FOOD SAFETY IN BEER INDUSTRY

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Abstract: The beer industry in Romania has known after the year 1990, unlike other sectors in food industry, a significant reshape process, technological improvement and economical growth. This paper proposes a theme with practical importance imposed by the necessity of security and control of the whole food chain according to the principle FARM TO TABLE – the principle of traceability in the perspective of Romania joining the European Union. To control technological process from viewpoint of contamination risks, it was elaborated a HACCP system in beer manufacturing.

Keywords: food safety, traceability, HACCP system, beer's stability

The manufacturing and merchandizing of quality food products, safe for the consumer's health, is the main objective of every manufacturer in the food industry. Once entered in the European Union Romania must fulfil a number or conditions among which the implementation of communitarian aquis is found, that includes, besides harmonizing the legislative field, adopting European standards, in all fields, especially those concerning human health and safety.

The recent legislation stipulates restricted limits for deficient origin contaminants in foodstuffs also in beer. The novelty consists of risks identification, represented by possible biological, micotoxical and chemical contaminants, very much incriminated by European legislation, correlated also with Europe Union integration approaching.

Lately European and world scientific research is mostly targeted towards food products QUALITY AND SAFETY, proof being the recent financing programs given by the European Community (FP6 Priority 5 *FOOD QUALITY AND SAFETY).* In the past years this field has known many national and international meetings, scientific papers were made and scientific research contracts were unfurled.

According to Low no.150/2004 concerning food safety, food industry factories must adopt in the shortest time possible, but no later than January 1st 2007, to the present principles and procedures concerning food fields' legislation. "Nothing is more effective and nothing is cheaper than caution' and food safety problem has zero tolerance in the European Union. On a European scale the European Food Safety Authority (EFSA), with its headquarters in Parma (Italy), is acting and in 2004 a Veterinary Agency for Food Safety (AVSA) has been organized in our country as well, as a national authority in this field with responsibilities concerning food quality and safety.

In the past years the beer industry, unlike other sectors of food industry has known a significant reshape process, technological improvements and economic growth. Presently over 100 beer brands are being produced in Romania, with an estimated sale volume of 3 million hl of beer according to the Romanian Association Beer Industry. This is why it is necessary that a maximum importance is given to MICROBIOLOGICAL AND CHEMICAL SAFETY of the finished product in this industry also IN ORDER TO PROTECT CONSUMERS.

Generally, beer as a finished product is a stabile product because of its low pH, the presence of hop constituents, low oxygen and nutrients level, alcohol content (Moll, M., 1991, Dan, V., 2001). But, for beer to become a safe food for consumers THE INTEGRITY OF THE WHOLE FOOD CHAIN FLUX must be assured, by implementing a Food Safety Management System. This system must compulsory includes a HACCP manual, guide of good work and hygiene practices.

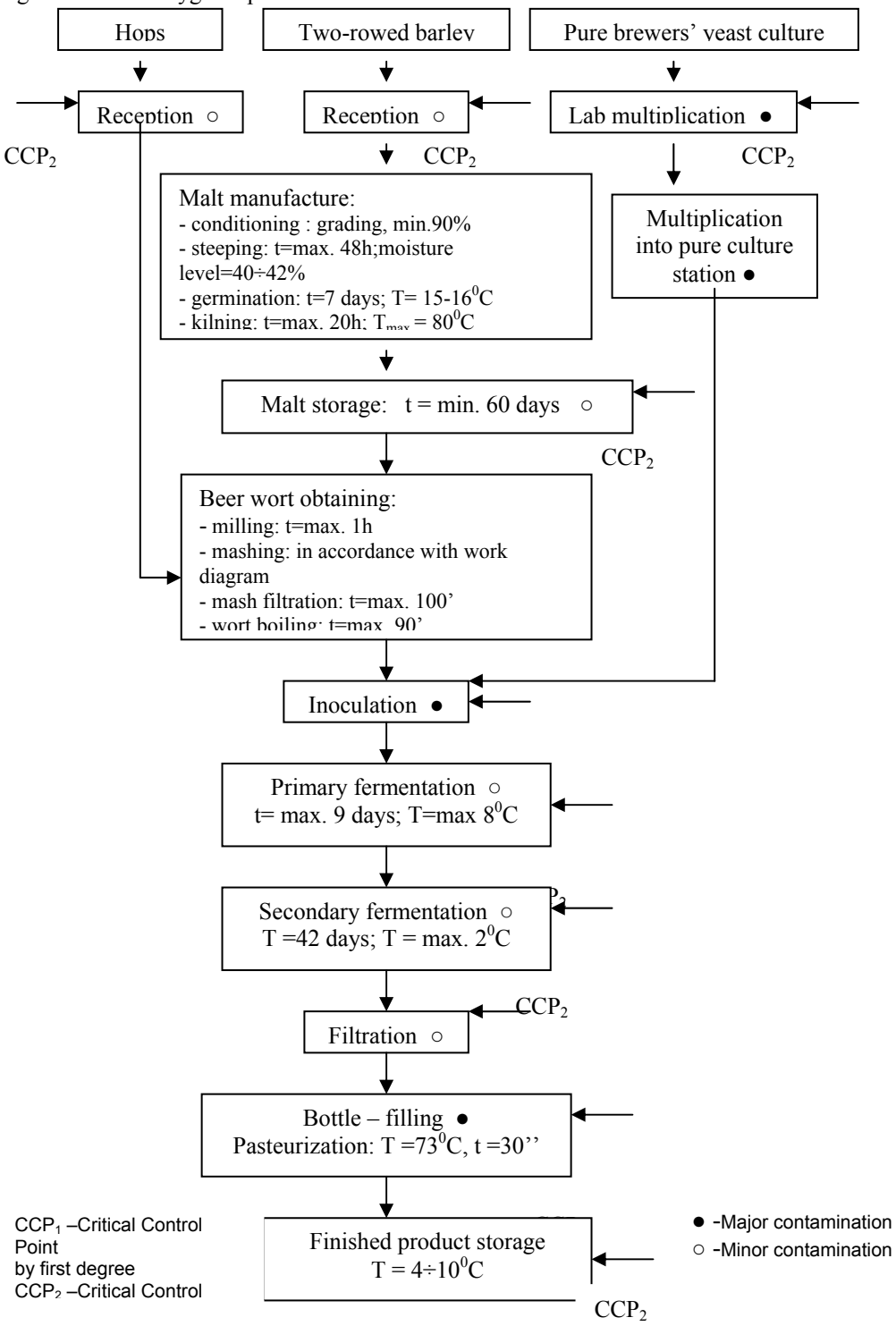

Fig.1. Simplified flow diagram to the Pilsner beer

It is known that the HACCP system (Hazard Analysis and Critical Control Point), GHP (Good Hygiene Practices) and GMP (Good Manufacturing Practices) permits identifying risks, establishing monitorizing procedures and corrective actions for preventing eliminating or reducing them at an acceptable level and is made in according to CODEX ALIMENTARIUS standards and profile standards series.

In figure 1 we propose an HACCP system for Pilsner beer production. In the flow diagram to the manufacturing of the Pilsner beer, it has indicated the contamination points and Critical Control Points, too. The application of the HACCP has permitted the recording and maintaining under control of the identified risks. The HACCP method has a dynamic nature. Hence, it will check again every time is necessary, when the raw materials, equipments, manufacturing technologies or cleaning and disinfecting techniques are modified. This model completed of GMP and GHPs, permitted to observe the main risks of the technological process for Pilsner beer brewing, establishing of critical limits, control actions and monitoring methods. The greater risks are the microbiological contaminations at each stage of production. Also, the technological state of the plant and the skill of the brewery personnel have a direct effect on microbiological contaminations.

The good work practices guides are useful instruments of high importance for food industry specialists', which that helps them, obtain quality products by respecting hygiene rules throughout food chain stages.
In the field of food safety there is an international standard (FDIS) – ISO 22000: *Management systems for food security. Requirements for the whole food chain*. This international standard dynamically combines HACCP principles and applying steps with premise programs, using risks analysis to determine the needed strategy in order to ensure risk control.

In order to prevent contamination risks they all must be known by manufacturers. Risk is defined by the NACMF (National Advisory Committee on Microbiological Criteria of Foods) as being any element of a biological, physical or chemical nature that is a threat to consumer's health (Rotaru, G., Moraru, C., 1997).

For example, beer can be contaminated by:
- *asbestos,* beer filtration was performed using cellulose containing asbestos. Since 1980 the use of asbestos as a filter aid has ceased and beer no longer contains it. It has never been shown that there is a risk of tumor formation caused by asbestos ingested in beer. In our country it is still use in older beer factories;
- *biogenic amines* (histamine, tyramine, spermidine, putresceine, cadaverine etc.). Their presence in beer has been studied by numerous scientists (Steiner and Lanzlinger –1988, Wackerbauer and Toussaint – 1994, Cerutti *et al.* –1999, Izquierdo-Pulido *et al*. - 1999). Beer as a finished product may contain low quantities of biogenic amines higher quantities being due to microbiological contaminations. These substances can cause headaches and migraines.
- *Heavy metals:*
  - *arsenic,* the level of which must not exceed 0.2 mg/l beer. The major source is the heating of malt kilns with anthracite or, in the last century, the use of starch syrups hydrolyzed with impure sulphuric acid (lead chamber process). Other sources of arsenic are hop treatment products and impurities in kieselguhr. It is well known the collective intoxication in Manchester (1900) with over 400 cases out of which 300 fatal caused by beer containing up to 15 mg/l As. Presently in our country beer 's arsenic content is not currently being determined;
  - *lead,* the level of which must not exceed 0.2 mg/l, may be introduced in water, from old lead pipes, from impure kieselguhr or from packing;
  - *iron* in beer may be derived from several sources such as the iron in the diluting water, or the iron in kieselguhr or other materials in direct contact with the beer;
  - *cadmium*, may be transferred into beer from new installations made of stainless steel that has not been passivated. Cadmium is one of the most toxic metals causing the itai-itai (doctor Noburo Hagino from Toyama) diseases that manifests through acute pains propagated from the extremities into the whole body. At he same time, because of bone structure modification the body shrinks reaching almost unbelievable size.

In the case of all metals that can be measured in beer it is important not exceed the recommended standards for drinking water. In our country according to Low MS 975/1998 the maximal limits for heavy metal are: As – 0.1 mg/kg, Cd – 0.05 mg/kg, Pb – 0.3 mg/kg, Zn – 5 mg/kg, Cu – 1 mg/kg, Sn – 50 mg/kg, Hg – 0.05 mg/kg (Banu, C., *et al.*, 2003);

- *mycotoxins* can be produced by contaminants on cereals used as raw materials. An inappropriate keeping in silos of raw materials may lead to contamination with moulds type *Fusarium, Aspergillus, Penicillium, Nigospora*, that produce micotoxins. Woller and Majerus (1982, 1983) analysed a number of beer assortments in which they found infinitesimal quantities of micotoxines of 1-2 ug/l. Payen et al. (1993) obtained the following results with 86 European beers: of 37 samples 4 were found to be contaminated with ochratoxin A 5-110 ug/l; of 49 beers 6 were contaminated with epoxytricothecenes; of 49 samples, 1 beer contained a concentration of 100 ug/l of zearalenone. Micotoxins cause diseases by with acute or chronic poisoning. Also, these micotoxins are responsible for gushing of beer, phenomenon that appears when the bottle is opened. The gushing phenomenon may appear from other causes: the use of hops reach in poliphenols, poor hygiene, and calcium oxalate crystals. No rapid prediction test for gushing caused by malt has proved entirely satisfactory. Donhauser *et al.* (1990) proposed a test in which the wort produced is carbonated with 9 g/l CO_2 at 4^0C. After agitation at 20^0C the amount of beer that overflows is measured.
- *nitrate, nitrite, nitrosamines*- the principal sources of nitrate are the water, hop and beer yeast. The World Health Organization tolerates 40 mg NO_3^- /l and regulations of several countries allows up to 50 mg/l (Moll and Moll, 1990).Spiegelhalder *et al.* (1999) published a list of NDMA (N-nitrosodimethylamine) contents of beers showing some contained between 2 and 10 ug/kg. A large number of researchers confirmed these results and the malting industry undertook measures to reduce the NDMA content in malt. Acid washing of weast can remove a major source of contaminants responsible for N nitroso compounds (ATNCs) formation (Simpson and Hammond 1990).
- *pesticides, fungicides, herbicides* – hundreds of compounds are available for treating the raw materials while they are growing and such compounds are found on the hops, barley and other cereals and also in ground waters. In 50 beers analyzed the concentration of halogenated hydrocarbons was less than 2 ug/l on average (Liebl *et al.*, 1983).

Already some states of the European Union have adopted a horizontal legislation concerning food safety, obliging manufacturers to merchandise only risk free food.

In conclusion, Romanian beer should be an European level product from SECURITY, QUALITY, presentation and marketing points of view.

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