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STUDY OF THE MAIN TECHNOLOGICAL PARAMETERS AND SENSORY CHARACTERISTICS OF SOME NETHERLAND BEER VARIETIES

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ABSTRACT

Netherlands beer, known for brands such as Heineken, Amstel, Grolsch, but also for a wide range of craft beers (lager, blonde, ale, stout, etc.), deserves a systematic analysis from a technological and sensory perspective. This study analyzed 10 types of craft beer produced in the Netherlands, including 7 lagers and 3 stouts, with a focus on analyzing the main chemical components and, especially, conducting a sensory analysis. A first observation, from a chemical composition perspective, is that all dark beers and three of the seven light beers had a much higher alcohol content compared to Romanian Stas beer. In terms of acidity, all values obtained for lagers, with the exception of two, are close to those of Romanian STAS beers. In terms of sensory analysis, dark beers successfully fell into all the categories analyzed and were considered exceptional.

INTRODUCTION

The Netherlands is one of the world's largest beer exporters, alongside Germany, Belgium, and Mexico. Dutch beer combines solid tradition (classic lager), craft innovation (IPA, barrel-aged, sour, etc.), advanced production technology, and a strong international presence. This diversity makes the Netherlands one of the most important and dynamic European beer markets. Netherlands beer has a long tradition and is recognized worldwide for its quality and variety. The Netherlands is one of the world's largest beer exporters, with famous brands and a beer culture that combines traditional methods with innovation (Brrigs D.E., 1995).

Beer has been produced in the Netherlands since the Middle Ages. Initially, it was brewed in monasteries and households. In the 19th century, the beer industry rapidly industrialized, leading to the emergence of large commercial brands, some of which are still active today (Hough et al., 1999). Well-established (mainstream) brands include: Heineken (Lager) – an international brand produced in over 70 countries; Amstel (Lager), part of the Heineken group; Grolsch (Lager), famous for its swing-top bottle; Bavaria (Lager) produced by Swinkels Family Brewers, an independent company with a long tradition; La Trappe – one of the few Trappist beers in the world, produced in a Catholic monastery (Abdij Koningshoeven) and Hertog Jan – A popular craft beer with a variety of styles (Pilsner, Dubbel, Tripel, Grand Prestige, etc.) (Oliver,&Garrett, 2011; Skelton T., 2022).

Craft beer and the first microbreweries appeared in the 1990s, inspired by the craft beer movement in the United States and Belgium, and experienced rapid growth in 2000 when traditional Dutch styles such as saison, tripel, and witbier were rediscovered, alongside modern influences from the US, such as IPA, stout, and sour. After 2010: The number of microbreweries grew rapidly, and after 2020, craft breweries became a common sight even in small towns and villages. International collaborations and innovations—such as mixed fermentation and barrel aging—play an increasingly important role in the contemporary Dutch beer landscape (Unger& Richard, 2001,2005).

MATERIALS AND METHODS

The main objectives of this study were:

1. Determining the main chemical characteristics of the Dutch blond and dark beers analyzed
2. Determining the sensory characteristics of the Dutch beers analyzed

To achieve these objectives, we determined the following chemical parameters for 10 brands of beer from the Netherlands: alcohol concentration, total acidity, color, and carbon dioxide. They were also analyzed and described from an organoleptic point of view.

Ten craft beers were analyzed, including seven lagers: LORRE SWEET 'N SOUR, LANGHARING TUIG, SANCTI ADALBERTI, NOG EENDJE, DOUBLE FRUITED SOUR, NEVEL STOOF, VANDERSTREEK, and 3 dark beers: SMOKEY, MALLUST 1818, DISC OF 5, Imperial STOUT.

RESULTS AND DISCUSSIONS

1. Results of the analysis of the main chemical characteristics of Netherlands beers

The main chemical constituents of the Netherlands beers analyzed are presented in Table 1.

According to the data presented, a first observation is that all lagers fall within the STAS standards, with the lowest alcohol concentration being in LORRE SWEET 'N SOUR beer, at 5 % vol., and the highest in VANDERSTREEK beer, at 7.5 % vol. As for dark beers, they all have a very high alcohol content, far exceeding the maximum values in Romanian STAS. Thus, these beers have an alcohol content of 8.5 % vol. for SMOKEY, 10.0 % vol. for MALLUST 1818, and 11 % vol. for DISC OF 5, Imperial STOUT. One explanation for this could be the addition of sugar to the wort and fermentation with high fermentation yeasts.

Acidity is a parameter that balances the taste of the product, in this case beer, in perfect correlation with the other constituents, alcohol and the characteristic bitterness given by hops. The acidity of Romanian beers, depending on the beer category, ranges between 2.0-4.6 g/100 ml of beer. For Netherlands beers, the lowest acidity is 3.70 g/100 ml of beer for the SANCTI ADALBERTI brand, which is close to the acidity value of a dark Pils beer in Romania. All other beer brands, both light and dark, have higher total acidity values. All other beer brands, both lager and dark, have higher total acidity values. The highest values are found in the LORRE SWEET 'N SOUR brand, 14.44 g/100 ml, and DOUBLE FRUITED SOUR, 10.92 g/100 ml. These two types of lager have added mango and passion fruit concentrates.

In terms of carbon dioxide content, it can be seen that, compared to Romanian beers, 8 out of 10 Netherlands beers have a lower carbon dioxide content. The exceptions are the LANGHARING TUIG and NEVEL STOOF lagers, which have values comparable to Romanian STAS beers.

Color is an important characteristic of beer, and consumers currently tend to prefer beers with a lighter color. With the exception of dark, brown, and specialty beers, where technology allows the addition of coloring agents such as caramel, the color of blonde beers is influenced by the raw materials used (whose color is determined by the drying process), the intensity and duration of brewing, and the duration and temperature of boiling the wort with hops. The explanation for the dark color of these beers is mainly due to the Maillard reactions during the technological process. Also, the extraction of coloring substances from malt and hops into the wort plays a role in determining the color. There is a significant difference between the values obtained for lager beers and those for dark beers. In terms of the color of lager beer, the Romanian STAS indicates iodine solution consumption values of 0.55-1.4 ml, which can be considered to apply to Netherlands lager beers, with one exception. In the case of dark and specialty beers, these values increase, ranging between 20-44.5 ml of iodine in the STAS. It can be seen that two of the three Dutch dark beers exceed the maximum value in the Romanian STAS, reaching a consumption of 72.3 ml of iodine/100 ml of beer in DISC OF 5, Imperial STOUT.

2. Results regarding the sensory characteristics of Netherlands beers

LORRE SWEET 'N SOUR is a blonde beer produced at Brouwerij Homeland, a Netherlands craft brewery.

Appearance: Golden color, slightly opalescent, with light amber reflections. White, aerated foam with moderate persistence.

Aroma: Initial sweet notes of malt, caramel, and honey. It has light fruity accents, with hints of citrus and mango. And a subtle floral nuance, due to the hops.

The taste is initially sweet and velvety, thanks to the malt. This is followed by a pleasant contrast, with a refreshing acidity and slightly tart citrus notes (lemon, grapefruit). The finish is balanced, with a slight bitterness from the hops, which tempers the initial sweetness.

This type of beer is ideal for those looking for an unconventional flavor profile, where sweetness and acidity create a complex and refreshing experience.

LANGHARING TUIG

This is a Van Moll Langharing Tuig beer, Hoppy Weizen variety (a combination of wheat beer and hops). It is also a craft beer from the Netherlands.

Appearance: light yellow color, clear, good foaming capacity, with white, persistent foam with a lacy appearance.

Aroma and taste: typical wheat notes, slightly sweet, with a hint of banana and cloves and strong hop accents that give it a balanced bitterness with a fruity character.

Texture & Body: has a light and effervescent texture, ideal for consumption on hot days.

SANCTI ADALBERTI -This beer is produced by Adbijdieren Egmond, a Netherlands brewery associated with Egmond Abbey. Therefore, it is an abbey beer, which means that it respects monastic traditions in beer production, even though it is not produced in a Trappist monastery. It is certified as organic beer, which means that natural ingredients and traditional production methods are used.

Appearance: Golden color, clear, with slight amber hues. White and creamy foam, with good persistence in the glass.

The taste is initially sweet with obvious notes of honey and fresh bread (from the malt). It has fruity notes (ripe pear, peach), balanced with a moderate bitterness, well integrated by the hops.

NOG EENDJE

Bird Brewery NOG EENDJE is a fresh and balanced blonde ale, appreciated for its light character and pleasant aroma.

Appearance: golden yellow in color, with slight amber reflections. The head is white, aerated, medium density, with moderate persistence on the glass.

Aroma and taste: pleasant aroma, with notes of tropical fruits, subtle hints of freshly baked bread, and light floral tones possibly from the hop variety and the yeast used in fermentation. The taste is balanced between the sweetness of the malt and the bitterness of the hops. The aftertaste is clean, slightly dry with a subtle bitterness that lingers.

DOUBLE FRUITED SOUR

This is a craft beer style that emphasizes the intensity of fruit and the acidity specific to sour beers. It is characterized by a rich sensory profile, due to the use of twice the amount of fruit compared to standard variants.

Appearance: Golden color, opalescent due to the fruit addition, moderate to high alcohol content (7 % ABV) for a sour beer.

Aroma - intense notes of fresh, very expressive fruit (e.g., citrus, berries, peaches, passion fruit). Slightly sour undertones, with possible lactic or yogurt accents if lactic bacteria are used in fermentation. Sometimes subtle notes of vanilla or spices may appear if the beer contains additional additives.

Taste – A balance between fruity sweetness and refreshing tartness. Pronounced but pleasant acidity, often derived from lactobacillus fermentation or the addition of tart fruits (raspberries, currants, passion fruit). Low or no bitterness, with an emphasis on the freshness and juiciness of the fruit.

NEVEL STOOF

Nevel Stoof is a craft beer produced by the Netherlands-based brewery Nevel Wild Ales, known for its use of local ingredients and spontaneous fermentation. Stoof is a wild ale with a complex sensory profile.

This beer is inspired by traditional styles but has a unique character due to its fermentation with wild yeast and the use of unusual ingredients. This beer is inspired by traditional styles but has a unique character due to fermentation with wild yeasts and the use of unusual ingredients.

Appearance: It has an intense yellow color with amber reflections and a white, fine, moderately persistent head.

Aroma: Intense notes of caramelized pears, ripe apples, light spices (cinnamon, cloves), sweet malt with subtle notes of wild yeast, which give it a rustic character.

Taste: A harmonious balance between fruity sweetness and refreshing acidity, with hints of ripe fruit and a slight sensation of tannins, reminiscent of young red wines. The aftertaste is moderately persistent, with a tart and dry note that invites another sip. Nevel Stoof is an excellent choice for those who appreciate complex craft beers with wild fermentation influences and deep fruity aromas.

TURF 'N SURF VANDERSTREEK

It is produced by the Netherlands brewery vandeStreek bier. This beer is an innovative interpretation of the Tripel style, enriched with aromas of smoked whiskey and sea salt.

Aroma: Fruity notes specific to a traditional Tripel, complemented by subtle accents of smoked malt and a hint of sea salt.

Aftertaste: Medium persistence, leaving hints of smoke and a slight salty sensation on the palate. The aftertaste is moderately persistent, leaving hints of smoke and a slight salty sensation on the palate.

Taste: A harmonious balance between the sweetness of malt, the smoky influences of whiskey, and a delicate salty note.

Body: Creamy and velvety texture with moderate carbonation that amplifies the complexity of the taste.

Ingredients: Water, barley malt, wheat malt, sugar, smoked whiskey, hops (El Dorado, Magnum), yeast, salt, coriander.

This beer offers a complex taste experience, combining the tradition of the Tripel style with maritime and smoky influences, making it ideal for those looking for new and surprising flavors.

SMOKEY

This beer is The Original Smokey, from Kromme Haring, an Imperial Smoked Porter. It offers a complex taste experience, combining the tradition of the Tripel style with maritime and smoky influences, ideal for those looking for new and surprising flavors.

The term "Smokey" in the context of beer refers to a sensory profile characterized by smoky aromas and flavors, often achieved through the use of smoked malt or special production techniques. These beers are appreciated for their complexity and uniqueness.

Appearance: Variable color, usually dark brown or reddish, with a brown, creamy, lacy head of medium density but persistent.

Aroma: Predominant smoky notes, often similar to those of burnt wood or charcoal, combined with hints of caramel or chocolate, depending on the type of malt used. **Taste:** A balance between the sweetness of the malt and a slight bitterness, with a noticeable smoky taste. It may have aromas of dark chocolate, caramel, and coffee, specific to a Porter. The high alcohol content (8.5 % ABV) can give it a medium to robust body with a complex aftertaste and moderate carbonation. The high alcohol content (8.5 % ABV) can give it a medium to robust body with a complex aftertaste and moderate carbonation.

MALLUST 1818 is a craft beer produced by Brewery Mallust, a brewery in Veenhuizen, Netherlands. The name "1818" refers to the year Mallust was founded, adding a historical and local touch to the product. This brewery is renowned for its traditional styles inspired by Belgian and German beer recipes.

Aroma: Delicate notes of malt and hops, with floral and fruity accents (banana, apple, pear) and Belgian yeast that give it a complex character.

Taste: Balanced, sweet at first, with tones of malt and honey, followed by a slight bitterness of hops and a dry, alcoholic finish. The aftertaste is dry and spicy, with a slight sensation of warmth from the high alcohol concentration, 10 % vol.

Texture: Medium to full-bodied, with a velvety texture and moderate carbonation.

MALLUST 1818 is an excellent choice for Pilsner lovers, offering a pleasant combination of flavors and a smooth drink.

DISC OF 5, Imperial STOUT, from UTCA Brews, is an Imperial Stout beer, known for its high body, complex aromas, and much higher alcohol content than other stouts.

Appearance: opaque black liquid, sometimes with ruby reflections, with creamy, dense, brown foam and good persistence.

Aroma: intense notes of roasted coffee, dark chocolate, caramel, molasses, sometimes with hints of vanilla and/or dried fruit (figs, dates), wood, or even whiskey if aged in barrels.

Taste: balanced between sweet, bitter, and alcoholic strength, it can give the sensation of bitter cocoa, espresso, brown sugar. The aftertaste is long, intense with the persistence of roasted aromas and sometimes with a slightly alcoholic finish.

Disc of 5 is a complex, strong, and robust beer, suitable for slow consumption at a higher temperature than a regular beer (10-14 °C). It is best enjoyed with chocolate desserts, mature cheeses, or smoked dishes.

CONCLUSIONS

A first observation, from a chemical composition perspective, is that all dark beers and three of the seven light beers had a much higher alcohol content compared to Romanian Stas beer. The lagers with the highest alcohol content were DOUBLE FRUITED SOUR with 7 % ABV, NEVEL STOOF with 7.4 % ABV, and VANDERSTREEK with 7.5 % ABV. The alcohol content of Dutch dark beers, in ascending order, ranges from 8 % ABV for SMOKEY, 10 % ABV for MALLUST 1818, and 11 % ABV for Disc OF 5. In terms of acidity, all values obtained for lagers, with the exception of two, are close to those of Romanian STAS beers. The two lagers with very high acidity are LORRE SWEET'N SOUR with 14.44 g/100 ml of product and DOUBLE FRUITED SOUR with 10.92 g/100 ml of beer. The explanation would be that these two brands of lager, of the SOUR type, are made using a special fermentation process, with yeast and lactic bacteria that give them this sour taste. The color, expressed in ml of 0.1 n iodine solution, falls within the Romanian STAS values. For lager, values between 0.8-1.7 ml of 0.1 n iodine solution were recorded (STAS: 0.55-1.4 ml of 0.1 n iodine solution), while for dark beers the values were 34.1-72.3 ml of 0.1 n iodine solution. Iodine 0.1 (STAS: min 36.0-min 44.5 ml iodine solution 0.1 n.).

The carbon dioxide content of Netherlands beers is lower than that of Romanian beers, with one exception. Thus, the carbon dioxide content of lager beers ranges between 0.19 and 0.34 g/100 ml sample, with the exception of LANGHARING TUIG beer, which has 0.98 g/100 ml sample. In fact, sensory analysis also revealed higher effervescence in this brand of beer. The carbon dioxide content in dark beers is 0.9-0.26 g/100 ml of product, while in Romanian dark beers it ranges from 0.32 to 0.34 g/100 ml of beer.

In terms of organoleptic properties, all types of lager analyzed are of good quality, meeting the requirements of Netherland consumers. The most balanced was SANCTI ADALBERTI, followed by NEVEL STOOF and VANDERSTREEK. Beers with high acidity, such as SOUR beers, which have a sour and bitter taste, did not meet the requirements of Romanian consumers (LORRE SWEET'N SOUR and DOUBLE FRUITED SOUR).

In terms of sensory analysis, dark beers successfully fell into all the categories analyzed and were considered exceptional.

REFERENCES

Brrigs D.E., 1995. Malting and brewing Science, vol. I, Editura Chapman et Hall, Londra, https://www.amazon.com/Malting-Brewing-Science-Malt-Sweet/dp/0412165805

Hough I.S. şi colab., 1999. Malting and brewing Science, vol. II, Editura Chapman et Hall, Londra, https://books.google.ro/books?id=ZZPTBwAAQBAJ&printsec=frontcover&hl=ro&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Oliver, Garrett (Editor), 2011. The Oxford Companion to Beer, *https://global.oup.com/academic/product/the-oxford-companion-to-beer-9780195-367133?cc=ro&lang=en&*

Skelton, Tim, 2022. Beer in the Netherlands, 2nd ed., https://skeltonink.eu/product/beer-in-the-netherlands-2nd-edition/

Unger, Richard W. *A., 2001.* History of Brewing in Holland, 900–1900: Economy, Technology and the State, *https://www.researchgate.net/publication/291202413_R-W_Unger_A_history_of_brewing_in_Holland_900-1900_Economy_technology_and_the_state*

Unger, Richard W., 2005. Brewing Science in the Netherlands, 1815–1914. Brewery History, nr. 121, pp. 47–65.

Table 1

The main chemical constituents of Netherlands beers

No. sample	Beer sample	Alcohol, %vol	Total acidity, g/100 ml sample	Carbon dioxide, g/100 ml sample	The color, ml sol I 0,1 n
1	LORRE SWEET ‘N SOUR	5.0	14.44	0.25	0.8
2	LANGHARING TUIG	5.5	4.66	0.48	1.7
3	SANCTI ADALBERTI	5.7	3.70	0.21	1.3
4	NOG EENDJE	6.0	5.84	0.20	1.2
5	DOUBLE FRUITED SOUR	7.0	10.92	0.20	0.8
6	NEVEL STOOF	7.4	7.24	0.34	1.5
7	VANDERSTREEK	7.5	5.42	0.19	1.2
8	SMOKEY	8.5	6.90	0.26	62.0
9	MALLUST 1818	10.0	6.10	0.23	34.1
10	DISC OF 5, Imperial STOUT	11.0	7.30	0.19	72.3