

PUBLICATION CZECH HOPS

Traditionally like each year was edited international publication Český chmel – Czech hops. This publication has been officially published at fair Drinktec in Munich last week. As is well known by many studies and response on the world confirmed Czech hop is a sign of quality and finally superiority as evidence by both the czech hops districts by law No. 97/1996 and particular „Žatecký poloraný červeňák“ minutes to the list protected Designation of origin by Regulation No. 503/2007. This publication is published by the Ministry of Agriculture of Czech Republic in cooperation with the Hop Growers Union. Editor-in-chief is Mgr. Zdeněk Rosa, BA. that already the introduction captures the uniqueness of Czech hops and its rich history. Further, he deals with overview of information that reader can find.

Introductory speech to the publication contributed Minister of Agriculture Ing. Jakub Šebesta that highlighted importance quality and growing tradition of hops in Czech Republic. Further, his words summarized statistics hops variety and areas at our land.

Beer is, without a doubt significant drink by czech man and czech hop is closely related with czech beer. The „České pivo“ was registered to the protected designation in year 2008. And under this authorization in addition to many other parameters focus on raw materials including the czech varieties. Ing. Jan Veselý deals with protected geographical indication (PGI) in this publication. Ing. Josef Patzak, PhD., from Hop Research Institute Co., Ltd. in Saaz introduced individual departments and their head employees. This record gives some insight about activity and importance of the work Hop Research Institute.

Scientific articles afforded Ing. Karel Krofta, PhD., Content of prenylated hop flavonoids in czech and foreign beers and Ing. Josef Ježek, Utilization of irrigation systems in hop growing.

Further publication content description czech variety of hops from authors Ing. Vladimír Nesvadba, PhD. and Ing. Karel Krofta, PhD. Description is including characteristic of varieties or content individual components.

From historical site (like importance part) Ing. Zdeněk Tempír, CSc. written articles called: The tradition of „Dočesná“ (Hop harvest festival) and further Antonín Mohl that like teacher, researcher and mainly the most significant hop grower its activity has helped raise the profile of the field.

It should be stressed that the Czech hops still maintains its uniqueness and quality even during extreme adverse climatic effects which are evidence of the harvest results of the last two years both in revenues and in the quality and content of alpha acids are above-average results of the last crop year. Information that the questions of the quality of Czech hops, depending on global warming is not authentic and not based on long-term follow facts and not based on concrete facts found in the long-range observation. Czech beer drinkers therefore does not need to worry

about the future, that the Czech hop growers fail to deliver high-quality raw materials to produce high-quality Czech beer. Similarly, the foreign customer is always satisfied by the traditional quality Saaz hops. The quality of hops is evaluated not only for the content of alpha acids which is typical for aromatic and delicately flavored hops Czech variety hops are a group of aromatic varieties, and especially the variety Saaz is considered the best aromatic variety of the world due to its ratio of alpha and beta bitter acids, due to essential oil content, where the main feature this variety contains high levels of farnesene. For variety Saaz is also a high content of polyphenols, which have a many beneficial health properties. Breweries, which bought Czech aromatic hops evaluate especially his exceptional sensory characteristics and its contribution to a balanced and pleasant bitterness of beer, which ensures high consumption.



CONTENT OF PRENYLATED HOP FLAVONOIDS IN CZECH AND FOREIGN BEERS

OBSAH PRENYLOVANÝCH FLAVONOIDŮ CHMEVĚV ČESKÝCH A ZAHRANIČNÍCH PIVECH

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Abstract
 Content of isoxanthone (IX) in most of Czech and foreign beer brands did not exceed 500 µg/l. Concentration of xanthone (X) was up to 150 µg/l. The majority of prenylated flavonoids were of the isoprenylated type with branched C₁₅ side chain. The average content of prenylated flavonoids was found to be higher and varied the four brands due to lower lupulin content and higher proportion of C₁₅ isomers. Level of IX in beer can be influenced by choice of hop variety and lupulin content. Level of prenylated flavonoids is affected also during process of drying and heating and used for hopping. Monitoring of isoxanthone concentrations in hop extracts of brewing technology is an important measure to ensure that high levels occur at the middle of beer production. Critical points are cooling of wort, fermentation and filtration. Low ratio of isoxanthone to xanthone during beer production is indicated experimentally (20:1). Testing of the stability of IX and X in various media is needed to assess which was done in the time period of 2 months. Storage time concentration of IX was reduced by 10-11 % based on storage temperature. Content of X was not significantly affected under storage conditions.

Introduction
 Hops, as a base material in beer production, are the only source of prenylated flavonoids, isoxanthone (IX) and xanthone (X) (Fig. 1) in the beverage. The importance of the above mentioned agents has been rapidly growing in the past decade by reason of the discovery of numerous health effects. As for isoxanthone, this is especially the ability to affect some types of cancer, as well as cardiovascular, anti-inflammatory and anti-oxidant effects. The chemopreventive effect of isoxanthone in the area of carcinogenesis may consist of the inhibition of metabolic activation of pro-carcinogens, increasing of the activity of carcinogen-detoxifying enzymes and/or some growth-inhibitors in the final stage [1]. Isoxanthone together with some hop resin components also inhibits migration of tumor cells. The health effects of xanthone are similar to those of isoxanthone, but the pronounced IX activity against a tumor cell line is compensated by higher concentrations and easy availability in beer for many years. Isoxanthone was considered a source of estrogenic hop effects. However, based on extensive in vitro and in vivo studies, Phipps and al. [2] identified X prenylation as the main of the estrogenic effects. Based on the comparison of the estrogenic effects of X-IX and other agents, natural isoxanthone or hop X is found to be a more effective phytoestrogen. Isoxanthone and X prenylation are natural substances, structurally and functionally similar to estrogens of the mammalian origin. They are used, e.g. in the case of substitution treatment of women, in order to reduce health complications in the postmenopausal period. The bioactivity of X-IX in beer is the concentration of isoxanthone (IX) (0.005-0.010 mg/ml), contained in hops in the quantity of 10-150 g/kg weight, in standard beer. X-IX concentration in every liter (~0.5 µg/l) that is equivalent to phytoestrogenic (estrogenic) effect. It has been found that xanthone itself is capable of stabilizing the isoxanthone content in beer into 50%. Therefore, due to regular beer consumption, the daily intake of phytoestrogen may increase as much as to a physiologically active level [3].

In spite of the fact that isoxanthone is contained in hops to the greatest extent, its concentration in beer is lower due to thermal transformation to xanthone. On the contrary, xanthone is a dominant hop prenylated flavonoid. During the brewing process, hop losses of prenylated flavonoids, caused by an imperfect extraction in wort, adsorption to malt protein and yeast. Several studies show that total isoxanthone addition, mostly in fermented beers at 20 to 30 °C, does not significantly affect during subsequent filtration, whereby the addition hop drop to 10 to 20 %. Xanthone concentration in filtered beer is thus lower than 1 µg/l. The content of xanthone in beer was normally around the level of 100 µg/l [4]. The structure of the most important prenylated flavonoids contained in hops and beer is shown in Fig. 1. Analytical determination of hop prenylated flavonoids in beer is normal use. Various laboratory using liquid chromatography coupled

Abstract
 Obsah isoxantonu (IX) v většině českých a zahraničních piv značek nepřesáhl 500 µg/l. Obsah xantonu (X) byl maximálně 150 µg/l. Většina prenylovaných flavonoidů byla isoprenylovaného typu s rozvětveným C₁₅ bočním řetězcem. Průměrný obsah prenylovaných flavonoidů byl vyšší a lišil se čtyřmi značkami kvůli nižšímu obsahu lupulinu a vyššímu podílu C₁₅ izomerů. Úroveň IX v pivu může být ovlivněna výběrem druhu chmele a obsahem lupulinu. Úroveň prenylovaných flavonoidů je ovlivněna také během procesu sušení a vaření. Monitorování koncentrací isoxantonu v extraktech chmele v technologii pivovarské výroby je důležitou opatření k zajištění vysokých úrovní v průběhu výroby. Kritické body jsou chlazení sladu, fermentace a filtrace. Nízký poměr isoxantonu k xantonu během výroby piva je indikován experimentálně (20:1). Testování stability IX a X v různých médiích bylo provedeno v období 2 měsíců. Úroveň IX v pivu byla snížena o 10-11 % v závislosti na teplotě skladování. Obsah X nebyl významně ovlivněn podmínkami skladování.

Úvod
 Chmel je jedinou surovinou pro výrobu piva, je zdrojem estrogenických prenylovaných flavonoidů, isoxantonu (IX) a xantonu (X) (viz obrázek 1). Důležitost těchto látek v pivu rostla v posledních letech díky objevení mnoha zdravotních účinků. Je to zejména schopnost ovlivňovat některé typy rakoviny, stejně jako kardiovaskulární, protizánětlivé a antioxidantní účinky. Chemopreventivní účinek isoxantonu v oblasti karcinogeneze může spočívat v inhibici metabolické aktivace pro-carcinogenů, zvyšování aktivity karcinogen-detoxikujících enzymů a/nebo některých inhibičních látek v konečné fázi [1]. Isoxanthone spolu s některými složkami chmele také inhibuje migraci tumorových buněk. Účinné účinky xantonu jsou podobné těm isoxantonu, avšak výraznější účinek isoxantonu proti nádorovým buňkám je kompenzován vyšší koncentrací a snadnou dostupností v pivu po mnoho let. Isoxanthone byl považován za zdroj estrogenických účinků chmele. Nicméně, na základě rozsáhlých in vitro a in vivo studií, Phipps a kol. [2] identifikovali X prenylací jako hlavního zdroje estrogenických účinků. Na základě srovnání estrogenických účinků X-IX a dalších látek, přirovnali isoxanthone nebo X prenylací k fytoestrogenům. Isoxanthone a X prenylace jsou přirozené látky, strukturně a funkčně podobné estrogenům živočišného původu. Jsou používány, např. v případě substituční léčby žen, aby se snížily zdravotní komplikace v období po menopauze. Bioaktivita X-IX v pivu je koncentrace isoxantonu (IX) (0,005-0,010 mg/ml), obsaženého v chmele v množství 10-150 g/kg hmotnosti, v standardním pivu. Koncentrace X-IX v každém litru (~0,5 µg/l) odpovídá fytoestrogenickému (estrogenickému) účinku. Bylo zjištěno, že samotný xanthone je schopen stabilizovat obsah isoxantonu v pivu na 50%. Protože kvůli pravidelné konzumaci piva může denní příjem fytoestrogenů překročit fyziologicky aktivní úroveň [3].

Fig. 1. Structure of the most important prenylated hop and beer flavonoids.
 Obr. 1. Struktura významných prenylovaných flavonoidů chmele a piva

