Photon-induced reduction in barley malt processing time and quality improvement

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Barley (*Hordeum vulgare* L.) is the traditional grain for making malt because of its inherent and abundant content of and ability to synthesize critical hydrolytic enzymes needed in the downstream processes (fermentation, baking, and confectionary production). The malting process is done in three steps – steeping, germination, and kilning, of which germination is a major rate-limiting step. It takes more time to germinate than to steep or dry, and this is where most of the biochemical reactions that make barley malt what it is taking place. In order to increase return for the stakeholders in malting production, it is critical to find means to reduce the processing time, particularly the germination time, while maintaining or improving the malt's quality attributes. In this study, we proposed the application of modulated photon energy to increase abiotic stress during barley germination with light-emitting diode (LED) and pulsed ultra-violet (UV) sources. In dual photoperiod (12 h on – 12 h off), LED systems were used to supply photon energy between 75 to 150 PAR (µmol/m^2/s) for a period of 0 to 5 days of germination. The dried barley malt indicated that the treated samples showed a comparable amount of diastatic power (DP) (150 – 172 °L) and gamma-aminobutyric acid (GABA) (29 – 32 mg/100 g), a major bioactive compound between day 3 and 4 of germination with a range that surpasses what is desired for most malt application. A similar energy range was simulated for the pulsed UV light system, and we obtained similar results on the 3rd and 4th day of germination. However, the beta (?)-glucan level, a constituent of the cell that creates filtration problems when malt is used for brewing, had an exceptionally high level indicating minimal degradation during steeping and germination. Overall, this study showed that controlled application of photon energy could reduce malting time. Future work will focus on the application of other photon sources and exploration of means to modulate ?-glucan levels in the final malt.