Abstract

Currently, in the food market, is observed increased consumer awareness, and hence growing expectations for new products. Brewers therefore need to be able to brew a wide variety of beer styles while maintaining a high process efficiency. As a result, companies are under increasing pressure to produce high-quality beers at the lowest possible cost. In order to do this, brewers / technologists are looking for new raw materials and production methods.

In recent years, plasma water (PTW) obtained in the presence of low-temperature, low-pressure glow plasma (LPGP) has been gaining more and more popularity. Plasma process can take place in an environment of various gases, such as air (PTWAir) or nitrogen (PTWN). The results presented so far show that, depending on the plasma treatment time, water obtains various physicochemical properties that may have a positive effect, e.g. on plant growth and the germination process. In addition, other studies show that it has a significant effect on microorganisms.

The research presented in the doctoral dissertation concerned on comprehensive analysis of the use of water, exposed to low-temperature, low-pressure glow plasma (LPGP), in the brewing industry. The idea of the work was based on the experiences in this field carried out in other branches of industry. Therefore, it was decided to check whether PTW will improve the beer production process and its quality.

The results of the research showed that PTW obtained in the atmosphere of air and nitrogen improves the malting process of barley grain without deteriorating the quality of malt produced for the needs of brewing. The use of PTW water during grain soaking, compared to the control samples, resulted in obtaining a higher final soaking degree (41.5% PTWAir, 41.6% PTWN, 38.7% CW) and higher sensitivity of the grain to water (26.6% PTWAir, 25.3% PTWN, 14.0% CW). Moreover, in the course of the research, significantly higher energy and germination capacity of the soaked PTW samples (98.3% PTWAir, 99.5% PTWN, 97.2% CW) were found.

In the second stage of the research, it was observed that yeasts react differently to the presence of plasma water, depending on the strain. The influence of PTW water on individual strains strongly dependent on the type of atmosphere in which plasma treatment occurred. Plasma water obtained in the air atmosphere (PTWAir) positively influenced the quality features of brewer's yeast during rehydration. It improved yeast viability, flocculation and

glycogen content. On the other hand, in the case of PTWN, almost all of the aforementioned quality parameters of yeast were deteriorated.

In the third stage of the research, it was shown that the lager yeast strain *Saccharomyces pastorianus* W34/70, after rehydration in the presence of PTWAir, started the fermentation process faster compared to the reference sample (CW). Moreover, it was observed that rehydration of yeast in PTWAir significantly influenced the metabolism of microorganisms, and the composition of beer volatile compounds. This phenomenon is particularly evident in the case of terpenes concentration, considered to be desirable aroma components. In the case of rehydration in PTWN, in beers obtained with each of the analyzed strains (*Saccharomyces cerevisiae* US-05, S33, T58, *Saccharomyces pastorianus* W34/70) lower alcohol content, actual extract, apparent extract and the degree of biomass multiplication compared to control samples were found.

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