other ingredients with alcohol. The bitters may be prepared and sold as a concentrate (cocktail bitters) where drops are added as flavouring to a beverage, or be prepared as a drink that is served neat or with ice (digestive bitters). Bitters have a long history, with recognizable names including Angostera (a cocktail bitter) and Pimms No.1 (a digestive bitter).[1]

One regional health authority requested a review of recipes and food safety plans associated with several different formulations of digestive bitters.

What are the risks associated with infused alcohols?

Ethanol is not a particularly toxic chemical and mixes readily with water. Depending on the concentration of the alcohol its inhibitory effect on micro-organisms may result from acting as a desiccant (at higher concentrations above 20%), or it may interfere with cellular membranes (between 10 and 20%). Wines have lower alcoholic content, but are also stable from having high content of phenolic compounds, acidic pH and low sugar. The hazard of most concern in a liquid food stored at room temperature is *C. botulinum,* due to the absence of oxygen and lack of other controls. Although rare, outbreaks of botulism have occurred from alcoholic fermented beverages in uncontrolled settings, such as prisons.[2,3] If ethanol (alcohol) is the sole barrier to food preservation, concentrations need to be in the range of 18 to 21% for "microbiology stability".[4] Other studies have suggested that ethanol will have an inhibitory effect at lower concentrations, from 6 to 11%, but have also demonstrated these effects are reversible, i.e., once ethanol is removed, *C. botulinum* spores will grow and toxin will be elaborated.[5]

Previous guidance on infused alcohols from British Columbia

In 2011, inquiries were made into purchasing vodka or other alcohols from the Liquor Distribution Branch, then infusing them with flavours (i.e. coffee bean or bacon for example), and rebottling back into the original bottles. However, this is not a legal activity per the *Liquor control and Licensing Act* in BC (38.1).[6]

A similar natural health product, mushroom extract in ethanol, was also evaluated by Food Protection Services in 2013. During that evaluation it was determined that the final pH and water activity combination controlled the risk of *C. botulinum.* [7]

Recommendations from BCCDC

We previously determined that the source of alcohol was not purchased from a Liquor Distribution Branch so concerns with the *Liquor control and Licensing Act* did not apply; further the alcohol was being purchased legally from an approved source.

Based on the revised food safety plan, recipe and ingredient list and flow chart provided by the operator, we offer the following evaluation.

In recipe type A, during *phase 1 alcohol steep*, a variety of ingredients are soaked in 8 litres (L) of 95% alcohol. Following this step, ingredients filtered out from the steep are boiled in 12L of water. This is cooled, and then the original 8L of 95% alcohol are added back.

The calculation for this formulation is $((8L)(95\%) + (12L)(0\%)) \div 20L = 38\%$ alcohol.

This is the same value as illustrated in the "apothecary bitters recipe index". This percentage of alcohol will effectively prohibit the growth of *C. botulinum* and formation of toxin.

In the recipe type B, the title of phase 2 also says "Boiling and Water Addition"; however, it does not appear there is any water boiling step? Regardless, 12L of water is added to the 8L of 95% ethanol, and the resulting 38% ethanol concentration would be similarly inhibitory to *C. botulinum*.

For both recipes in Phase 3 the addition of a simple sugar recipe (which appears to be at minimum concentrations of 50% sucrose in 1L of fluid), would not adversely affect the overall inhibitory alcohol concentration (adding one litre of sucrose reduces it to 36.2% ethanol), further, this should effectively lower the water activity, providing a further inhibitory affect.

Regarding the overall safety of the recipe and food flow, we recommend:

1. In recipe A, after boiling and before addition of the alcohol, the amount of time for cooling of the solution would be considering a critical control point to prevent the outgrowth of *Clostridium perfringens* and *Clostridium botulinum* spores. The solution, once it falls below 60°C, should be cooled to a temperature sufficient for the alcohol to be added within 4 hours. We do not recommend this product be out of temperature control, without any other hurdles, for longer than

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4 hours. If the alcohol is not added within 4 hours, then the solution should be fully cooled within 2 hours to 4°C, and held at this temperature until the alcohol can be added.

2. In Recipe A, after boiling, orange zest is added. As a precaution, we would recommend that the oranges (rind) be cleaned before zesting. Similarly, with the limes mentioned in Recipe B for latin lime bitters, these should be washed before zesting and addition. We're not entirely sure what "bruised" refers to in both of these recipes. If this refers to "seconds" or fruits that are not of high quality, we would not recommend purchasing anything other than unbruised, unblemished high quality produce.
3. It would be useful for the recipes to be tested for pH and A_w at least once, to further inform on the safety of this product for room temperature storage. This would be a helpful indicator to rule in or rule out whether temperature control for safety (addition of another hurdle) would be warranted. We would recommend testing in at least 2 scenarios, at the end of Phase 2 (before the syrup/clarifying step) and at the end of Phase 4, when the product is bottled. It would also be useful if the operator retained a sample of the bitters to the end of its shelf life and tested a final time to ensure stability of the product.
4. There are many dried spices and ingredients - ensure all ingredients are sourced from an approved supplier.

In conclusion, the recipe and plan provided can be reasonably assumed to be safe, provided the above recommendations are followed.

References

1. Wikipedia. Bitters. 2014 [cited 2014 Mar 14]; Available from: http://en.wikipedia.org/wiki/Bitters.
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5. Daifas DP, Smith JP, Blanchfield B, et al. Effect of ethanol on the growth of Clostridium botulinum. J Food Prot. 2003 Apr;66(4):610-7.
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   http://www.bclaws.ca/civix/document/id/complete/statreg/96267_01#section1
7. Parameters for determining inoculated pack/challenge study protocols. J Food Prot. 2010 Jan;73(1):140-202.

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