Realization of Automatic Processing of Buttered Tea Based on Expert Control Algorithm

Zhang Weijiang, LUO Zhang
LinZhi, China
School of Electrical Engineering
School of Food Engineering
Tibet Agriculture and Animal Husbandry College
E-mail 1711547647@qq.com

Abstract. Traditional craft and parameters of butter tea manufacturing have been optimized and intelligent manufacturing could work well. In order to reduce fluoride content in the brick tea, pretreatment process is added. One-step process of extraction of tea is adopted and of parameters is optimized. The total numbers of colony and bacterium of the extraction of tea are tested at temperature 25. The local optimums found by hill climbing algorithm could be fit for a special group. Control rules worked out on the basis of good practice and user characteristics. Intelligent manufacturing of buttered tea is achieved. Soluble fluorine is decreased effectively. The scientific craft ensures quality of the extraction of tea in the storing process. It saves time of making buttered tea. Improving quality of butter tea and intelligent processing be realized.

1. Introduction
Buttered tea occupies a very important position in the life of the Tibetan people, but its processing parameters are not specifically quantified. Under the traditional technology, the increase of fluoride content in the extraction of tea soup is a serious problem. If the extraction process of tea soup is optimized, it can effectively reduce the fluoride content in tea soup. The traditional process will pay more manpower. Automatic processing will solve such problems. Expert intelligent control system integrates the merit of expert reasoning and intelligent control and can overcome the shortage of classical control theory. It is a close control system oriented target task. In this paper, the extraction process of tea soup was optimized on the basis of experiment. Based on statistics, the parameters of butter tea in different regions were collated, in order to meet the needs for automatic generation. The processing parameters of buttered tea were further optimized by hill climbing algorithm to achieve a satisfactory rate of 85%. From the point of view of the region and different populations, the expert control algorithm adjusts the processing parameters of butter tea to ensure the quality of butter tea. Butter tea processing taste can fully meet the needs of the most people. The automatic processing of buttered tea is more healthy than traditional handicrafts. The fact shows that the expert control system has achieved satisfactory results in the processing of buttered tea.

2. Process analysis of butter tea

2.1. Traditional craft of butter tea
Traditional buttered tea processing technology can be divided into tea soup extraction and buttered tea stir two processes. The extraction of tea can be divided into mashed brick tea, cooking, separation all
three steps. The first cooked tea still need to extract several times to discard. The extraction process of tea soup is shown in Figure 1. Mix the boiled water, salt, butter and tea soup thoroughly in the container until the butter is dissolved sufficiently.

2.2. Optimization of processing technology of buttered tea

The traditional butter tea processing technology can be divided into tea soup extraction and butter tea stir two processes. Tea extraction can be divided into open, broken brick tea cooking, separation of several steps. Isolates for tea and tea, tea as the raw material of buttered tea, after the first cooked tea also need to extract several times to discard. The extraction process of tea liquor is shown in figure 2. Tea is generally placed 4320min after the extraction, the cooking time is 20 ~ 30min, there is no fixed time.

The content of fluorine in brick tea is not higher than 300mg/kg, otherwise easily lead to dental and produce toxic effects on the human body. The average content is up to 2625.38mg/kg, the total content of fluorine is high, the range is 1296.66 ~ 4739.89 mg/kg, the average fluorine content is 3274.51 mg/k. At degrees Celsius, soaked tea can significantly reduce the content of fluoride in the range of 1 minutes, also very good retention of active ingredients in tea. Tea soaked in water at 60 degrees Celsius for 1 minute is considered as the optimization of a new process. At the temperature of 100 degrees Celsius conditions, tea was cooked 20 minutes and atmospheric pressure is a standard
atmospheric pressure. It was found that the extraction rate of tea-polyphenols is the highest at 1:30. The traditional process still follow the practices of the past, extracted by exposure to cooking on tea, due to the impact of the boiling point of water, the extraction efficiency is low, has led to repeated extraction technology on the traditional tea. Because the pressure cooker is widely used in the plateau area, the pressure cooker can be used to extract the tea liquor, which can significantly extract the efficiency. The content of tea polysaccharide was determined by phenol sulfuric acid method, and the result was shown in figure 4. It can be seen that the increased percentage of tea in polysaccharide solid-liquid ratio increased, the ratio of material to liquid measured in 1:25, when the tea polysaccharide content of the highest, 1.1%. The content of polyphenols is higher than that in the extraction of polysaccharide, mainly considers the content of polyphenols, so we selected the material liquid ratio 1:30 extraction efficiency factor in brick tea.

Using high pressure extraction equipment can effectively improve the extraction efficiency of tea soup. The effective ingredients can be extracted in brick tea in the case of the best material ratio. The optimization process of tea soup is shown in Figure 1. In order to reduce the leaching of active ingredients in the process of soaking, the proportion of hot water and tea was controlled. The content of tea polysaccharide was determined by phenol sulfuric acid method in the process of experiment. The content of tea polyphenols was determined by ferrous tartrate colorimetric method.

3. Searching for local optimum solution of buttered tea

Traditional process, buttered tea of different raw material ratio and no strict quantitative, mainly rely on processors depending on experience. If a ratio (automatic setting value) is fixed, automatic production could not meet the tastes of different groups. In this case, the local optimal solution can be
used to solve the above problems. The solution of the optimization problem exhibits multi peak characteristics. For the same special group, the local optimum solution of buttered tea is similar, so different populations (different experimental objects) are another constraint condition for the optimization problem of buttered tea. Hill climbing algorithm is a locally preferred intelligent algorithm, which adopts heuristic method, and applies feedback information in the search process to help decide the generated solution. The evaluation function \( K(x) \) is used to evaluate the distance between the target state and the current state. The evaluation function \( K(x) = 0.8 \) is set here. The search flow of the local optimal solution is shown in Figure 3. Although buttered tea raw materials are the same in different regions, there are still obvious differences in the proportion. The population of 5 different regions was selected as the experimental group to determine the optimal ratio of buttered tea. People in different groups must consider factors such as age, gender, occupation, and so on. From the actual situation, the initial solutions of different groups can be determined.

![Figure 3. The search flow of the local optimal solution.](image)

4. Construction of expert control system

4.1. Knowledge of problems

The main problems faced by the intelligent processing of buttered tea are three problems. The problem one is how to extract user's feature information in intelligent machining process. The problem two is how to obtain the optimum processing technology and raw material proportion of the best crisp tea
camellia according to the user information. The problem three is how to determine the optimal amount of buttered tea according to the population information of the user, and determine the maximum processing quantity and minimum processing quantity in the intelligent processing process. User feature information includes: The user's region, the number of users' family members, the average age of the user's family members and other related information.

4.2. The conceptualization of knowledge
The conceptualization of knowledge includes data types, known conditions and objectives, assumptions, and control strategies. For the data type, the user's address information and the average age of the user family are integer variables, and the amount of buttered tea is usually floating point type. The local optimum solution and the modified empirical value of buttered tea in different regions are array data.

4.3. Formalization of concept and formalization of form
Further optimization is based on the local optimal solution, according to the main characteristics of the user to optimize.

Rule 1: if the user is a farmer's family and the average age is 12, then the output optimal solution is \( f(x_1) \).

Rule 2: if the average age of users is far greater than 12, then the output optimal solution is \( f(x_2) \).

Rule 3: if the average age of users is far greater than 12, then the output optimal solution is \( f(x_3) \).

Rule 4: if the user is a worker's family and the average age of family members is far greater than 12, then the output optimal solution is \( f(x_4) \).

Rule 5: else the output optimal solution is \( f(x_5) \).

\( f(x_1) \) is the output value of the optimal solution of rule 1, \( f(x_2) \) is the output value of the optimal solution of rule 2, \( f(x_3) \) is the output value of the optimal solution of rule 3, \( f(x_4) \) is the output value of the optimal solution of rule 4, \( f(x_5) \) is the output value of the optimal solution of rule 5. The control rules of the other groups are similar to those of the first group.

The control rules of the first 1 group are listed, and the control rules of the other groups are similar to those of the groups 1. It is very convenient to use the computer language to optimize the control rules in the controller. In order to ensure the improvement of expert system, it is necessary to continuously test the inference rules of knowledge base, so as to reach the level of expert.

5. Conclusions
The two conclusions in this article are very important. The proportion of butter is very important in all variables. The value of several variables in butter tea will vary depending on the drinker. In order to ensure the health of butter tea, the addition of salt is relatively small.

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