

Research on the Influencing Factors of China Apple Juice Trade

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Abstract: China is the first country in the world in which apple juice is produced and exported and the main producing area is concentrated in the north of China. Some domestic companies which export apple juice are founded. China's apple juice, mainly exported to USA, Japan and the Europe, has a strong international competitiveness. However, due to the breed and raw material, Chinese apple juice export faces some challenge, like the loss happening in the transport process. The objective of this study is to research China's apple juice export situation and problem using the comparative analysis method. To cut down the loss, this study is trying to offer a relative scientific research for fruit juice industry by analyzing how temperature and concentration influence on thermal conductivity of apple juice, affecting the whole juice industry. It is with great significance to solve the realistic problems and promote China apple juice industry and its international trade.

Keywords: Apple juice, export, influencing factors

INTRODUCTION

As is predicted, the price of apple juice is going toward the level where is 1,800-1,900 dollars per ton, which is much higher than 1,000 U.S. dollars per ton in the beginning of this year. The price of apple itself has also gone up to 207 U.S. dollars per ton, with the processing and output ratio at 1:7 (Zhang, 2008). With the rise of global income levels as well as the impact of healthy diet consciousness, the broad prospects for the development of fruit and vegetable juice industry, especially in emerging and developing countries, the rapid growth in consumer demand (Ying-Ying *et al.*, 2010). Because concentrated broad use of apple juice, demand is growing, but subject to the supply of raw materials, the rigid lead to limited growth capacity and expected global apple juice concentrate in the next 3 years will remain tight (Tan, 2009). A state of equilibrium, the price will rise steadily. Will be a large increase in the short-term, 07/08 World of apple juice concentrate prices exacerbate tensions in the global supply and demand, as the second largest exporter of Poland is significantly reduced and the selling price is expected to reach at the price level of 1,800-1,900 U.S. dollars per ton (Gao, 1996; Han and Lei, 2011).

In spite that fruit and vegetable juice industry in China started later than other countries, but mainly due to the rich resources and low labor cost of fruit and vegetable products, the industry has gone by the very rapid development in recent years (Tan, 2009). From the view of global industry structure shift, subject to high labor costs and resource prices, the developed countries gradually turn to import high-quality, low-cost and labor-intensive products from developing countries, which also provides a good opportunity for China's fruit and vegetable juice industry (Zhu, 2008).

Nowadays, China has become the largest country who produces and exports apple juice in the world and its main export areas focus on the United States, Japan, Russia and the European Union countries. As to the provinces, with the good weather conditions for apple to grow, both Shaanxi and Shandong are important apple juice production and export provinces in China. China's apple juice production has lower cost advantage, but apple juice market is abroad. China apple juice export encounters technical barriers, which affects china apple juice export and trade. Therefore, this study tends to resolve the problem mentioned above how to develop the apple juice industry in China and how to discuss the loss during the whole course of the industry chain.

The objective of this study is to research China's apple juice export situation in recent years and the problems by using the comparative analysis method. What's more, it aims at offering a relative scientific research for fruit juice industry by analyzing how temperature and concentration influence on thermal conductivity of apple juice, which may to a great extent affect the whole industry. From the empirical analysis, we can find that it is with great significance to solve the realistic problems and promote China apple juice industry and its international trade market status.

INTERNATIONAL MARKET OF APPLE JUICE

The world's apple juice industry developing situation: The most important and the only raw materials for concentrated apple juice are apples. The main apple original places focus in the temperate regions and due to the special geographical position, the only part of the countries and regions in the world are suitable for planting high-quality apples. Apple's

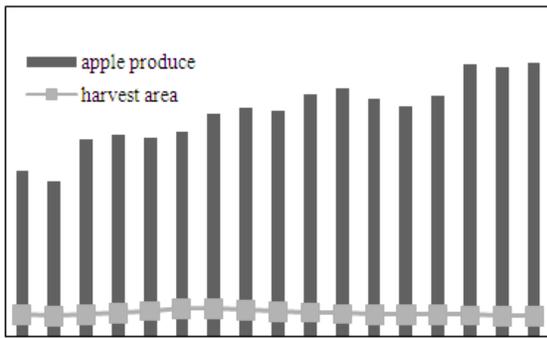


Fig. 1: The main original production places of apples in the world (1990-2006, 10,000 ton per year and 10,000 ha per year) Data resource: USDA (FAS)

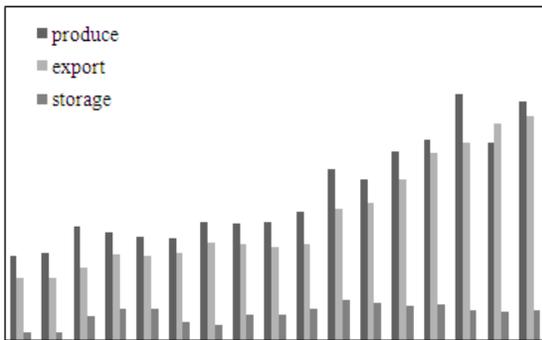


Fig. 2: The world's produce, export and storage of apple juice (1990-2006)

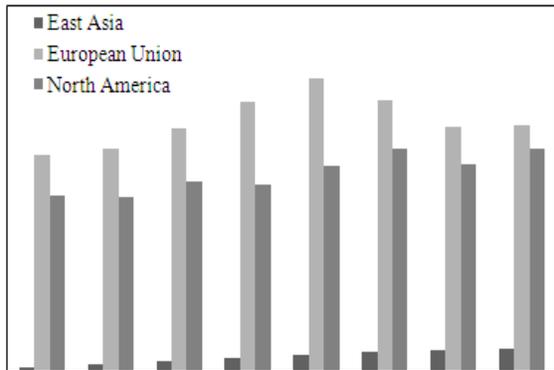


Fig. 3: The consumption of apple juice in some regions (1999-2006, 10,000 ton per year) Data resource: USDA (FAS)

production of the world's top ten apple producing countries in 2006 to 46.05 million tons, accounting for 81.3% of the total world production. Changes in major producing countries will directly affect the supply and demand situation. Overall, however, due to the impact of the acreage reduction and climate, the natural environment and other factors, the world's apple production growth slows down these years.

Figure 1 is the main original production places of apples in the world (1990-2006, 10,000 ton per year

and 10,000 ha per year). In the modern society, more and more people choose the healthy life mode by doing more exercise and drinking more purely natural drinks other than beers. The consciousness of healthy life contributes to most of the development of the apple juice industry. Since 1990s, the produce quantity of apple juice has been on an increasing trend, steady but rising, so is the export. As to the storage, from 1993 to 2006, it nearly remains at a level which is around 200,000 ton per year. Figure 2 shows the world's produce, export and storage of apple juice (1990-2006).

Beside the supply, the demand is also taken into consideration. As Fig. 3 shows, from the angle of different regions, the consumption of apple juice of East Asia is still at a low level compared to that of EU and the US.

Developing countries will be the main growing market of apple juice in the future. Eastern Europe, the Middle East and the Asian and Pacific region represented by the emerging markets who are fast in the speed of the rise of the new consumption growth pole. The large population of developing countries is very low, but the per capita consumption of juice. There is still a developing country, per capita fruit juice costs amount to 16 kg, compared to more developed countries, a 65 kg big gap existing. China's juice consumption has only just started and the annual per capita consumption of juice is less than 0.8 kg, only about 1/40 of the juice consumption in developed countries and it is only 1/10 of the world's average level. Therefore, China is a huge potential market for apple juice industry development.

The world's apple juice market share: Product market share index. Market share is a country's total exports accounted for the world merchandise exports ratio. Apple juice market share in international market is equal to our country apple juice exports/world apple juice exports. The index higher shows the industry international competitiveness is stronger:

$$MS_{ij} = X_{ij} / X_{wj}$$

MS_{ij} = Country i commodity in the international market share

X_{ij} = I commodity y in j country exports

X_{wj} = Total exports to the world j

If a country has a product with large international market share, the product is likely to have a great deal of competitiveness in the international market (Cheng *et al.*, 1994; Rodenbush *et al.*, 1999; Tan, 2007; Ying-Ying *et al.*, 2010).

Since China joined in the WTO, the share of China's apple juice has been increasing steadily in the international market, up to the peak (49%, almost half of the whole quantity) in 2007, but it dropped to 42% in 2009 because the international financial crisis

Table 1: Apple juice international competitiveness evaluation of China (2003-2009/%)

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|------------------------------------|------|------|------|------|------|------|------|
| China international market share | 25 | 27 | 32 | 36 | 49 | 43 | 42 |
| Poland international market share | 19 | 16 | 16 | 18 | 1 | 13 | 14 |
| Germany international market share | 10 | 10 | 10 | 07 | 6 | 6 | 6 |

Table 2: RCA of China

| Year | 2005 | 2006 | 2007 | 2008 | 2009 |
|--------------|------|------|------|------|------|
| RCA of China | 4 | 4 | 5 | 5 | 4 |

(Table 1) Market share has been living the first in the world, which shows apple juice export of China has strong competitive in the world. From Table 1, as China's major competitor, Poland's market share has dropped to 20%. German has 5% market share at present.

REVEALED COMPARATIVE ADVANTAGE INDEX

Revealed Comparative Advantage (RCA) is to measure the product or industry in the international market competitiveness. It describes a state of each industry relative export performance. An industry in country could be judged to have more export competitiveness by RCA index, thus revealing a country trade advantage in international market. The RCA index refers to a state of a commodity exports accounted for the export share with gross and total world exports of this kind of commodity exports share ratio. As the function below:

$$RCA_{ij} = (X_{ij} / X_{tj}) / (X_{iw} / X_{tw})$$

where,

- X_{ij} = i country's export products of export value
- X_{tj} = j countries of the national total export value
- X_{iw} = i the world export products export value
- X_{tw} = The world total export value

In general, RCA value is divided into comparative advantage, relative advantage, no relative advantage or disadvantage: if $RCA > 2.5$, a country's commodity is extremely competitive; if $1.25 < RCA < 2.5$, the country commodity has strong international competitiveness; if $0.8 < RCA < 1.25$, the country product has moderate international competitiveness; if RCA is less than 0.8, the country's commodity competition ability can be considered weak (Zhang, 2008).

Table 2 shows the RCA of China. With strong international competitiveness, China's apple juice occupies an important production and trade position in the world market.

THE TEMPERATURE CONTROL OF APPLE JUICE

The experiment background: the principle and method: From fresh fruit to the fruit and vegetable juice, it is a very complicated process, including long

time processing, more important, the cold storage, by adopting international standards and advanced processing technology. Continuing to maintain the natural fresh fruits and vegetables, Fruit and vegetable juice packaging is the key point. For the equipment is expensive, producers is lack of investment, which makes China's apple juice production technology backward, affecting the quality of products. So it is imperative to do research on the relative aspects. For the quality of the juice, as well as the fresh degree, the temperature is crucial but usually ignored in the production and storage process. To solve the problem when the apple juice is stored and transported, in the following part an experiment will be used to study the temperature control by thermal conductivity. Due to data shortage of thermal parameters in this experiment, the tepid probe test system will be used to determine the thermal conductivities of apple juice of different concentration at each degree of different temperatures (in the range from 3°C to 50°C).

The influence factor of thermal conductivities of apple juice:

In the course of juice processing and storage, the juice is always accompanied by the exchange and transfer of heat, which requires insight into the optimal choice of processing technology and equipment. The thermo-physical parameter of apple juice, which precisely reflects the thermal conductivity of the juice heat transfer capacity of important indicators, deserves a deep research by experiment and other methods.

Firstly, construct an environment for the experiment, using the concentrated apple juice from company A, with the concentration degree is 80%. And then the apple juice is diluted into different concentration degree according to the request of the experiment, ranged from 0% (pure water) to 80%.

The coefficient of thermal conductivity in the apple juice test system uses a thermal physics method, a micro-thermal probe method, which is based on the line source transient that mold is heated by applying a steady voltage of the thermal probe is inserted into the infinite homogeneous samples, thereby measuring probe the needle temperature over time of the slope of the change in the number, to obtain the thermal conductivity of the sample is measured, the relationship of the formula is:

$$\lambda = \frac{q}{4\pi} \frac{d\bar{\theta}(t)}{d(\ln t)}$$

Table 3: Regression equations and variance analysis describing relations between concentration, temperature and thermal conductivities of apple juice

| Group | Regression equation | Linear correlation |
|-------|-------------------------------|--------------------|
| 1 | $\lambda = -0.0033s + 0.5758$ | 0.998 |
| 2 | $\lambda = -0.0034s + 0.5758$ | 0.994 |
| 3 | $\lambda = -0.0035s + 0.5758$ | 0.996 |
| 4 | $\lambda = -0.0036s + 0.5758$ | 0.995 |
| 5 | $\lambda = -0.0037s + 0.5758$ | 0.998 |
| 6 | $\lambda = -0.0037s + 0.5758$ | 0.992 |

In the formula:

λ = The thermal conductivity of the apple juice sample, W/(m·k)

q = The heating power of the probe, W

$\bar{\theta}(t)$ = The average temperature rise of the probe tested, K

t = The time, S

After the experiment and the data analysis, the coefficient and the equations of different apple juice samples can be obtained, as the Table 3 shows.

From the Table 3, it can be seen that no matter how the temperature of apple juice changed and no matter how much the concentration was, the correlation between the thermal conductivities and two parameters are so next to 1, which means they are almost totally relative to each other. Thus, it can be proved that the temperature and the concentration of apple juice are key to thermal conductivities during the course of storage and transport.

A brief sum-up: The results of the experiment in this part tell that temperature and concentration of apple juice do have significant influence on the thermal conductivities, which affects the storage surroundings and time length. There is a high negative correlation coefficient between concentration and thermal conductivity at the same temperature; meanwhile a high positive correlation exists between temperature and thermal conductivity of apple juice with same concentration. Then the experimental data may be used to develop mathematical regression duality equations about thermal conductivity to temperature and concentration. Thus the model can supply the apple juice industry with relative and practicable scientific references.

THE PROBLEMS OF CHINA APPLE JUICE EXPORT

The highly-concentrated trade markets: Export market concentration degree is high, mainly in several countries, which makes the export risk rise (Liang *et al.*, 1991). China is the largest country producing and exporting apple juice. However, 80% of the output needs exporting because the domestic consumer market is still in initial stage. From Table 4, we can see that China's apple juice export market mainly concentrates

Table 4: Apple juice export structure of China (2007-2010, %)

| Year | USA | Japan | Germany |
|------|------|-------|---------|
| 2007 | 0.36 | 0.09 | 0.10 |
| 2008 | 0.49 | 0.12 | 0.05 |
| 2009 | 0.48 | 0.11 | 0.08 |
| 2010 | 0.49 | 0.08 | 0.05 |

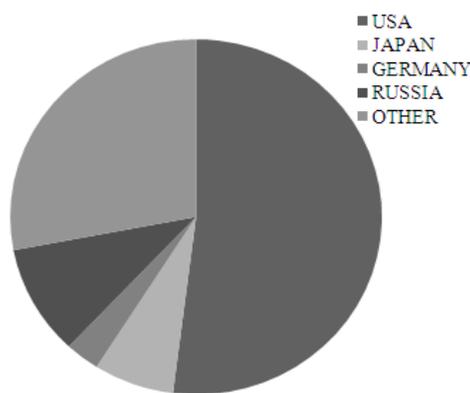


Fig. 4: The mainly export countries of Chinese apple juice from January to August in 2010

in the United States, Japan, Germany, Russia and several other countries who produce few apples or have high production cost of apple juice, especially the EU countries (Feleke, 2009).

The international financial crisis in 2008 caused China's apple juice export market concentration degree is high, mainly in the USA. Future efforts should be made to open up new markets to diversification of the export market, avoid market risk and reduce market impact. With economic rising gradually, the fruit juice demand growth is rapid, the international markets should be vigorously developed, particularly in Russia, South Africa where there exist great market demands and potentials.

From January to August in 2010, Fig. 4 shows that the countries that Chinese apple juice concentrate and export more than 10,000 tons are: The United States (253,000 tons), the Russian Federation (50,500 tons), Japan (34,900 tons), Canada (28,800 tons), Holland (27,000 tons), Australia (23,100 tons), South Africa (20,800 tons) and Germany (12,800 tons).

Japan imports a lot of vegetable and fruit juice from China, the juice is coessential change serious, with lower prices (Tan, 2007).

From January to September of 2009, the quantity of concentrated apple juice exported from China to 27 EU countries is 90,000 tons, reducing the amount of 58% compared to the same period in 2007. China's new concentrated crop juice yield was only 40% in the same period in 2007. In 2008, concentrated fruit juice industry was experiencing the depression that it never encountered before in the world. The demand of the international market was all of a sudden down turning, the fruit trade volume of Shaanxi was almost equivalent to 1/2 of the global import and export volume. Sales of

concentrated apple juice, as well as the raw fruit price, suffered a disastrous decline.

Low-quality raw materials: Processing of fruit scarcity of raw materials, apple quality and acidity are low. As a result of apple juice on the processing of raw materials has a certain requirement; the use of specific processing of fruit to extract high quality apple juice is required. Chinese processing apple orchard base rate is low, lack of a large number of processing fruit plantation. Processing of fruit scarcity of raw materials a lot of enterprises using bad fruit as raw material processing, quality will be effected, the price and international high-quality products vary greatly. Develop their own raw materials base vigorously to meet the needs of the market at home and abroad (Hooper and Lopper, 1950).

It is needed to monitor the whole production process to ensure productions safety, especially the fruit of raw materials acquisition security, firmly abandon rot materials such as fruit of substandard raw materials. To learn and use advanced management tools, constantly improving their own management level and product quality, guaranteeing quality of fruit juice health and safety, establish perfect product traceability system and product recall system; strengthen enterprise and industry self-discipline, widely accept the supervision of the community China's enterprises in the base construction, training and selection of prenatal fruit processing raw materials of fruit and other aspects of the work hard. Strengthen the internal management of enterprises, strictly in accordance with the foreign standards of production. To construct high quality apple production base, accelerate the construction of high quality apple demonstrative base of science, technology and constantly improve the level of scientific development of apple industry.

Weak circulation: Chinese apple juice concentrate industry in the industrial chain is in the upper, apple juice exports are mostly roughing products, raw materials, the lack of the corresponding terminal and terminal product brand, compared with Nescafe, Coca Cola and other well-known foreign food & Beverage Company of raw materials providers, industry chain is not complete, lack of product pricing. Fruit and vegetable juice processing chain contains from fruit to fruit and vegetable juice concentrates slurry to the consumer market. The chain currently in China has a significant imbalance development characteristic. It is necessary to develop deep processing treatment energetically, raise produce treatment to change ability, add value, lengthen agricultural industry chain and increase its voice in the international market.

The backward equipment technology: The equipment of the juice yield and the quality in China is lower than other countries that are also developed in apple juice

industry. In recent years the ultra high temperature sterilization for beverage production and processing of fruit juice is widely used, thus it is needed to make juice with high temperature resistant bacteria in or on the field in bacteria, make juice health indicators further assurance. The introduction of foreign advanced production equipment and technology to improve the quality of apple juice (press, ultra filtration, evaporator, canning machine) and enhance the Chinese fruit juice industry in the international market competitiveness shows crucial.

Apple deep processing technology obtains comprehensive breakthrough, solution in the production of concentrated apple juice browning, two cloudy, precipitation, aroma recovery and control of heat resistant bacteria and its main technology problems. The Chinese apple juice concentrate industry technical level and product quality must promote in the world.

Free will of the farmers and disordered markets: During a long time, Chinese farmers act according to their own free will, lacking spirit of cooperation, competition, there is no scientific marketing strategies and methods, lack of information service; therefore it is difficult to conform to international market (Cheng *et al.*, 1994). The peasants usually jump on the bandwagon when prices rise, while the prices of mutual demand a low price.

The backward packaging technology: In the production process, as well as the packaging, transportation and storage process, Apple juice is constantly subjected to a variety of microbial contamination and the items with a wide variety of microorganisms. Although we can use chemicals, gas, temperature control measurements and other advanced technology for sterilization, actually it is still not enough for everyday production and storage. Aseptic packaging of food refers to the sterilized food, such as beverage, dairy and so on, which is processed in sterile packaging, closed in sterilization container, without preservatives and no refrigerated conditions gets longer shelf life. As consumers put forward to higher requirements to food packaging and preservation of function, improving food packaging to extend the freshness of food has become an important research topic for many manufacturers. At present, aseptic packaging in food industry is most popular. Its application is not limited to fruit juice and juice drinks, but also used for packaging of milk, mineral water and wine. Canada apple juice has been using for aseptic processing. In our country, aseptic packaging technology application in apple juice is strengthened.

Apple juice concentrates full steel circulation turnover box packaging technology. Innovate through the technology and equipment of energy-saving projects, reduce the production cost, solves the problem

of product packaging. Fruit juice sterilization and packaging products is the key for its preservation. When thinking of the sterilization hand to kill pathogenic bacteria in fruit and vegetable juice, passivity technologies of fruit and vegetable juice in the enzyme, consider the quality of the product and the flavor, color and nutrition composition and physical properties such as viscosity, stability. Pet bottles and Tetra Pak is common packaging. Only by adopting international standards, advanced processing technology and advanced packaging materials of a few fruit juice, could maintaining the natural fresh apple juice continue.

The possible countermeasures: In the world market of apple juice, China does have stronger international competitiveness than other countries, but it also faces some problems. It is very important to develop new markets actively and cultivate fine material. The solutions are that: To improve planting structure. To strengthen scientific and technological research and development efforts, cultivate high acid apple varieties, develop high grade and special varieties of apples, developing high acid apple juice concentrate could improve the quality of raw material and strengthen the quality safety control. To make efforts to develop new markets by reducing China's apple juice export market concentration degree to disperse the export market, reduce the excessive dependence on the international market risk. To extend the industrial chain by building brand and strengthen the construction of circulation, reduce circulation cost. To improve the production technology, strengthen the research and development, the technology and the world synchronicity (Rodenbush *et al.*, 1999).

CONCLUSION

From a global perspective, China's apple juice has stronger international competitiveness, but also faces some problems. It is very important to develop new markets actively and cultivate fine material. The model of the experiment in this study can offer a practicable and feasible way of the temperature control in the process of transport of apple juice. And the loss can be reduced a lot in the future. It is of great significance to solve the realistic problems now the industry has encountered and then promote China apple juice industry and its international trade link, which can also help the world's apple juice trade and the industry development.

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