Advanced Analytical Methods For The Analysis of Chemical And Microbiological Properties of Beer

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ABSTRACT

Beer is a worldwide consumed and universally popular beverage due to its pleasant sensory properties and nutritional/medicinal functions. Chemical (flavor, safety, nutritional and medicinal aspects) and microbiological (brewing yeast and contaminating microorganisms) properties of beer are among its key attributes. In this article, application of advanced instrumental methods for the analysis of chemical and microbiological characteristics of beer is discussed. Advanced instrumental techniques for the quick, reliable, selective and relatively sensitive analysis of food products including beer are widely used for research or quality evaluation purposes.

Key words: analysis, beer, flavor, hygiene, instrumental, microbiological, nutritional

INTRODUCTION

Beer, a brewed beverage made principally from malt (germinated barley), hop, water and yeast, is one of the most popular drinks worldwide. In 2004, the per capita consumption of beer around the world was 72.9 L (annually) on average, while in some countries this figure was higher than 130 L¹. Popularity of beer arises from its pleasant sensory attributes and favorable nutritional and health (in light-to-moderate consumption) characteristics². Investigations have shown that there is a high tendency for beer consumption among different levels of societies due to the above-mentioned criteria³-⁵.

Most beers produced worldwide have alcohol content in the range of 3 - 6% (v/v)⁶,⁷. While a low-strength beer contains about 2 - 3% of alcohol, a medium/average-strength beer has about 5% and a high-strength/strong beer has about 6 - 12% of alcohol². In recent years, there has been an increased market share for low-alcohol (< 2.5% alcohol content) and non-alcoholic (< 0.5% alcohol content) beers²,⁶,⁷,⁸.

Chemical aspects include flavor, chemical hygiene (chemical safety) and nutritional and medicinal attributes. Flavor is by far the most important sensory attribute of beer. Chemical aspects of food materials comprise only the background level of perception. Among chemical aspects, flavor compounds (for example) are directly perceived as flavor; whilst, for example, chemical substances contributing to the foam formation are not perceptible unless they appear in the foreground state of visual foam. Microbiological aspect is associated to the analysis of type and viable counts of microorganisms including brewe r’s yeast as well as contaminating (invading) microorganisms.

Due to their efficiency and sensitivity, advanced instrumental methods of analysis are widely used for the assessment of different foods (including beer), for research or for quality evaluation purposes. The aim of this article is to review the most important advanced instrumental methods for the analysis of chemical and microbiological characteristics of beer.

I. Chemical Analysis

(1) Flavor

The typical beer flavor comprises a complex balanced mixture of numerous flavor agents, such as phenolics, proteins, carbohydrates, isohumulones (iso-alpha-acids), alcohols, tannins, lactones, aldehydes, unsaturated carbonyl compounds, vicinal diketones, ionones, methyl esters, fatty acids, essential oils, sulfur-containing volatile compounds, nucleotides, mineral ions and organic acids. More than 800...