

Safety evaluation should emphasize authenticity, processing cleanliness, and the stability of active compounds during storage and heating. Appearance-based adulteration is a real concern in chrysanthemum tea, because sulfur fumigation can counterfeit quality while damaging antioxidant properties and causing loss of bioactive compounds (Wei et al., 2024). In addition, chrysanthemum flavonoids are sensitive to light, oxygen, high temperature, and extreme pH, so storage and processing stability should be treated as part of product safety and quality assurance (Miao et al., 2026). Functional verification can also assist sensory-safety grading: first-grade Fubaiju showed stronger saltiness and astringency by electronic tongue and stronger antibacterial effects against *Escherichia coli* and *Staphylococcus aureus*, indicating that sensory discrimination and biological activity can serve as auxiliary indexes in Hangbaiju quality evaluation (Yang et al., 2025).

3 Effects of Harvest Period on the Quality of Hangbaiju

3.1 Effects of harvesting at the bud stage and early flowering stage on the quality of Hangbaiju

Harvesting Hangbaiju at the bud stage and early flowering stage generally favors the accumulation of key medicinal constituents, especially flavonoids and chlorogenic-acid-related compounds. In Hangbaiju capitula, total flavonoids were higher at S1 and S2 than at later stages, and total polyphenols rose first and then declined, peaking at S2 (Lu et al., 2024). HPLC-based analysis of four Hangbaiju products likewise showed that total flavonoids and chlorogenic acid reached their maximum at the Hualei stage, with Taiju ranking next. In medicinal chrysanthemum more broadly, flavonoid and chlorogenic acid contents were highest at the bud stage, and comprehensive evaluation placed the best harvest window between the bud and young-flower stages when both active and nutritional ingredients were considered (Ma et al., 2016). Untargeted and targeted metabolomics in *Chrysanthemum indicum* also showed that most varying flavonoids and phenolic acids were higher at the initial stage than at the eventual stage, supporting the value of early harvest for preserving active compounds (Yang et al., 2024).

Early harvest also appears advantageous for commercial differentiation and antioxidant potential, although the exact optimum depends on which compounds are prioritized. Taiju, defined as flower heads with opened ray florets but closed tubular florets and harvested earlier than Duoju, showed higher caffeoylquinic acids and stronger antioxidant activities than the later-harvested Duoju samples (Gong et al., 2019). In Hangbaiju harvested at different collection periods, metabolomics identified distinct volatile and flavonoid markers between Taiju and Duoju, and in Taiju most of the differential flavor volatiles and five of six flavonoid markers showed upward trends, indicating that earlier harvest contributes to a unique flavor and efficacy profile (Yang et al., 2022). A related grading study on Fubaiju, a Hangbaiju subvariety, found that smaller inflorescence diameter was associated with higher chlorogenic acid and 3,5-O-dicaffeoylquinic acid, and these trends were consistent with changes across the chrysanthemum picking period (Yang et al., 2025). Together, these findings indicate that bud-stage to early-flowering harvest is usually more favorable when the goal is to maximize polyphenol-rich medicinal quality rather than flower size or yield.

3.2 Effects of harvesting at the full flowering stage on the quality of Hangbaiju

Harvesting at the full flowering stage often provides a balanced quality profile, especially when producers must weigh active constituents against morphology, harvest efficiency, and marketable output. Developmental classification work in edible Hangju separates blooming into five stages and places harvest standards around stages 4 and 5, indicating that practical harvest commonly occurs near full opening rather than at the earliest bud stages (Liu et al., 2025). A cultivar study comparing half-bloom and full-bloom flowers found that harvest stage significantly affected moisture, total phenolics, total flavonoids, anthocyanins, and β -carotene, even though antioxidant activity did not differ significantly overall (Julianti et al., 2026). The same study also showed that harvest stage interacted with cultivar to alter phenolics, anthocyanins, β -carotene, and antioxidant activity, which suggests that full-bloom performance cannot be judged independently of genotype (Julianti et al., 2026).

For Hangbaiju specifically, full bloom appears to be a compromise stage rather than the peak for most medicinal markers. The 2011 Hangbaiju harvesting-stage study showed that delaying harvest increased yield markedly, but the highest total flavonoids and chlorogenic acid occurred earlier than full flowering, while luteolin-7-O-glucoside