Research on the Source and Treatment of Candied Waste-Water

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Abstract. Preserves are fruits and vegetables pickled with sugar or honey, which are divided into 6 categories according to their characteristics and 4 categories according to their local flavor. The processing techniques of candied fruit include: grading, peeling, preserving the fruit embryo, preserving and hardening, sulfur treatment, dyeing and pre-cooking. With the progress of the process, the candied waste-water with different water quality characteristics was produced. The treatment methods of candied waste-water include biochemical, chemical and physical chemical methods, and chemical methods can be divided into 6 kinds of treatment methods, such as REDOX and neutralization. Because of the large amount of fruit juice and sugar, candied waste-water can be treated by biochemical method to meet the discharge standard.

1. Introduction
The original meaning of "candied fruit" is the raw material of fruit and vegetable, through the processing method of marinating with sugar or honey, has evolved into the traditional product name of our country. There are a variety of candied products in China, which can be classified into the following 6 categories according to the characteristics of the products [1]: (1) candied sugar: after the raw materials are made of candied honey, the finished products are immersed in a certain concentration of sugar solution, with a slightly transparent feeling, such as: honey kumquat, sugar sweet-scented osmanthus, moleseed, etc. (2) return sand: after the raw material is boiled with sugar, the surface of the finished product is dried, with white icing, such as: sugar wax gourd, golden silk jujube, kumquat cake, etc. (3) preserved fruit: after the raw material is made of sugar-soiled sugar and dried, the surface of the finished product is not sticky, not dry, transparent, no icing out, such as: preserved apricot, pineapple (slice, block, core), ginger sugar slice, papaya (strip, grain), etc. (4) cool fruit: raw materials in the process of sugar or sugar cooking, add sweeteners, spices, etc., the surface of the finished product is dry, with a strong flavor, such as: lilac plum snow seeds, eight zhen plum, plum kumquat, etc. (5) licorice products: the raw materials are made of fruit billet, impregnated with sugar, licorice and other food additives, and then dried. The finished products have sweet, sour and salty flavors, such as plum, gancao olive, orange peel and plum. (6) fruit cake: the raw material is processed into a sauce, after concentrated drying, the finished product is in the shape of slices, bars, blocks, such as hawthorn cake, appetizer kumquat, fruit peel, etc.
According to local flavor, it is divided into Jing style, Guang style, Su style and min style. (1) Beijing type preserves are mainly represented by preserved fruit, also known as Beijing preserved fruit, or "north honey", and "north preserved fruit". It originated in Beijing area, the feudal times for tribute. Dried fruit is the selection of fresh fruits and vegetables, after sugar, sugar boiled, and then by drying or drying. Its product characteristic is: the finished product surface is dry, does not stick to the hand, presents the translucent shape, contains the sugar content high, soft and has the toughness, the taste is thick sweet, has the original fruit flavor. (2) Originated in the ancient city of Suzhou, the soviet-style candied products are mainly sugar and sand products, now throughout the river, Zhejiang, Shanghai, Anhui and other places. Su-style candied fruit is characterized by exquisite material selection, fine production, unique shape, bright color and elegant flavor. (3) cantonese candied fruit originated in Guangzhou, Shantou and Chaozhou. It is mainly made of licorice flavoring products (commonly known as cool fruit) and icing products. It has a production history of more than 1,000 years. Cool fruit products, semi-dry or dry surface, taste more sweet or sour, salty, sweet taste, mouth long aftertaste. Sugar-coated preserves, pure in texture, with a layer of white icing on the surface, as if poured a layer of sugar, also known as "candied sugar". Its product surface is dry, there is icing sugar, sweet and glutinous entrance, the original fruit flavor is thick, the product color is many, and the flavor is unique. (4) Originated from Xiamen, Fuzhou, Quanzhou, Zhangzhou areas in Fujian province, here is rich in olives, with this as the main raw material and made into candied fruit, so min-style candied fruit is represented by olive products candied products. Min-style preserves, dry or semi-dry on the surface, low sugar content, slightly lustrous, fine and dense meat, with outstanding flavor, refreshing and aftertaste.

2. Processing method, production process and source of waste water of preserves

2.1. Processing method of preserves
Before processing sugar products, some necessary treatment of raw materials should be carried out according to the nature of fruits and vegetables and the processing needs, which is conducive to processing and improving the quality of products [2]. (1) Selective grading: in order to make the products consistent, the raw materials are graded according to maturity and size, generally divided into 2 ~ 3 grades, and rotten, sick insects and bad fruit are eliminated. (2) Peeling, core-cutting, slicing and slicing: the purpose of these treatments is to make sugar easy to repair and dehydrate, shorten the time of sugar making, and improve product quality. The fruit and vegetable with big shape and thick skin should be peeled and cut. Jujube, plum, xiao-mei class wait for small form fruit, and small red orange, kumquat wait to give priority to with edible fruit skin, do not peel, cent, often delimit seam in fruit face or puncture hole, facilitate the infiltration of sugar. (3) Fruit embryo curing: fruit embryo is a kind of semi-finished product produced by candied fruit, and it is also a preservation method for storing fresh raw materials for future use. Salt is usually used as the main ingredient in the curing of fruit embryos, sometimes with alum or lime to make them moderately hardened. There are two ways of curing: dry curing and wet curing. The dry salting method is suitable for the kind with higher maturity or more juice. Wet salting method is used for immature fruit or less juice, dense meat and strong sour, bitter taste of the species, salt concentration of about 10%. Create a slight lactic acid in the process of pickled in salt water and alcohol fermentation, is advantageous to the sugar and part of pectic substances decomposition, the permeable material organization, but also can promote the bitter, acidity and eliminate peculiar smell matter decomposition, improve product quality, when raw material translucent state, can take out the sun dry germ or wet preserved embryos. (4) Crispness preservation and hardening: in order to prevent canker and breakage of candied sugar, it is often used to harden loose and soft fruits, melons, cherries and red bayberry to preserve crispness. The raw material is impregnated in a solution of lime, calcium chloride, calcium bisulfite, etc., or lime and alum are added to harden the embryo. Lime, calcium chloride, alum and other salts belonging to calcium and aluminum, containing calcium and aluminum plasma can react with pectin in the fruit to produce insoluble salts, making the tissue hard and resistant to cooking. (5) sulfur treatment: in order
to make the product bright and beautiful, the raw material is often treated with sulfur before sugar production to inhibit oxidation and discoloration, improve the fruit sugar infiltration, and play a role in preservative. Sulfur treatment involves impregnating or fumigating the fruit for several hours in a solution of sulfurous acid and sulphite containing about 0.3% sulfur dioxide. The raw materials treated with sulfur should be rinsed and desulphurized before sugar production to reduce the content of sulfur dioxide to less than 20ppm so as not to affect the flavor. Rinse should be changed many times, time to achieve the elimination of residual effects. (6) Dyeing: at present, China's temporary artificial pigment for food has amaranth red, carmine red, lemon yellow, indigo, etc., the dosage shall not exceed one part of ten thousand, too much distortion, affecting the quality. The method of dyeing is to dip the raw material in the pigment solution or to dissolve the pigment in the dilute sugar solution, so that it can be colored at the same time when the sugar is prepared. (7) Pre-cooking: most fruits and vegetables should undergo a short period of heat treatment before sugar production to inhibit microbial activities, make enzymes inactive, remove air from the raw material tissues, and prevent spoilage and oxidative discoloration. However, the important purpose of candied fruit processing is to moderately soften the tissue and facilitate sugar infiltration. In addition, to a few have peculiar smell, bitter fruit and vegetable, through precook can make it’s reduce or get rid of. The method and time of precooking should be determined according to the conditions such as the types of fruits and vegetables, the size of the shape, and the requirements of the process. Generally, it is advisable to precook for several minutes under the condition of no less than 90°C, and hot to the transparent state of tissue.

2.2. Main production process of candied fruit
There are many traditional candied fruit products with unique flavor in China, among which Beijing, Guangzhou, Suzhou, Fuzhou and other places are the most famous. Known as the north candied fruit and south honey, it is a high sugar product with a certain shape after fresh fruit is hardened and boiled with sugar, and the sugar content is 60% ~ 70%. According to the product form into dry - state preserves, wet - state preserves and cool fruit. Different kinds of candied fruit have different requirements for harvesting, curing, drying, seasoning, packaging and storage of raw materials. The processing process of candied fruit is as follows [3]. (1) Dry state: selection of raw material → pretreatment → impregnation of sugar solution → drying → icing → packaging → finished product. (2) Wet state: selection of raw material → pretreatment → impregnation of sugar solution → canning → sealing → sterilization → cooling → packaging → finished product.

Cool fruit products are traditional products with a long history in China. The main ingredients are licorice, salt, sugar and other flavorings. The finished product can keep the original fruit complete structure, the surface is dry, some show salt frost, sweet taste, sweet and sour taste, slightly salty, with the original fruit flavor. After the food, thirst, appetizers and stagnation. The processing process of cool fruit is as follows:

Raw material selection → pretreatment → honey impregnation → adding ingredients → drying → packaging → finished products.

2.3. Source of candied waste-water
In the process of processing and production of candied fruit, a certain amount of polluted water is produced along with the removal and cleaning of rotten fruit in the classification. In the process of peeling and cutting, water cleaning is needed. During the curing process of fruit billet, salt impregnation produces high salinity waste-water, sugar impregnation produces high sugar waste-water, and the dissolution of juice. Waste-water is produced in the process of rinsing and desulfurization of sulfur treatment, in the process of solution dyeing and precooking.
3. Treatment of candied waste-water

3.1. Biochemical method
Biochemical method is to use all kinds of microorganisms in nature to decompose the organic matter and some inorganic poisons in the waste water, so as to transform them into stable, non-toxic substances, so as to make the water purified. The biochemical treatment of waste-water is one of the most important processes in waste-water treatment system. Biochemical methods can be divided into aerobic biological treatment and anaerobic biological treatment. If the BOD5/CODc of waste-water is greater than 0.3, the waste-water has good biodegradability and is suitable for biochemical treatment. Because of the large amount of fruit juice and sugar, candied waste-water can be treated by biochemical method to meet the discharge standard. The main structures of biochemical method are aeration tank and secondary sedimentation tank, in which sewage can be effectively degraded by microorganisms with good treatment effect and low cost, which is an effective way to treat cool fruit waste-water [4].

3.2. Chemical method
The chemical treatment of sewage is to remove the pollutants in the water by means of chemical reaction. The commonly used chemical treatment methods are oxidation method, neutralization method, electro-chemical method and chemical precipitation method. (1) REDOX method: organic and inorganic pollutants in the dissolved state in sewage are oxidized and reduced to harmless substances due to electron migration after adding oxidants and reducing agents. Commonly used oxidants are oxygen in the air, bleaching powder, ozone, chlorine dioxide, chlorine gas, etc., oxidation method is used to treat phenol, cyanide waste-water. Commonly used reductants are iron filings, ferrous sulfate, sodium bisulfite, etc. (2) neutralization method: the process of removing excessive acid and alkali in sewage by chemical methods and making its pH value reach neutral is called neutralization method. Alkali is used as the neutralizing agent in the treatment of acid-containing sewage, and acid is used as the neutralizing agent in the treatment of acid-containing sewage. Acid or base all point to inorganic acid and inorganic base, general answer is in accordance with "with waste cure waste" principle, also use medicaments neutralize treatment, can undertake continuously, also can undertake intermittently. (3) Electrochemical method: the toxic substances in sewage can be converted into non-toxic substances. For example, in the process of removing sulfur from candie waste-water, alkaline substances can be considered to remove it due to the presence of acidic gas.

3.3. Physical chemistry method
Physical treatment method is a simple water treatment method that USES physical action to remove floating matter, suspended matter and grease of sewage, and at the same time to recover useful substances from waste-water. The physical methods commonly used in water treatment include gravity separation, adsorption, coagulation and precipitation, extraction, flotation, stripping, reverse osmosis and electrodialysis. (1) Gravity separation method: refers to the use of sediment, suspended solids and oils in sewage under the action of gravity and water separation characteristics, through the natural sedimentation, the suspended solids in sewage with a large proportion of the removal. (2) Adsorption: effectively remove the highly toxic and refractory pollutants in the waste-water. After treatment, the effluent quality is good and stable, and there is no secondary pollution, so adsorption method plays an irreplaceable role in waste-water treatment. Commonly used adsorbents are activated carbon, fly ash, modified cellulose, clay minerals, silica gel and resin. Activated carbon and resin are the main adsorbents. Zhang Xiaoxuan et al. [5] studied the chroma and COD removal rate of the dye waste-water treated by activated carbon, and the results showed that the decolorization rate of acidic fuchsin, alkaline fuchsin and active black b-133 waste-water treated by activated carbon was above 97%. COD removal rates were 63.28%, 95.66% and 84.62%, respectively. But activated carbon regeneration is difficult, physical and chemical stability is poor, so the treatment cost is higher. Extraction method extraction method mainly consists of the complexion of extraction agent and
pollutant molecules, or the pollutant in the water enters the extraction inner phase through a very thin film layer under the action of carrier, so as to purify the waste-water. Luo Xuehui et al. [6] selected trioctylamine (TOA)/n-octanol/kerosene as the extraction agent for the experimental study on the treatment of aniline 2, 5-bisulfonic acid industrial waste-water, and the treatment effect was remarkable. Li Xiaoyan et al. [7] conducted complexation extraction test on CLT acid waste-water using 7301 -H2SO4-NaOH chemical extraction-reverse extraction system, and the COD removal rate of the waste-water reached 93.5%. The reverse extraction efficiency is 100%, the recovery in waste-water is concentrated 8 ~ 10 times, and the extraction agent can be recycled. (4) Flotation: it is mainly used to treat emulsified oil or fine suspended solids in waste-water which are difficult to be removed only by natural sedimentation or floating. The principle is based on the difference of surface tension blowing air into the waste water to make suspended matter or emulsion adhere to the bubble surface to float and then separate and remove [8-9]. (5) Stripping method: this method is actually a direct steam distillation process, mainly used for the treatment of waste-water with certain volatile organic compounds. (6) Reverse osmosis method: it is a membrane separation technology. The waste-water is pressed into a reverse osmosis device equipped with a semi-permeable membrane as a diaphragm by a high-pressure pump and then filtered by pressure to separate the dissolved substances from the waste-water. It has been applied in seawater desalination, chemical industry, pharmaceutical industry, sugar industry and food industry [10-11].

4. Conclusion
According to the characteristics can be classified into 6 categories, according to the local flavor into 4 categories. With the progress of the process, the candied waste-water with different water quality characteristics was produced. A certain amount of polluted water is produced in the process of removing and cleaning putrefied fruit, curing, dyeing and sulfur treatment. Biochemical, chemical and physical chemical methods constitute the main methods for the treatment of candied waste-water. Among them, the main structures of biochemical method are aeration tank and secondary sedimentation tank, in which sewage can be effectively degraded by microorganisms and the treatment effect is good.

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