

2020; Yu et al., 2020). Therefore, Hangbaiju raw material quality control should shift from traditional sensory judgment to a comprehensive evaluation model integrating “sensory evaluation+physicochemical testing + intelligent identification.”

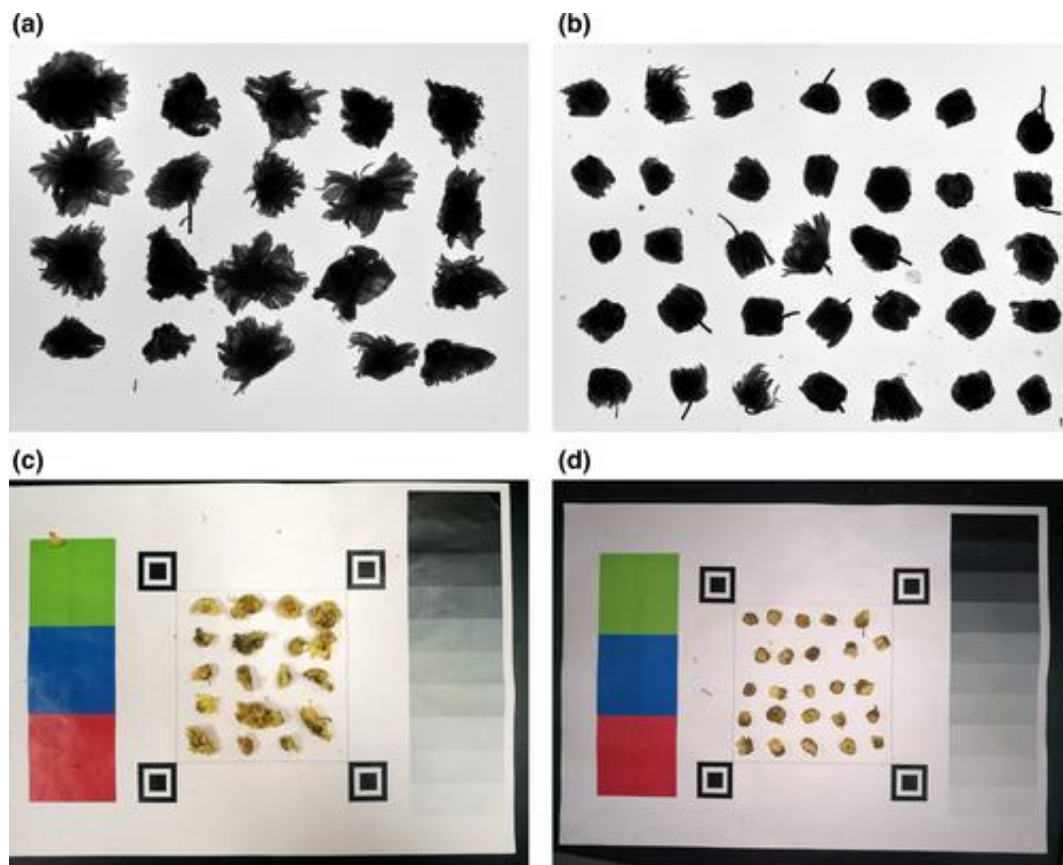


Figure 1 Representative contour images of chrysanthemum teas (Adopted from Liu et al., 2020)

Image caption: (a) Hangbaiju by a gel imager, (b) Hangtaiju by a gel imager, (c) Hangbaiju by a smartphone, and (d) Hangtaiju by a smartphone (Adopted from Liu et al., 2020)

Harvest period and primary processing conditions have important effects on Hangbaiju quality formation. Generally, harvesting at an appropriate flowering stage can yield higher active ingredient contents and better appearance quality. After harvesting, grading should be carried out promptly according to flower diameter, flower integrity, color, impurity content, and active component levels, so as to achieve differentiated utilization of high-quality and ordinary raw materials. Studies have shown that optimized kill-green and drying processes can shorten drying time, improve color, and enhance the retention of phenolics, sugars, amino acids, volatile compounds, and antioxidant activity (Prabawa et al., 2023; Xu et al., 2024; Leelapattana and Asavarachan, 2025). Therefore, standardized cultivation, timely harvesting, graded primary processing, intelligent detection, and quality traceability should be integrated to build a raw material quality control system covering cultivation and processing, thereby laying a foundation for the development of high-quality Hangbaiju tea beverage products.

3.2 Tea beverage processing and flavor preservation technologies

Processing technology is an important factor determining the quality of Hangbaiju tea beverage products. Traditional Hangbaiju processing mainly involves steaming, kill-green treatment, and drying, aiming to preserve flower shape, color, and aroma characteristics. With increasing market demand for high-quality tea beverage products, modern processing technologies are gradually moving toward precision, low-temperature operation, and intelligence. Studies on tea beverage processing technologies have shown that non-thermal or mild processing methods, such as cold extraction and ultrasonic extraction, help improve the extraction efficiency of active components while reducing the degradation of polyphenols and aroma compounds (Liang et al., 2021; Liang et al., 2022). For Hangbaiju tea beverages, extraction temperature, extraction time, solid-liquid ratio, and concentration