EFFECTS OF INLET TEMPERATURE AND FEED CONCENTRATION ON QUALITY OF SPRAY DRIED INSTANT GREEN TEA POWDER

Pradhini Digdoyo¹, Adil basuki Ahza¹, Natthawuddi Donlao², Puwanart Fuggate²

¹Departement of Food Science and Technology, Faculty of Agricultural Engineering and Technology, Bogor Agricultural University, IPB Darmaga Campus, PO. BOX 220, Bogor, West Java, Indonesia
²School of Agro-Industry, Mae Fah Luang University, Muang, Chiang Rai 57100, Thailand

ABSTRACT

Tea is a popular drink because of its unique aroma and characteristic flavor which is controlled by key chemical components which are volatile terpenes, teaine, organic acids, and polyphenols. Currently, the quality of instant green tea powder has been improved. It has some advantages like increase solubility, shelf life, and flavor. Instant green tea powder is produced through drying method like spray drying. This process, unfortunately, potentially has deleterious effects on some component in green tea, like polyphenol compounds and volatile compounds.

The objective of this research is to study effect of inlet air temperature and feed concentration in feed on quality of green tea powder. Main material used in this research was green tea leaf which was supplied by Boonrod Tea Factory. The drying method used in this research was spray drying. There are three level of inlet temperature used in this research, which were 180°C, 200°C, and 220°C. This research also used three level of feed concentration which were 3%, 6%, and 9%. Parameters studied in this research were volatile compounds, chemical compound, and physical properties of green tea powder.

The result shows that inlet temperature and feed concentration significantly affected (p<0.05) the quality of green tea powder. Generally, increased temperature (up to 200°C inlet temperature) decreases amount and type of volatile compound, particularly ketone, total polyphenol, teaine content, solubility, and bulk density (p<0.05). On the other hand, increased feed concentration increases L value, b value, gallic acid, teaine, and catechin content (p<0.05). The best green tea powder is the one with 6% total solid in feed and 180°C inlet temperature. It has highest amount of terpene and also contains hydrocarbon and aldehyde. It also has low moisture content (4.17 ± 0.02 %), high total polyphenol content (26.42 ± 0.07 %), high teaine content (7.06 ± 0.01 %), and highest catechin content (26.16 ± 0.13 %). Physical properties analysis shows it has low water activity (0.21 ± 0.02), lowest a value (3.80 ± 0.35) low b value (18.87 ± 0.14) high hygroscopicity (9.09 ± 0.94 %) high solubility (98.79 ± 0.53 %) and low bulk density (0.51 ± 0.18 g/mL).

Keyword: green tea, spray drying, powder

SUMMARY

Tea has been consumed worldwide for years and one of the most popular drinks. Tea is popular because of its characteristic flavor which is controlled by some key chemical components like volatile terpenes, teaine, organic acids, and polyphenols. Recently, popularity of tea has increased due to its potential health benefits mostly from activities of antioxidant flavonoids present in tea. As the development of technology, instant green tea powder has been produced because it has some advantages, such as prolong shelf-life, reduce transportation and storage cost, and also more practical. The objectives of this research is to study effect of inlet temperature and feed concentration on quality of instant green tea powder which was produced by spray dryer.

In the preliminary research, chemical and volatile compounds of raw materials include were analyzed. In experiment I, production of concentrated green tea was done through freeze concentration process using freeze concentrating machine. There were three feed concentration used in this research, which were 3%, 6%, and 9%. In experiment II, production of green tea powder was done through spray drying process using JMC-minilab spray dryer. There were three inlet temperature used, which were 180°C, 200°C, and 220°C. The instant green tea powder were then analyzed for its volatile compound, physical properties (such as water activity, bulk density, color, solubility, and hygroscopicity), and chemical compounds (such as moisture content, total polyphenol content, gallic acid, catechins, and teaine contain).

The result of chemical compound analysis of raw material shows that green tea leaf has moisture content 6.91±0.02 %, total polyphenol content 28.80±0.18 (g/100 g db), gallic acid 0.45±0.02 (g/100 g db), teaine 1.21±0.02 (g/100 g db), and total catechin 3.72±0.08 (g/100 g db). Volatile compound analysis shows that green tea leaf contains ketones, aldehydes, alcohol, and terpenes. Spray drying process caused change in volatile and chemical compounds of green tea. Inlet temperature and feed concentration significantly affected quality of green tea powder.

Analysis of chemical compound of green tea powder shows that green tea powder have moisture content in range of 4.04±0.01% to 4.41±0.02%, total polyphenol content in range of 20.65±0.01 g/100 g to 26.20±0.04 g/100 g, gallic acid content in range of 2.21±0.10 g/100 g to 2.68±0.07 g/100 g, teaine content in range of 6.20±0.01 g/100 g to 7.41±0.00 g/100 g, and total catechin in range of 15.17±0.02 g/100 g to 26.20±0.04 g/100 g. Analysis of volatile compound shows that green tea powder contain alcohol, ketone, hydrocarbon, acid, aldehyde, azole, and terpene.

Generally, increased temperature (up to 200°C inlet temperature) decreases amount and type of volatile compound, particularly ketone, total polyphenol, teaine content, solubility, and...
bulk density. On the other hand, increasing feed concentration increases L value, b value, gallic acid, teaine, and catechin content. The best green tea powder is the one with 6% feed concentration and 180 °C inlet temperature. It has the highest amount of terpene and also contains alcohol and hydrocarbon, which resembles to green tea leaf. It also has low moisture content (4.17 ± 0.02 %), high total polyphenol content (26.42 ± 0.07 g/100 g), highest total catechin content (26.16 ± 0.13 g/100 g), and high teaine content (7.06 ± 0.01 g/100 g). Physical properties analysis shows it has low water activity (0.21 ± 0.02), lowest a value (3.80 ± 0.35), high solubility (98.79 ± 0.53 %), low hygroscopicity (9.09 ± 0.94 %), and low bulk density (0.51 ± 0.18 g/mL).