aceto BAlsamico tradizionale di Modena: DEterminazione Spettroscopica e Sensoriale dell'Avanzamento della maturazione in batteria

BADESSA

Traditional Balsamic Vinegar of Modena: Spectroscopic and Sensory Determination of the Progress of Maturation in the battery of barrels

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Partner: Consorzio Tutela Aceto Balsamico Tradizionale di Modena

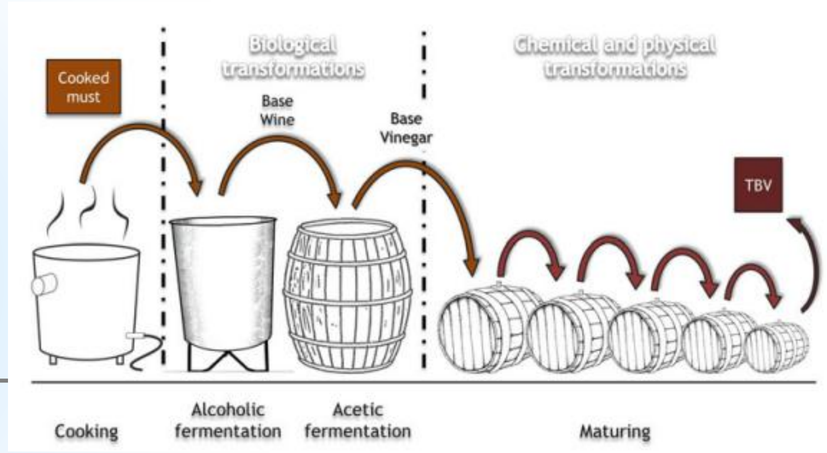
Founded in the heart of land rich in culinary history and tradition and appointed in 2009 by the Italian Ministry of Agriculture (MIPAAF, now MASAF), Consorzio Tutela Aceto Balsamico Tradizionale di Modena D.O.P. (Traditional Balsamic Vinegar of Modena P.D.O. Protection Consortium) protects and promotes this quintessentially Italian product, known all over the world for its unrivalled quality and deep roots in the Modena area.

We are committed to promoting Traditional Balsamic Vinegar of Modena P.D.O., product of unique expertise, fruit of passion, a love for the land and infinite patience. Our mission is focused on increasing the knowledge and recognition of this quality product through the promotion of a culinary culture that goes beyond geographical boundaries to reach enthusiasts and connoisseurs in every corner of the planet.

Partner: Mister Smart Innovation Scrl

MISTER Smart Innovation since 2009 is a research laboratory and innovation center, accredited to the Emilia-Romagna High Technology Network. Established as a Public-Private Partnership, MISTER supports start-ups, associations, SMEs and large industries by providing custom solutions in the fields of sensors, machine learning, IOT, AI, immersive digital technologies, computer vision, additive manufacturing, 3D design. Since 2017 MISTER is the managing body of the Bologna CNR Tecnopolo.

Traditional Balsamic Vinegar of Modena



Paolo Giudici, Federico Lemmetti, Stefano Mazza, «Balsamic Vinegars - Tradition, Technology, Trade», © Springer International Publishing Switzerland 2015

Traditional Balsamic Vinegar of Modena is a product that ages for a very long time and has a specific production method codified by the Consortium.
The aging process can be divided into 4 distinct phases:

1) **preparation of the cooked must**
2) **alcoholic fermentation**
3) **Acetic fermentation**
4) **Maturing and aging in the battery**

ABTM: A Very Multifaceted Product

The maturation of balsamic vinegar along its path in the set of barrels (the battery!) is a number of complex chemical-physical processes, which lead to the formation of a high amounts of products (esters, polymers, sugar degradation compounds, etc...), whose nature and percentage between them also strongly depends on the boundary conditions (characteristics of the starting must, microclimate of the vinegar cellar (temperature, humidity), wood of the barrels, and so on...).

Each chemical and physical parameter can be singularly measured with specific analytical instrument: however, it's definitively challenging to univocally relate these measured parameters to the whole organoleptic characteristics of the single vinegar.

The power of AI

01 AI techniques involve very powerful methods to analyze together huge amount of data to identify patterns, common features and trends

02 These methods allow for the extraction of useful information from complex data, improving understanding and prediction of phenomena.

Why BADESSA

Exploit artificial intelligence algorithms to study and verify the existence of unique features, measurable experimentally, able to univocally characterize the maturation of Traditional Balsamic Vinegar of Modena, in the frame of the single production battery and the single “acetaia”.

The study will be conducted starting from the analysis and identification of the main spectroscopic features (specific forms of the spectrum of light absorbed by the product, from ultraviolet to near infrared) that can act as markers of the ABTM product during its evolution and maturation over time.

The spectroscopic features will be studied and related, in a data fusion perspective with artificial intelligence algorithms, with a set of measured chemical-physical parameters characterizing the product (viscosity, pH, electrical conductivity, …).

Why BADESSA

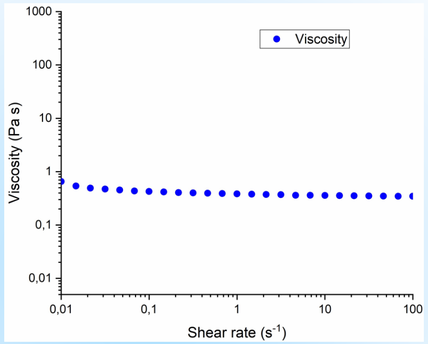
The study is will be performed on different “acetaie” and different batteries within the single “acetaia”, with the aim of identifying spectroscopic features common to the product as the maturation progresses, as well as any distinctiveness of the individual battery. These markers may be used for a precise characterization of the product, as well as a potential tool in the fight against counterfeiting.

Why BADESSA

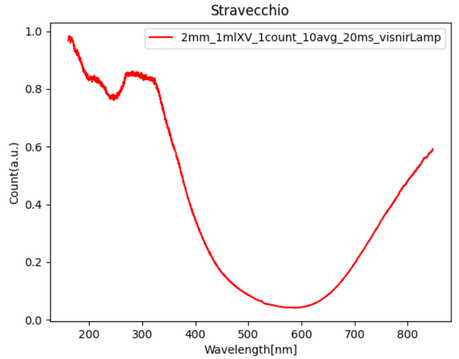
BADESSA aims also to experimentally verify the (expected) corresponding between the experimental features of the data analysis and the organoleptic quality evaluation performed by a panel of trained tasters.

The positive verification of this correspondence will allow the Consortium to include objective and experimentally measurable characteristics in the qualitative descriptors of the product, as well as being useful for the purposes of dissemination and marketing activities.

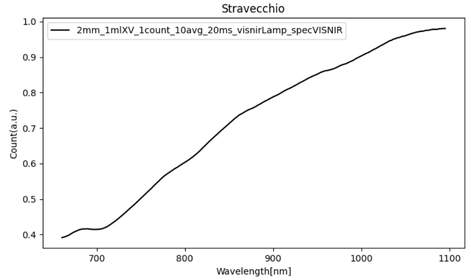
The data: some examples



viscosity measurement of a vinegar sample over 25 years old



UV-Vis-NIR spectra of a vinegar sample over 25 years old



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