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Advancements in Electronic Sensor Technologies for Tea Quality Evaluation

Authors : Raana Babadi Fathipour

Abstract : Tea, second only to water in global consumption rates, holds a significant place as the beverage of choice for many around the world. The process of fermenting tea leaves plays a crucial role in determining its ultimate quality, traditionally assessed through meticulous observation by tea tasters and laboratory analysis. However, advancements in technology have paved the way for innovative electronic sensing platforms like the electronic nose (e-nose), electronic tongue (e-tongue), and electronic eye (e-eye). These cutting-edge tools, coupled with sophisticated data processing algorithms, not only expedite the assessment of tea's sensory qualities based on consumer preferences but also establish new benchmarks for this esteemed bioactive product to meet burgeoning market demands worldwide. By harnessing intricate data sets derived from electronic signals and deploying multivariate statistical techniques, these technological marvels can enhance accuracy in predicting and distinguishing tea quality with unparalleled precision. In this contemporary exploration, a comprehensive overview is provided of the most recent breakthroughs and viable solutions aimed at addressing forthcoming challenges in the realm of tea analysis. Utilizing bio-mimicking Electronic Sensory Perception systems (ESPs), researchers have developed innovative technologies that enable precise and instantaneous evaluation of the sensory-chemical attributes inherent in tea and its derivatives. These sophisticated sensing mechanisms are adept at deciphering key elements such as aroma, taste, and color profiles, transitioning valuable data into intricate mathematical algorithms for classification purposes. Through their adept capabilities, these cutting-edge devices exhibit remarkable proficiency in discerning various teas with respect to their distinct pricing structures, geographic origins, harvest epochs, fermentation processes, storage durations, quality classifications, and potential adulteration levels. While voltammetric and fluorescent sensor arrays have emerged as promising tools for constructing electronic tongue systems proficient in scrutinizing tea compositions, potentiometric electrodes continue to serve as reliable instruments for meticulously monitoring taste dynamics within different tea varieties. By implementing a feature-level fusion strategy within predictive models, marked enhancements can be achieved regarding efficiency and accuracy levels. Moreover, by establishing intrinsic linkages through pattern recognition methodologies between sensory traits and biochemical makeup found within tea samples, further strides are made toward enhancing our understanding of this venerable beverage's complex nature.

Keywords : classifier system, tea, polyphenol, sensor, taste sensor
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