



## Advances in the analysis of aromatic compounds in hop “nugget” from Patagonia

S. B. González<sup>1</sup>, B. Gastaldi<sup>1,2</sup>, F. M. Silva Sofrás<sup>1</sup>, C. M. van Baren<sup>3</sup>, P. Di Leo Lira<sup>3</sup>, D. Retta<sup>3</sup>,  
A. L. Bandoni<sup>3</sup>

<sup>1</sup> Dpto. de Química, Facultad de Ciencias Naturales, UNPSJB - Sede Esquel, Argentina

<sup>2</sup> Consejo Nacional de Investigaciones Científicas (CONICET), Argentina

<sup>3</sup> Cátedra de Farmacognosia-IQUIMEFA, Facultad de Farmacia y Bioquímica, UBA.  
cbaren@ffyba.uba.ar

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In the manufacture of beer malt addition with small and varying amounts of two groups of hops (*Humulus lupulus* L.) which provide the bitter taste and the flavor profile of the beverage depending on the composition of its hundreds of volatile constituents. Overall, it is considered that there are four types of scents provided by the different hop varieties: 1, fats and green notes for the presence of aldehydes; 2, citrus chords (nerol and linalool); 3, fruity or floral notes due to the presence of certain alcohols and esters; 4, herbaceous and spicy notes provided by sesquiterpenes and their oxidized forms generated during the beer processing (1,2). (*E*)-caryophyllene and  $\alpha$ -humulene are two key sesquiterpene compounds in most of the varieties. Its percentage ratio allows differentiating between varieties. Other important sesquiterpenes compounds are of farnesene and selinene nuclei. Furthermore, the presence of myrcene is undesirable for giving a "chemical or solvent" aroma; however, this compound is easily volatilized during processing of the beverage. The presence of sulfur compounds is also of utmost organoleptic importance for its low odor thresholds that have been studied by several authors. New varieties of hops with new aromatic profiles are prized as a way to produce novel types of beer. In Argentina, “Nugget” is a variety characterized among the bitter ones (high humulones), for this reason the volatile components of this variety of hop from Patagonia, Argentina, were isolated by hydrodistillation and analyzed by GC / FID / MS. 102 constituents were identified, being the main: myrcene: 62.4%,  $\alpha$ -humulene: 11.7%, (*E*)-caryophyllene: 4.6%; methyl *cis*-4-decenoate: 1.6%, methyl 4,8-decadienoate: 1.5% and linalool: 1.0%. Hop Nugget from Patagonia presented high myrcene content compared with hops from the same variety of other regions; however, this monoterpene disappears to a great extent during brewing. Besides, minimal amounts of 2-nonanol and methyl 3,6-dodecadienoate were detected, both regarded as typical markers of this variety. The ratio  $\alpha$ -humulene/(*E*)-caryophyllene, used to characterize different varieties, was 2.5, similar to the values found with Nugget from Spain (1.6) and from the United States (3).

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