O·I·Analytical

Methodology

Bitterness in Beer by Segmented Flow Analysis (SFA)

(Cartridge Part #A002996)

1.0 Scope and Application

1.1 This method is used for the automated determination of bitterness in filtered beer or wort.

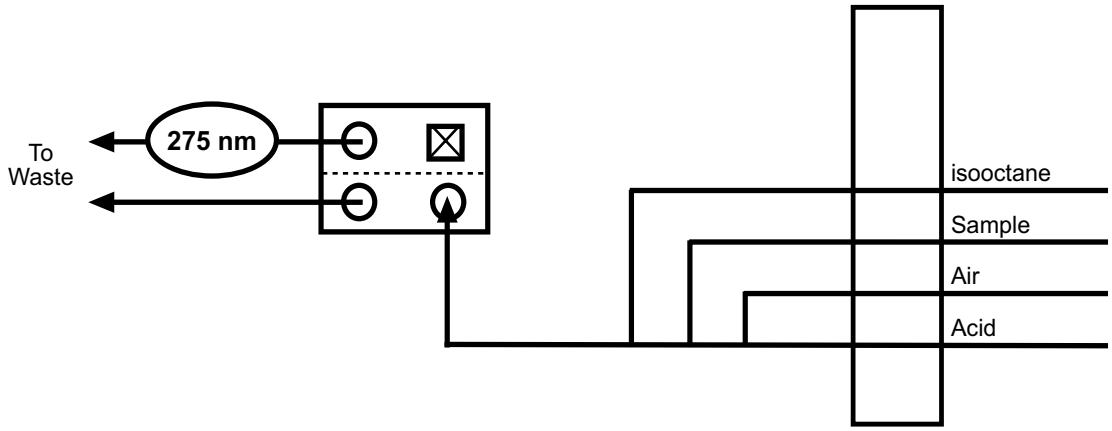
1.2 The applicable range of this method is 1.0–200.0 international bitterness units (IBU).

2.0 Summary of Method

2.1 To prevent excess foaming, samples are first manually degassed by agitation or sonication in the presence of octanol. The degassed samples are then aspirated into the reaction manifold followed by acidification. The acidified sample is merged with isooctane and extracted at a constant temperature. The extraction process forms an aqueous-organic segmented fluid pattern that requires phase separation after the extraction is complete. The phase separation is performed in the membrane module by an organic phase selective membrane where the organic phase flows to the detector and the bitterness components are measured at 275 nm.

2.2 The quality of the analysis is assured through reproducible calibration and testing of the SFA system.

2.3 A general flow diagram of the SFA system is shown below (see Section 17.0 for a detailed flow diagram).



3.0 Definitions

Definitions for terms used in this method are provided in Section 16.0, “Glossary of Definitions and Purposes.”

4.0 Contamination and Interferences

The American Society of Brewer Chemists defines bitterness in beer as all isooctane extractable species from an acidified beer sample. In the extraction procedure, unwanted components may be extracted such as plasticizers in tubing or reagent containers. These interferents have been eliminated in the present design of the OI Analytical Bitterness Analyzer. In addition, specifications for bitterness may be defined based on a modified procedure for specific applications or products.

5.0 Safety

5.1 The toxicity or carcinogenicity of each compound or reagent used in this method has not been fully established. Each chemical should be treated as a potential health hazard. Exposure to these chemicals should be reduced to the lowest possible level.

5.2 For reference purposes, a file of Material Safety Data Sheets (MSDS) for each chemical used in this method should be available to all personnel involved in this chemical analysis. The preparation of a formal safety plan is also advisable.

5.3 The following chemicals used in this method may be highly toxic or hazardous and should be handled with extreme caution at all times. Consult the appropriate MSDS before handling.

5.3.1 Hydrochloric Acid, Concentrated (HCl)

5.3.2 isooctane (C_8H_{18})

5.4 Unknown samples may be potentially hazardous and should be handled with extreme caution at all times.

5.5 Proper personal protective equipment (PPE) should be used when handling or working in the presence of chemicals.

5.6 This method does not address all safety issues associated with its use. The laboratory is responsible for maintaining a safe work environment and a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method.

6.0 Apparatus Equipment and Supplies

6.1 Segmented Flow Analysis (SFA) System (OI Analytical Flow Solution IV) consisting of the following:

6.1.1 Model 502 Multi-channel Peristaltic Pump

6.1.2 Random Access (RA) Autosampler

6.1.3 Expanded Range (ER) Photometric Detector with 5-mm pathlength flowcell and 275-nm optical filter

6.1.4 Data Acquisition System (PC or Notebook PC) with WinFLOW™ software

6.1.5 Bitterness in Beer Cartridge (OI Analytical, Part #A002996)

6.2 Sampling equipment — Sample bottle, amber glass, with polytetrafluoroethylene (PTFE)-lined cap. Clean by washing with detergent and water, rinsing with two aliquots of reagent water, and drying by baking at 110°-150°C for a minimum of one hour.

6.3 Standard laboratory equipment including volumetric flasks, pipettes, syringes, etc. should all be cleaned, rinsed and dried per bottle cleaning procedure in Section 6.2.

7.0 Reagents and Standards

7.1 Raw Materials

7.1.1 Brij-35® 30% w/v (OI Analytical, Part #A21-0110-33)

7.1.2 Hydrochloric acid, concentrated (HCl)

7.1.3 isooctane (C_8H_{18})