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Abstract

Rapid Method for Faults Detection in Beer Using a Low-Cost Electronic Nose and Machine Learning Modelling †

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Abstract: Beer is susceptible to developing different faults (off-flavours/off-aromas) due to its main ingredients and variability in the conditions within the production stages and storage; this is especially challenging for craft breweries. Therefore, it is important to develop novel, rapid, and non-destructive methods for detecting faults. A dry lager beer was used as the base to spike with 18 different faults commonly found in beer at two different concentrations. Those 18 samples and a control group were analyzed in triplicates using a low-cost and portable electronic nose (e-nose) to assess the volatile compounds. Three machine learning models based on artificial neural networks (ANN) were developed using the e-nose outputs as inputs to (i) classify the samples into control, low, and high concentration of faults (Model 1); (ii) predict faults in the low concentration samples (Model 2); and (iii) predict faults in the high-concentration samples (Model 3). The three models had very high accuracy (Model 1: R = 0.95; Model 2: R = 0.97; Model 3: R = 0.96). This method may also be applied within different stages of beer production for the early detection of faults, which may help to apply any corrective actions before obtaining the final product.

Keywords: off-aromas; beer quality; artificial neural networks; e-nose; early detection

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