

Analysis of theanine, glutamic acid, aspartic acid and arginine in tea – amino acids as quality markers



Introduction

Tea contains about 1% to 4% of amino acids, the main amino acids are theanine, glutamic acid, aspartic acid and arginine. Theanine, in particular, is almost unique to tea, accounting for 1% to 2% of the dry matter of tea and about 50% of all amino acids. Therefore, when discussing the amino acids of tea, the main research is on theanine.

Amino acid is a very important metabolite of the nitrogen cycle. Nitrogen nutrients are absorbed by the roots, and then transported to the buds and leaves and other parts of the tea tree, and the tea tree grows taller. Meanwhile, more and more natural amino acids will be accumulated, which are discovered and used by people. Amino acids in tea not only reflect the supply and transformation of tea tree nutrition, but also have a direct and important impact with the quality of tea. It is almost indispensable.

Most amino acids in tea are fresh, refreshing and sweet, and some are slightly sour. If the content of amino acids in the tea is high, the taste will be fresh, refreshing and sweet. If the content of tea polyphenols with pungent taste is also appropriate, then the taste will be mellow.

Detection of the content of the free amino acids in tea, mainly focus on theanine, which is used to measure the quality of tea.

The main effects of theanine:

1. Depression treatment

At present, theanine has been used to treat depression, which is the most common psychosis in the world. It is estimated that more than 100 million people in the world suffer from different degrees of depression, and the incidence of depression is as high as 1.5%. At present, western antidepressants, such as sertraline and paroxetine, are mainly used to treat depression. Although these drugs can effectively control the symptoms of depression, the side effects such as drowsiness, blurred vision, and high blood pressure are very obvious. If used for a long time, especially in large doses, it will cause great harm to patients. Drugs made with theanine can avoid these side effects. Health products manufacturers in the United States, Japan and other countries have developed and marketed a number of pure natural antidepressant capsules, whose major constituent is theanine and helper constituents are natural sedatives such as pineapple root extracts and hypericin. These capsules have a remarkable curative effect and have no side effects after long-term use.

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2. Protecting nerve cells

Theanine can inhibit the death of nerve cells caused by transient cerebral ischemia and has a protective effect on nerve cells. The death of nerve cells is closely related to glutamate, an excitatory neurotransmitter. The excess of glutamate will lead to the death of nerve cells, which is usually the cause of diseases such as Alzheimer's. Theanine and glutamic acid are similar in structure and will compete for binding sites, thereby inhibiting the death of nerve cells. Theanine may be used for the treatment and prevention of brain disorders such as strokes like cerebral embolism and cerebral hemorrhage, blood deficiency during brain surgery or brain injury and senile dementia.

3. Enhancing the efficacy of anti-cancer drugs

The incidence and mortality of cancer remain high, and drugs developed for the treatment of cancer often have strong side effects. Therefore, in cancer treatment, a variety of drugs that inhibit the side effects of anti-cancer drugs should also be used. Theanine itself has no antineoplastic activity, but it can improve the activity of many antitumor drugs. When used in combination with antitumor drugs, theanine can prevent antitumor drugs from flowing out of tumor cells and therefore enhance the anti-cancer effect. Theanine can also reduce the side effects of antitumor drugs, such as regulating the lipid peroxidation level and relieving the reduction of white blood cells and bone marrow cells. Theanine also has the effect of inhibiting the infiltration of cancer cells, and infiltration is a necessary way for cancer cells to spread, therefore theanine can inhibit the spread of cancer.

4. Sedation

Caffeine is a well-known stimulant, but people feel relaxed, calm and happy when drinking tea. It has been confirmed that this is mainly the effect of theanine.

5. Regulating neurotransmitters in the brain

Theanine affects the metabolism and release of neurotransmitters such as dopamine in the brain, and brain diseases caused by these neurotransmitters may also be regulated or prevented.

Sample Preparation and Analysis

1500 mg of green tea has been extracted by adding of 0.1 M HCl. The extract has been filtered by a membrane filter.

100 μ L of the filtered sample were mixed with 100 μ L sample dilution buffer (including internal standard norleucin with a final concentration of 100 nmol/mL).

Table 1: Amino Acid concentration in tea extract.

Amino Acid	μ g Amino acid/ 100 g tea
P-Ser	93.5
Tau	95.8
Asp	926.5
Thr	169.6
Ser	308.2
Asn	608.0
Glu	1333.7
Gln	453.8
Gly	17.6
Ala	252.6
Val	237.0

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Cys	46.1
Ile	123.6
Leu	122.6
Tyr	187.5
Phe	205.3
g-ABA	425.0
His	53.5
Trp	164.2
Lys	135.6
NH4	163.6
Arg	640.9
Pro	135.7
Theanine	6429.3

The samples were analyzed by the Amino Acid Analyzer ARACUS, manufactured and distributed by membraPure GmbH worldwide. ARACUS is using the classic routine analysis of amino acids by post-column derivatization with ninhydrin and the detection at 440 nm and 570 nm.



Figure 1: Amino Acid Analyzer ARACUS

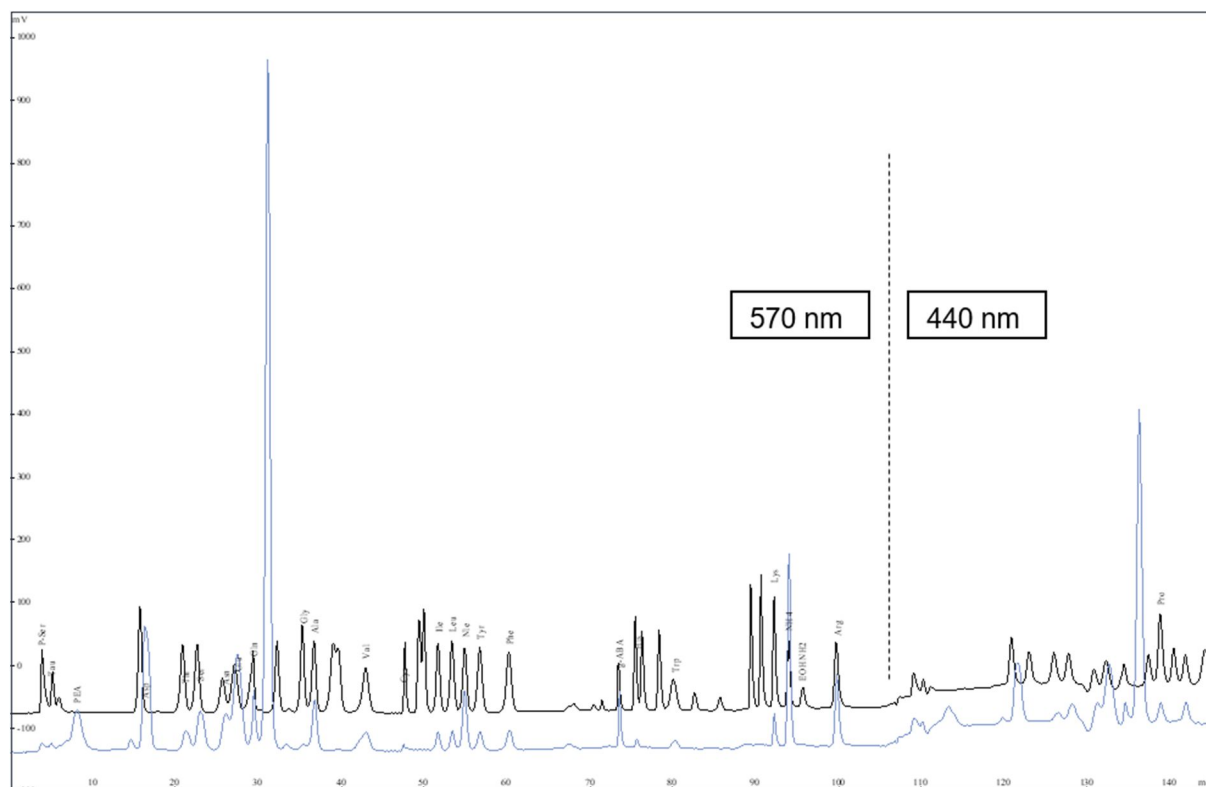


Figure 2: Comparison of a physiological amino acid standard (black) with the green tea sample (blue). The detection was performed at 570 and 440 nm. The concentrations of the individual amino acids were determined using a known concentration of a standard amino acid mixture.

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