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GROUP2

REDUCTION OF WASTE FROM BEVERAGE INDUSTRY IN SHIZUOKA PREFECTURE

New recycling methods of beverage wastes | Tokuro I winter semester group2	
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Group2 report.

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CHAPTER 1

Introduction

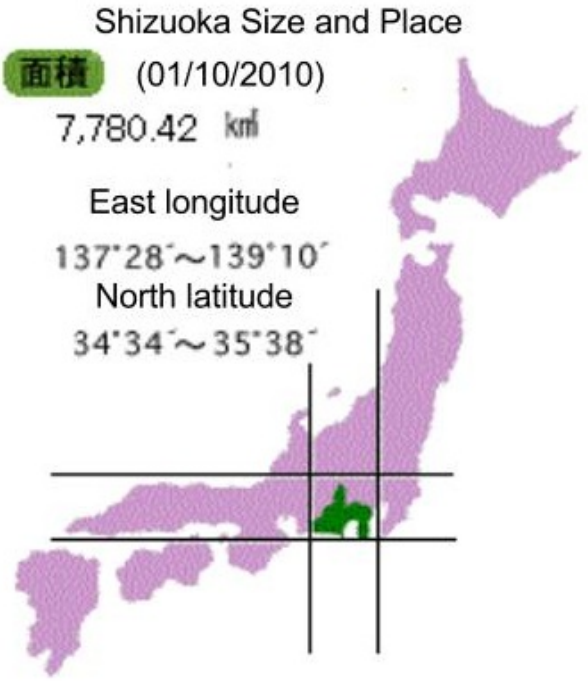
Preface

Our group aimed considering the current situation of beverage residue problem in Shizuoka and make a proposal. We listened to the relevant people, discussed the idea, visited some plants in Shizuoka and heard the lecture. After these we discussed new plans for beverage residue and summarized them to this report.

Shizuoka prefecture

Geography, Demography and climate

Shizuoka prefecture is located in the Chubu region of the Honshu Island of the Japan. Geographically it is demarcated by coast of the pacific ocean, Japan alps and well known mount fuji. (1)



Having 7,779.81 km^2 of total land area it bears 3751308 of population

with a 485.17/km^2 of population density. It comprises of 23 cities of which the city Shizuoka considered as the capital. Of the total land area only 35.1% is inhabited and the rest is covered by the forests.

Shizuoka prefecture is blessed with a mild climate due to its geographical position and has a 2324.9mm of average annual rain fall and 16.5℃of temperature.

Agriculture

With geographical location and favourable climate Shizuoka has a very good potential for agriculture, forestry and fisheries. Having ranked twelfth in agricultural out puts (Gross agricultural out put 208.6 billion yen in 2009),eighth in forestry products (Gross forestry out put 11.1 billion yen in 2009) and seventh in fisheries production (Total seas catch 55.8 billion yen in 2009) it accounts for 1.2% of Japan's GDP. Shizuoka ranks first in Japan in products such as green tea, mandarin oranges, “wasabi” horseradish, bonito, mackerel, yellowfin tuna, and cherry-colored shrimp. The prefecture accounts for more than 40% of national green tea production and 60% of its distribution with a total tea output of over 70 billion yen annually.(2)

Industry

Having access to plenty of clean water, the prefecture is leading in the beverage industry meanwhile the machinery industry in Shizuoka is the third biggest in Japan and the production volume is 19 trillion yen in 2005 since a lot of electric devices, transportation equipments chemical products and beverage products are produced in Shizuoka.(3)

Beverage industry

Shizuoka prefecture shares 18% of the national beverage production and which is the highest contribution as a single prefecture. Shizuoka has good conditions for beverage industry. First Shizuoka is close to both Tokyo and Nagoya, which are quite large cities. Second there are plenty of water in Shizuoka since south Alps supply water in a steady stream. Third, companies can collect some kinds of beverage ingredient in Shizuoka, such as Green tea, Citrus. (4)

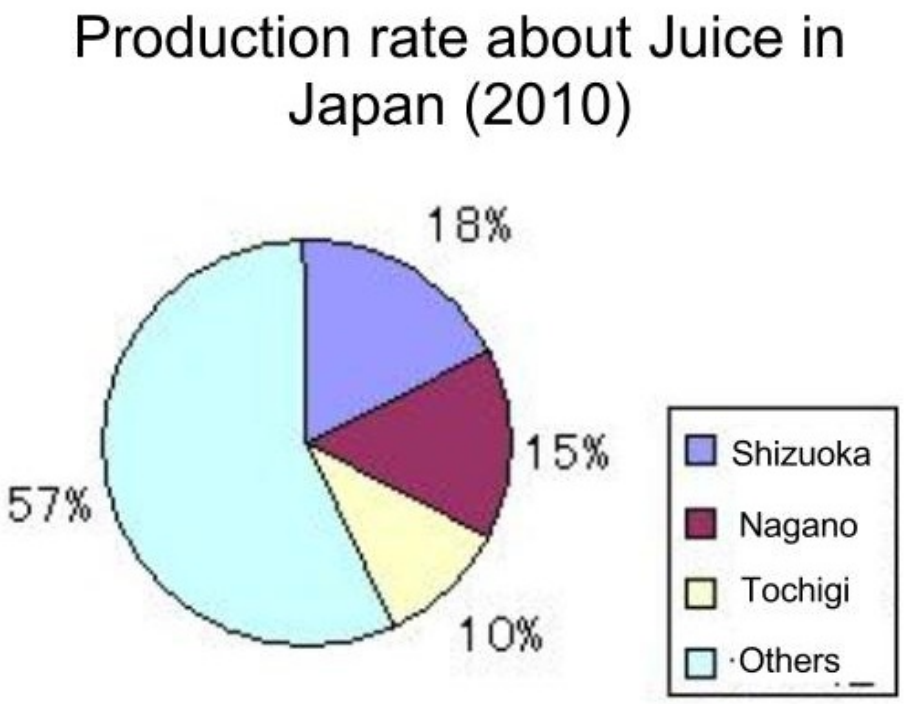


Fig2 Production rate about juice in Japan(2010)

Problem related to the waste produced in beverage industry

Being the leader in beverage industry the prefecture is suffering from its negative impacts having accumulated a larger volume of wastes. Therefore, proper disposal of these wastes are vital to prevent occurrence of any negative impacts to the society and environment even though the disposal of the same incurred a considerable cost to the industry. The approach of the government is to recycle/reuse those wastes since it is the best option and as well as the residues has its own unique properties for utilizing in the recycling process. Due to the prevailing recycling /reuse process incurred a considerable costs the producers have mild interests on that and therefore the government have had to imposed a food recycle low in 2000.

Nowadays many companies suffer a slump in the depression and they want to reduce these costs and they want to reduce the amount of residue and reuse it to save the money. Under this situation, many companies and the government are trying to devise new system for reusing residue.

"Under the current Food Recycling Law enacted in 2000, all food-related businesses, especially food manufacturers, retailers and restaurants that annually generate more than 100 tons of food waste, are required to reduce their wastes at least 20 percent by the end of fiscal 2006, for example by recycling it into fertilizer or feed. (5)(6)

Green Tea residue

Coffee residue

Green Tea residue

About Shizuoka visit

Our group visited some of the beverage plants in Shizuoka. In our visit, we learned some of the examples of the residue recycle system.

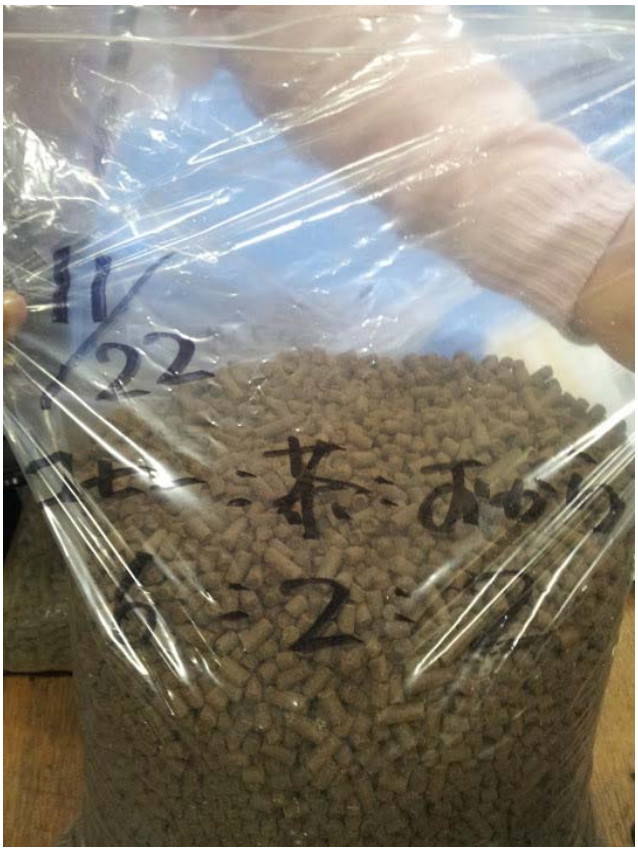
Shizuoka Yuka Kogyo, the plants we visited and interviewed, have four ways of reusing food residue. First they make feed for animal from Okara (tofu residue). By waste oil combustion Okara is dried and used for animal feed. They make dried Okara 6,000t per year. Second they make bio-ethanol from mix of Okara and potato peel which has enough starch for ethanol production. 800 liter of bio-ethanol are produced in one year. Third, they produce bio-diesel-fuel from waste oil and use it for cars and trucks in the plants. Forth, bio-pellet like fuel tablet are produced there. Coffee residue, green tea residue and Okara are mixed and dehydrated. Moreover they are pelletized in order to make them easily-handled. For these process, food and beverage residue could be re-used to some extent.

pellet in order to make them easy to handle.

For these processes, food and beverage residues are re-used to some extent.

Bio-ethanol producing machine

Tofu residues



Bio fuel pellets changed from residues of coffee and green tea, and okara

Other projects

Some companies have already do reusing in practice and government support food residue recycle movement throughout Japan,

For example, some plants produce animal feed from food residue (7)In other part, Government establish prize for the companies which try to create recycle system.(8)

Food residue recycle now gather momentum.

Key point for new solution

In Shizuoka we learned key points for solving this problem.

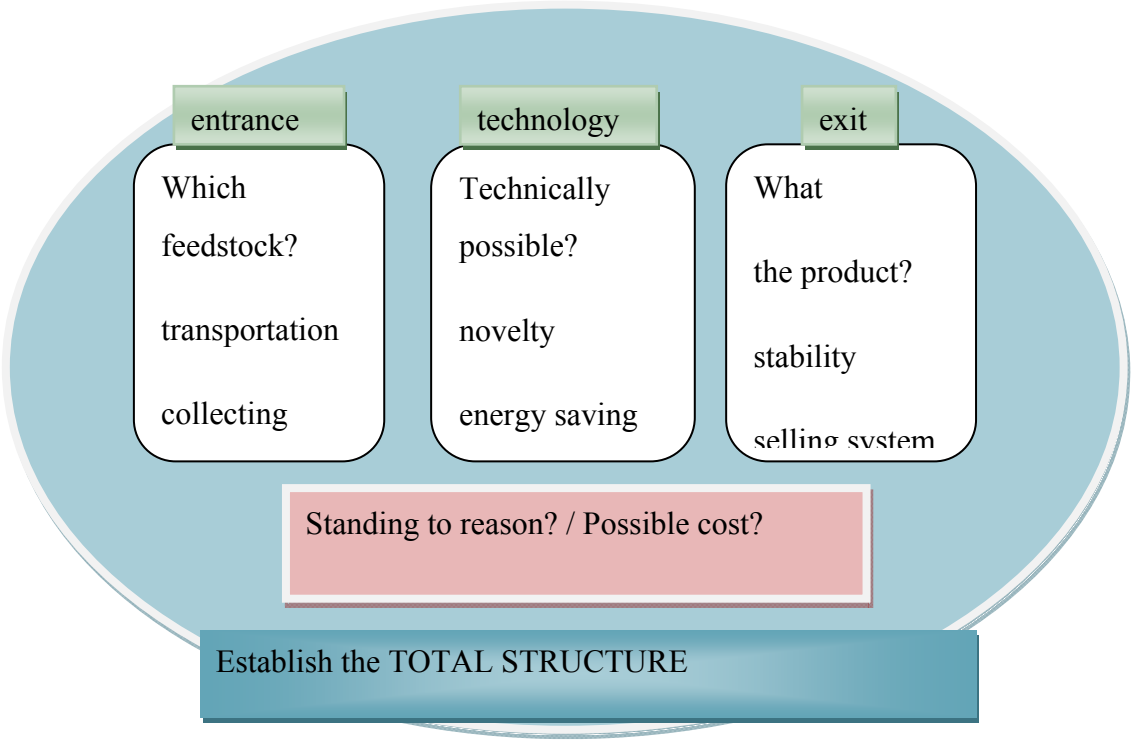


Fig3 Scheme for reducing the wastes.

The chart is to explain the key points.

Generally, people tend to consider the technology or the idea itself when they have to solve problems, but Mr.Ikegaya, the division head of the business management department of Shizuokayuka-kogyo, pointed to the absence of total structure. Even if they have the great technology or the great idea for the problem, they may fail to achieve success due to the lack of thinking of other factors. It does not mean inventing new technology is of no use. Of course innovation and new solution are needed and essential but they have to think of social system. If the products made by new technology have no demand, the technology will be in vain. We have to think from entrance to exit. When thinking of entrance we have to consider which feedstock or ingredient to use and check the ways of ensuring the amount of feedstock, the transportation of feedstock, the cost or time for collecting, ways of dividing the

ingredient and examine the quality and stability of the feedstock. As for exit, the points we have to check deeply is what we produce as a product, their quality stability, selling system, marketability and by-product. In our case feedstock is originally by-product of beverage but the products from by-product also has possibility of producing by-product. In conclusion we have to examine social circumstance in addition to the technology or idea.

Purpose of our Group

However 22,000,000t of food residue is by-produced each year in Japan and 80% of it are not recycled now. What we must do for this problem is to think of new ideas or improve current solutions. Members in our group were divided into two small groups and each small groups thought and discussed new approaches to the problem. After this introduction, we wrote each group's idea and thought. Therefore we set ideas of both two group in this report. Both will be meaningful, we hope.(9)

Chapter 2

Introduction

In Japan, almost 400 thousand tons of fruits juice is consumed every year. And 90% of them are imported as highly concentrated fruit juice. According to the research, there are four kinds of fruit juices, apple juice, orange juice, grape juice and pineapple juice. And 92% of the orange juice is imported from foreign countries, and left 8% comes from domestic market (10). It seems that 8% is small number here, but Japanese market is a great consuming market in the world, therefore great amount of oranges have been used as juice material. And in the case here, factories squeeze oranges. After squeezing processing, the orange peel residues could be a problem for the fruit squeezing factory, because it takes a lot of money to dispose them.

Right now, our proposal here is selling the dried orange peel to China as Chinese supplement food; chinpi. In this way, the factory could not only saving money to dispose the peels, but also earning money from selling chinpi.

Recently The JA Foods factory in sizuoka treat 2000 t/year of orange in order to extract juice, which generates 1000 t/year of wastes. And they deal with the price of 6JPY per kilogram. Right now, our proposal here is selling the dried bitter orange peel to China. In this way, the factory could not only saving money from disposing the peels, but also earning money from the new selling plan.

Current Situation

As we all known, there already have been some recycling methods for the orange peels, such as bath addition, aromatic substance, Chinese herbal medicine and so on. However, we took selling dried peel to China as the optimal proposal to the factory. There are several reasons that make the other recycling processes less feasible.

Firstly, Bath addition, aromatic substance and Chinese herbal medicine demand only a small content of effective ingredient in the whole peels, and the left becomes wastes. And in order to get it, it takes fussy and cost-effective procedures. By the way, we can see, there is not a huge market of these materials.

Secondly, in our proposal, in order to suppress cost, we take only one recycling method. We propose to buy only one kind of the machine, drying machinery. On the other hand, the other three methods need some kinds of machines because other recycling procedures are rather complicated.

Thirdly, in Chinese, there already has been one kind of the traditional food condiment, Chinpi, which could be made from the peel of three kinds of oranges, tangerine, regular orange and citrus reticulate. There are several main production bases in china, Chongqing, Hubei and Zhejiang. The total consumption is above 30,000 tons per year, which were used as condiment, medicine and export, therefore we need not afraid of cultivating new market.

Firstly, because of the large size of drought in china, especially the worst drought in Sichuan, most of orange trees dried out, causing great decrement in the orange production.

Secondly, even though china is a huge consumer market, people rarely pay attention to the peels. (The longer the peels have been stored, the more value them worth.)→delete?

The price of 3 years Xinhui orange peel is nearly 2800~3500JPY per kilogram, and The price of 10 years Xinhui orange peel is more than 11000JPY per kilogram.

The most important reason is the safety and sanitation situation of Japanese orange peel. Due to the excessive use of pesticides, China's food safety problems are worrying. Actually Japan does better than China in these respects.

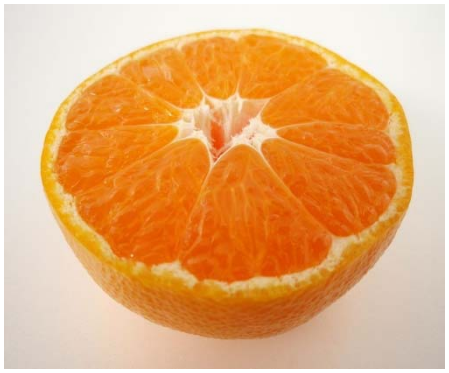
Varieties Evaluation as the Feasibility of Tangerine Peel.

Brief Introduction to the Main Kinds of Orange

Citrus is a common term for all kinds of oranges. It is believed to have originated in the part of Southeast Asia bordered by Northeastern India, Myanmar and the Yunnan province of China. Cultivating area of Citrus fruits have got wider since ancient times; the best-known examples of Citrus fruits are the Oranges, lemons, grapefruits and limes.(11)

In order to explain the orange peel marketing program, main varieties of citrus should be clarified, especially for the Chinese Chinpi variety, which known as Unshu Orange.In order to explain the orange peek marketing program, we introduce main varieties of citrus.

Mandarin orange



The mandarin is a small citrus tree that is more drought-tolerant than the other fruits. The mandarin is tender, and is damaged easily by cold. It can be grown in tropical and subtropical areas.

The mandarin has many names and varieties. The most famous and general kind of mandarin in

Japan is Unshu Orange. (12)Its thin rind is easy for us to peel apart and its bright orange pulp is sour-sweet and full-favored. It is convenient to eat, and the peel could be recycled and used in many ways, such as what we discussed in the former parts.

Bitter orange

Bitter orange, also known as Seville orange, sour orange, is used for extracting their essential oil, which is used in perfume as a flavoring and solvent. (13)Daidai is also a typical kind of bitter orange. It is used in Chinese Medicine and Japanese New Year celebrations. For the reason above, we presume that china has a huge Daidai peel market in China. However, depends on the data in Table 1 Daidai can't be used for the materials for chinpi because of its bitter contents. But the good new is the chemical content in Daidai, neohesperidine could be used in the Chinese Medicine and cosmetics.

Grape fruit and Orange

The grapefruits and orange, or what we can call tangerine in here are the other two many kinds of varieties in the whole orange family. (14)As they are not the main raw material of juice in Sizuoka factory, we just take a gaze on their figure, and just put it off.

Reasons why Citrus and Citrus Peels are Valuable

In oranges, the peel represents roughly 30% of the fruit mass and the highest concentrations of flavonoids in citrus fruit exsit in peel.

Citrus fruits contain sugar, organic acids, and a number of physiologically functional components such as citric acid, ascorbic acid, minerals, coumarins, and flavonoids such as naringin, hesperidin, neohesperidin, rutin, naringenin, hesperetin, nairutin, and tangeretin.

Citrus peels (CPs) are the primary waste fraction of citrus fruits and have been used as a source for molasses, pectin, cold-pressed oils, and limonene.

What Treatment Should be Done to Get Dried Tangerine Peel?

Effect of Heat Treatment

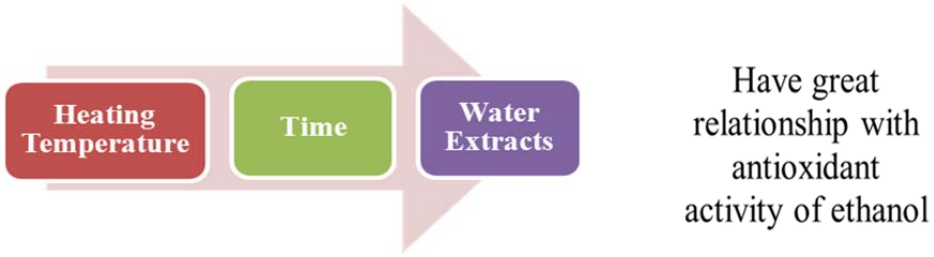


Fig4 Effect of Heat Treatment.(15)

Antioxidant activity of citrus peel extracts was significantly affected by heating temperature and duration of treatment on citrus peel and that the heating process can be used as a tool for increasing the antioxidant activity of citrus peel.We know that only Mandarin orange suitable for made into Tangerine peel.(15)

Juice rate, acidity and total sugars

Varieties	Blood Orange	Sweet Orange	Lemon	Bergamot	Bitter Orange
% Juice	50.167a	45.600a	27.733d	35.560c	26.533d
Acidity(g/l)	10.17c	1.09d	40.29b	0.710d	49.920a
Total Sugar (g/l)	127.993a	123.750a	75.983b	72.760b	122.467a

Table 1. Juice percentage, acidity and total of blood orange, sweet orange, lemon, bergamot and bitter orange.(16)

The CE-ESI-IT-MS method conducted by former researcher was applied to the analysis of main polyphenols in bitter and sweet orange peel extracts. Under the optimized CE-ESI-IT-MS conditions described above it is possible to analyze main compounds in

the different types of extraction procedures and to carry out a comparative study of the extraction capacity.(16)

Based on the table above, we can draw to two conclusions:

Firstly, Daidai, regards as the bitter orange, the acidity content make it is unsuitable to use as Chinpi. The sweet orange, such as Unshu orange used in JA factory might be able to sale to China.

Secondly, naringin (m/z 579.2) and neohesperidin (m/z 609.2) are the major polyphenols in bitter orange peels. Narirutin (m/z 579.2) and hesperidin (m/z 609.2) are major polyphenols in sweet orange peels.(17)

Feasibility analysis of Japanese citrus as Tangerine peel

Citrus variety which can use as a source material of Feasibility analysis of Japanese citrus can be made into tangerine peel (Seasoning or Chinese herbal medicine)

Due to the limitations of the literature, and there is no Japanese citrus tangerine peel feasibility thesis can be used as a reference, So this time, we designed experiments to verify the feasibility of Japanese citrus as tangerine peel.

Experimental Design

This experiment select Citrus Unshiu (produced in shizuoka,barcode:0226901005993), Citrus Kishu (produced in Wakayama, barcode: 0226901005993), and use China dried tangerine peel as a control group. Due to the limited means to buy, China's tangerine peel is a processing and storage of more than one year of medicinal tangerine peel, Because after processing, China's tangerine peel has obvious Chinese medicine smell, lack of aromatic tangerine peel, So China tangerine peel here is only as a reference

.After hand stripping orange peel， made into dried tangerine peel under the condition of drying after 144 hours at room temperature (20 degrees Celsius). Although dried tangerine peel as traditional Chinese medicine need storage for one year, but only take up to 48 hours(19) of dehydrated and dried orange peel (20 degrees Celsius）. In order to make the tangerine peel similar to market liquidity dried tangerine peel in a relatively short period of time， this test need 144 hours air-dry in room temperature .(25℃)(19)

Citrus Kishu　　Citrus Unshiu

Peel off the skin of Citrus Unshiu and Citrus Kishu， and divided into three groups, test weight, and dry.

	Citrus Unshiu			Citrus Kishu		
	Group A	Group B	Group C	Group A	Group B	Group C
day1	56.5	52.9	52.2	72.8	70.9	70.3
day2	43.8	45.1	42.2	57.2	58.2	53.9
day3	17.0	21.5	17.6	31.0	34.5	24.7
day4	15.8	14.4	14.6	22.4	20.8	20.9
day5	15.3	14.2	14.3	21.5	19.3	19.5
day6	15.2	14.2	14.3	21.4	19.3	19.4
day7	15.2	14.2	14.3	21.4	19.3	19.4
water loss	73%	73%	73%	71%	73%	72%

Table 2. Weight change of orange peel under drying. （unit: g）

We can know the water loss of Citrutas Unshiu rate is 73%， water loss of Citrus Kishu is 72%， It's the same water loss rate of tangerine peel is about 70%. The numerical accords with a requirement completely.

Eventually cut the made from tangerine peel into silk and then save.

Analysis of Results

Use the following indicators as a measure of benchmark after preparation is completed:

Appearance

：Whether moldy, whether dry, whether smooth whether the scar rift, how about the color.

The skin colour and lustre of Citrus Unshiu tangerine peel and Citrus Kishu tangerine peel are orange， endothelial color is white yellow， no corruption metamorphic phenomenon. Fully dry, a little water residue， the residual moisture of Citrus Kishu tangerine peel is higher than Citrus Unshiu tangerine peel.

No scar, impurities, bug eat by moth. China tangerine peel is the medicinal dried tangerine peel, the colour and lustre is dim, slightly mildew phenomenon ,fully dry, no residual moisture.

Traits

：Hardness, crispness, whether texture is close or not.

Citrus Unshiu tangerine peel of hardness outline is greater than the Citrus Kishu tangerine peel， Citrus Kishu tangerine peel of Citrus Unshiu outline toughness than tangerine peel. Both are easy to break， quality of a material is close, there are numerous recessions oil chamber. Japanese tangerine peel with Chinese tangerine peel compared, thinner and thickness is the thickness of the endothelium significantly thinner than the Chinese tangerine peel, as the medicinal value of Chinese medicine to be slightly lower than the Chinese tangerine peel.

Smell

：Whether the odor, whether aromatic, aromatic whether rich, and aromatic type.

Both of Citrus Unshiu tangerine peel and Citrus Kishu tangerine peel has citrus aromas, Citrus Kishu tangerine peel is rich of aromatic， both are no peculiar smell.

Chinese tangerine peel has no obvious aromatic, because after processing, has a unique fragrance of traditional Chinese medicine .

Taste

：Sugariness degree, bitterness extent, with odor or not, with or without fragrance, rich of flavor or not, taste for layering.

Both of Citrus Unshiu tangerine peel and Citrus Kishu tangerine peel are first taste sweet aftertaste symplectic, slightly bitter. Tangerine peel of Citrus Kishu acrid taste and bitter taste is better than Citrus Unshiu tangerine peel. Due to the new system is tangerine peel, both sweet and bitter taste is not very heavy. The taste of Chinese tangerine peel hard, have strong taste of Chinese medicine.

Part of the specifications standard about tangerine peel ：

Top –grade

: Dry goods. Surface of the orange is red or red and yellow, countless recessed oil point (bristles eye), of light visual clarity. Interior surface white yellow

It is easy to break, gas smell is good, taste spicy, bitter. No impurities, moth-eaten, moldy, lesion.(20)

Second-grade

: Dry goods. Irregular flakes, smaller, inter-breaking block. Surface is brown or yellow red color, dark green. The inner surface is white or greyish yellow, loose texture, hard and brittle, easily broken, gas smell and taste. No impurities, moth-eaten and moldy lesion.(20)

Because of limited of time, sweetness of Citrus Kishu tangerine peel and Citrus Unshiu tangerine peel is not completely converted into bitter, apart from this, other are in line with the first-class standard . Citrus Kishu tangerine peel is better than the Citrus Unshiu tangerine peel. The price of top-grade goods is higher than the average price of the circulation of tangerine peel, so we think that the Japanese tangerine peel in the Chinese market place, optimistic estimates, if operating properly, the Japanese tangerine peel price will be higher than the dried tangerine peel.

Evaluation of laws and regulations

According to our survey, currently, Japan does not produce genetically modified citrus, tangerine peel as a part of the crop fruit peel exports, not in violation of Convention on Biological Diversity（CBD）(21)and The International Treaty on Plant Genetic Resources for Food and Agriculture（ITPGR）(22).

Both of China and Japan have joined into WTO, both of them can enjoy MFN status, so tangerine peel can be exported with low tariffs.

Before 3.11 earthquake, China's imports of agricultural products in 2010 is about $ 72 billion, imports from Japan accounted for about 0.8%, nearly $ 600 million of imports. China's number of the proportion of agricultural products imports from Japan is very small. (23)

But since the earthquake in Japan on March 11, 2011, in particular, after the occurrence of the nuclear crisis, most countries have taken appropriate measures. China has taken a series of measures, the main purpose is to protect the public health and safety. (23)

From March 12, The Government of the Hong Kong Special Administrative Region Food Security Center strengthen the detection of Japan imported food, including fresh food such as milk, vegetables, fruit, meat and aquatic products for radiological testing.(23)

On March 24, 2011, AQSIQ(Administration of Quality Supervision, Inspection and Quarantine) announced the ban on imports of Fukushima, Tochigi, Gunma, Ibaraki, Chiba, dairy, vegetables and their products, fruits, aquatic animals and aquatic products.(24)

AQSIQ announced on the evening of April 8, 2011, expanding to prohibit imports of food from Japan, the variety and origin range of agricultural products, to further strengthen the inspection and quarantine supervision. Banned from Fukushima， Gunma, Tochigi, Ibaraki, Miyagi, Yamagata, Niigata, Nagano, Yamanashi, Saitama, Tokyo, Chiba imports food, edible agricultural products and feed. AQSIQ requirements, food production and imports from other parts of Japan, edible agricultural products and feed, provide proof of passing the detection of radioactive material issued by the Japanese government in the inspection, certificate of origin. Inspection and quarantine agencies must import food, edible agricultural products and feed for radioactive material detection, unqualified to be published according to the provisions after passing the imports.(23)(24)

Chinese agricultural imports from Japan to strict record the name, size, quantity, date of manufacture, production or import batch number, shelf life, exporters or purchase the name and contact information, and content delivery date.

The main origin citrus in Japan is in south of Shizuoka, Ehime and Kumamoto, Despite from 2011.4.8 began, China has promulgated the above provisions to restrict the import of Japanese agricultural products, but the citrus is not in the prohibited, Based on the above analysis, Japanese tangerine peel have a prerequisite for export to China.

Economical evaluation

Experiment we did shows that the chinpi's density is 0.274g/cm^3(40' Dry Van Containers)(25). Though maximum loading weight of largest maritime container is 26,680Kg (40' Dry Van Containers), but it is impossible to loading until maximum loading weight, since chinpi has low density. Volume of largest maritime container is 80m^3, which means maximum weight we can load in one container is 21,920Kg(25). The JA Foods factory in sizuoka generates 1000 t/year of wastes. When we dried this part of waste will lose 70% of the moisture. So the number of containers needed In one year is 300000Kg / 21920Kg =13.6 ≒14 (containaers).

This is the photograph of experiment to measuring the density of dried citrus peels.

Methods of measuring density of dried citrus peels

Separated 15 Unsyu citruses into 3 groups by 5.

Extracted all

Dried (105□ 8h)

Measured weights and volumes (packed into constant diameter tube)

Costs which can't be changed by wholesale price (/year)

Here we shows the costs which can't be changed by wholesale price（/year）.

Because fresh orange peel containing 70% moisture, if raw peels are transported, it will make transportation costs greatly increase, therefore, we choose to transport after drying. Since fresh orange peel will be easily spoiled, we must use refrigerated containers to keep it fresh, it will increase the cost. Because it has not been processed, it can only at a low unit price to sell to China. A wide range of data proves that the drying in Japan will reduce costs and enhance the unit price. Our goal is to sell Japanese orange peel (as

tangerine peel) in high-priced, high-profit. And then it is inevitable to choose the dry peels.

Drying way	Temperature(℃)	Time(h)	Final form
Far infrared	55.0	6.0	Fresh orange, smell is pure
Hot air	55.0	8.0	Fresh orange, smell is pure
Sunshine	20.0	144.0	Orange, I have mildew

Table 3. The comparing between far infrared, Hot air and Sunshine methods to dry.(19)

In the drying process of tangerine peel, we usually use dry, hot air and far infrared. Due to Japanese high cost of employment and high cost of land, for saving costs, after comparing, we choose hot air method to dry peels. Sunshine is bad at quality of goods, and it will take great costs, because it needs much time and labor force. And Far infrared is eliminated because the machine is complicated and it is not be able to dry huge amount of peels at one time. Then we choose the hot air drying method.

Machine we chose is HKO 6.5type.. (19)

costs which can't be changed by wholesale price（/year）			
	1 container	×14	place
Rental storehouse(28)(29)	1800	25200	Japan
Custom duty rate(27)	12000	168000	Japan
Costs of Loading to ship(28)(29)	25000	350000	Japan
Carriage costs（in Japan）(28)(29)	40000	560000	Japan
Carriage costs（on sea）(28)(29)	21000	294000	sea
Carriage costs（in China）(30)	40000	560000	China
Machine costs (depreciation)(26)		4444444	Japan
Machine costs（fuel : LNG）(26)		3617280	Japan
Labor costs		1440000	

Table 4. The costs which can't be changed by wholesale price （/year） （Unit：JPY）

(26) (27) (28) (29)

Rental storehouse

Dried peels are produced about 750Kg by one day(average), so one container(21,920Kg) is filled by 3 days. Rental fee of containers are \300/day.

Custom duty rate

Just as the term indicates

Costs of Loading to ship

Just as the term indicates

Carriage costs（in Japan）+Carriage costs（on sea）+Carriage costs（in China）

First, we decided the target city. Shanghai and Hong Kong are the ones of the large consumption cities of chinpi, but the usage of chinpi is different as below.

	usage of dried citrus peels	consumption
Shanghai	supplement food	comparatively little
Hong Kong	Daily dressing materials	much

Table 5. The different usage of chinpi.

We would like to sell chinpi in high price, so we chose Shanghai, because supplement food is more expensive.

Next we chose the port we bring the chipi we make. This table shows the carriage costs between two major port in Japan.

Start port	Reached port	Sea freight /yen/container	Road freight /yen/container
Tokyo	ShangHai	38000	25000
Osaka	ShangHai	21000	40000

Table 6. The carriage costs between two major port in Japan.(30)

Since total costs are less when we chose Osaka port than Tokyo port, we chose Osaka port.

Carriage cost in Shanghai is set 4000 JPY.

Machine costs (depreciation)

HKO 6.5type is 5million JPY. It can dry 1t of raw peels by single machine and needed time to dry is 8 hours by single operation. Average production of raw peels in JA Foods in Shizuoka prefecture is about 25t/day, so we can dry all raw peels using 8 machines by 3 times a day. The machinery costs is 5million × 8 = 40million JPY. Depreciation term of processing machine is determined as 9 years. The depreciation cost is 40million ÷ 9 ≒4,444,444 JPY.

Machine costs（fuel : LPG)

HKO 6.5type need 20000 Kcal / hour. 1 Kg of LPG has 12000Kcal and price of that is 210 JPY. The real rate of burning time is set 65%. We use 8 machines for 24 hours for 60days (December + January). Then the fuel cost is calculated as below.
(20000/12000)×0.65×210×8×24×60=2620800 JPY.

Labor costs

We operate machines on 3-shifts for 24hours a day. Every time, there is one person who operate the machine for60days. Then the labor costs is 1000(hourly fees)×24×60=1440000 JPY.

Costs which can be changed by wholesale price（/year)

Next we shows costs which can be changed by wholesale price（/year）.

Tariff and insurance costs are changed by the value of what is in the containers. Only a tariff rate and insurance rate are determined. Then firstly we should estimate the price of the goods we make.

Wholesale price is assumed three ways, low, middle(=average wholesale price in China), and high. Low wholesale price is conservative estimate, because Japanese tangerine

peel is not as good as Chinese tangerine peel on pericarp thickness. And due to lack of awareness, will be lower than the average market price. Middle wholesale price is the average wholesale price of dried tangerine peel in the Chinese market(31). High wholesale price is optimistic estimates. Because the Japanese tangerine peel is far better than Chinese dried tangerine peel on food safety, and as good as Chinese tangerine peel on the color. Using properly the business of marketing tools and take some time, price will be higher than the average price of the Chinese market.

The yellow part of the table shows cost.

Low wholesale price	middle wholesale price	High wholesale price	
30	51.4(31)	70	Chinpi price（/kg）
2250000	3855000	5250000	tariff(25%)
495000	848100	1155000	Insurance on sea(5.5%)

Table 7. Costs which can be changed by wholesale price (/year)（Unit：JPY）

Calculated revenue is as follow:

Low wholesale price	middle wholesale price	High wholesale price	
30	51.4	70	Chinpi price（/kg）
9000000	15420000	21000000	revenue

Table 8. Calculated revenue（Unit：JPY）

JA Foods factory in Shizuoka prefecture is producing 1000t of raw peels annually, and when they are dried, they lose 70% of their weight. So we can produce 300t of dried peels annually. Revenue is calculated as a product of price and weight.

Currently, JA Foods factory in Sizuoka deal with the orange peel at the price of 6.2 JPY/kg(as a raw peels). By exporting peels as the form of tangerine peel to China, Surplus by our plan is below.

	Low wholesale price	middle wholesale price	High wholesale price
benefit(/year)(=revenue-costs)	-4207444	254456	4132556
Present disposal costs(/year)	-6200000	-6200000	-6200000
Our plan’s advantage(year)	1992556	6454456	10332556

Table 9. The plan of exporting peels（Unit：JPY）

If compared with the present disposal costs, calculated value of benefit shows that our plan is worth introducing even if the wholesale price is low(30JPY/Kg).

Conclusion

In the biomass which come from JA Foods factory in sizuoka， we analysis how to deal with cellulite, the breed of orange peel come from JA Foods factory in sizuoka is Citrus Unshiu， this is also the main breed in sizuoka. Because of the limited experimental conditions, we can not evaluate this orange tangerine peel made from the perspective of ingredients and medicinal properties， But by simple experiments, we evaluated appearance, traits, smell, taste of indicators， come out an optimistic result. The tangerine peel made from Japanese citrus is the top grade in Chinese Pharmacopoeia. Exports to China as tangerine peel is feasible, and the policy and there is no resistance. By our calculation, when dried tangerine peel is sold at the low wholesale price 30JPY/kg to China, we can reduce the loss of 996076JPY/year. By our calculation, when dried tangerine peel is sold at the low wholesale price 30JPY/kg to China, we can reduce the loss of 996076JPY/year， When the tangerine peel is sold at middle wholesale price 51.4JPY/kg China, we can reduce the loss of 5457976JPY/year， but at high wholesale price to sell to China, we can create profitability as high as 3136076JPY/year. If the operator is on the right track, we can even south of the Kanto region Citrus Kishu and Citrus Unshiu, all made of dried tangerine peel sale to China. We should make full use of the Japanese tangerine peel, good color, low pesticide content and relative safety advantages, step up publicity efforts to build the industrial chain, we can completely change waste into treasure, will cause a headache for biomass conversion into commercial products, to create higher value.

Chapter 3

Recycling the Waste from Green tea and Coffee

Present situation and motivation

Shizuoka is one of the close prefectures to Japans main city of Tokyo which is identified as the worlds highly populated city (around 30% of the Japans population lives in Tokyo or close to Tokyo), having large amount of problematic waste materials like tea and coffee waste. Tea/coffee waste accumulation in observed two factories in the prefecture annually is about 4 000 to 5 000 tons.

Our sub group mainly focused on how to handle of these waste and make use of it focusing as a profitable venture while minimizing environmental problems in the area. Therefore we decided to use these waste to make environmental friendly bio degradable product with a high costumer attracted fields like horticulture (maintaining flower and vegetable pots as well as a medium)

People in Tokyo are heavily engaged with their day today work, finding with little time to relax. Present medical research studies showed gardening is one of the better way of relaxing, especially looking at flower plants / other vegetable plant with a keen interest will certainly reduce the tension and is good for the human health (reducing pressure and other mental stress). Hence this type of eco friendly product can easily find the market while solving serious problems in accumulation of waste materials.

Recycling approaches

Based on the above two waste materials accumulated in the area our sub group decided to suggest environment friendly economically viable two recycling approaches.

1) Making potting mixture using different percentages of tea and coffee waste for flowers and vegetables in the urban areas of Tokyo

2) Making disposable flower and vegetable planting pots by using different percentages of the tea and coffee residues with waste paper pulp as a binding material to be marketed for urban areas of Tokyo

Use as a row material for plant /flower pot

Presently factories in the area are spending additional money for the farmers who like to collect these waste materials as organic fertilizer for their near by field. But we thought by make use of the materials with other waste materials like paper waste it would be a income generating biasness to the factories who producing these type of waste.

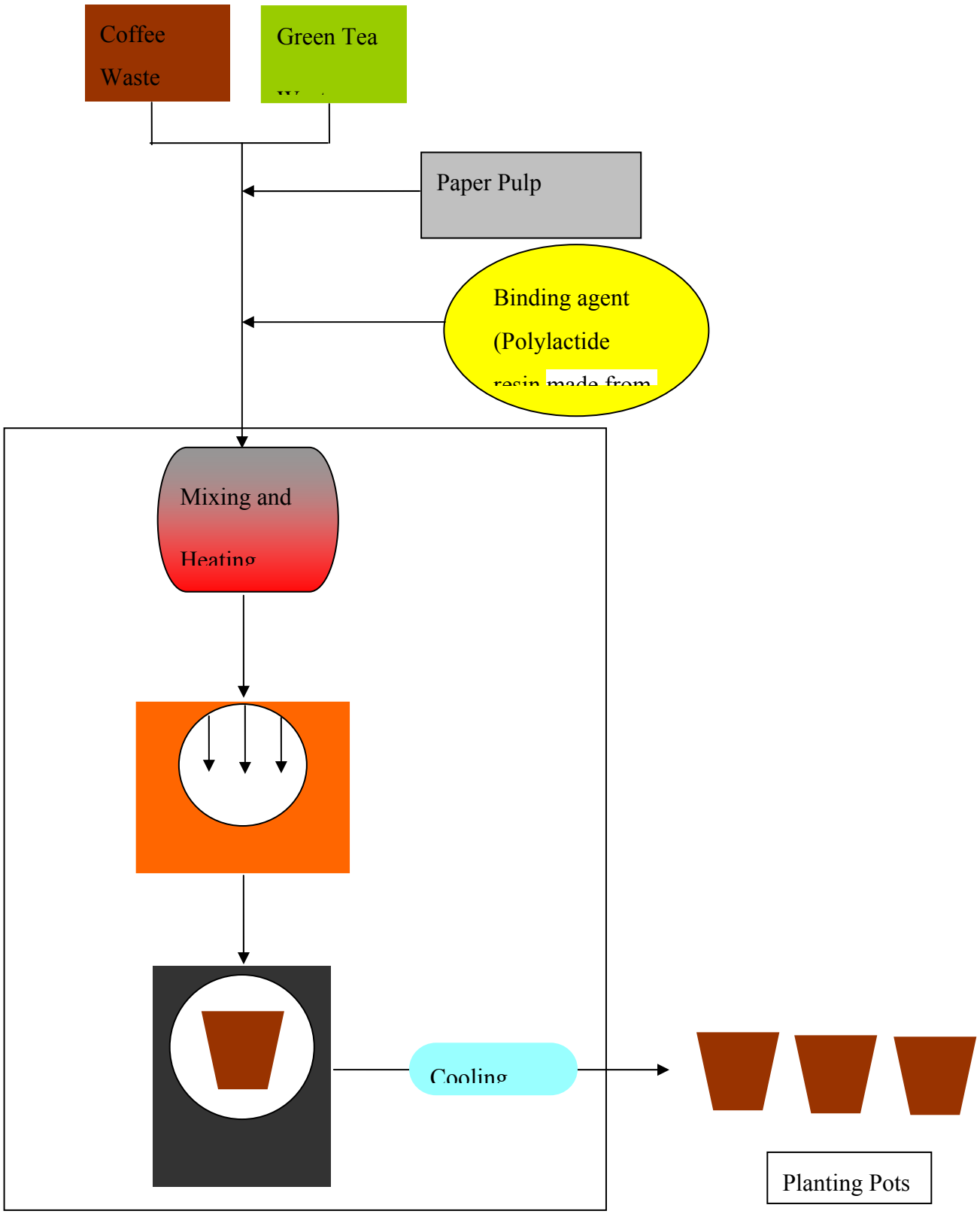
Present market value of thick gauge plastic flower pot (small size) is about 105 Yen and Present market value of thin gauge plastic flower pot (small size) is about 35 Yen. These values are whole sale prices, but making flower pots using coffee and tea grounds making thick gauge flower pot (weight 100-125 g) will cost only 25-30 Yen, including all the other expenses. One advantage of this type of business was the company can target number of flower pots for the season by predicting the amount of waste production for the season and at the same time they can get forward contracts (number of flower pots to be produced) with local companies dealing with the industry.

For the preparation of planting pot, it is needed simple technology with mixing instrument, binding agent, agitator, hydraulic pressure and the heating chamber.

Green tea waste has enough fiber materials, can mixed 2:1 ratio with dried coffee residues. To get extra firmness it is important to add waste paper pulp with binding materials. (Depending on the amount of coffee and tea residuals collected)

Similar type of large scale production of flower pots from major waste materials like paper waste was done in China. In addition to the paper waste, they use vegetable waste which contains fiber. After using these materials can be degraded without pollution. According to the factory sources report from China, by mixing carbonic glues, water –proof nonpoisonous and pollution–free plant/ flower pots can be easily manufactured at a competitive pries. FOB Price: US $0.0833-0.1000 / Piece

Fig. 5 Flow diagram of production of planting pots using Coffee and Green Tea waste.(38)



Preparation of a potting mixture/medium

(Using green tea and coffee residues as a potting mixture)

Adding coffee to compost or worm bin is a great idea. Again, it creates a nitrogen-rich soil result, and gardeners swear that worms fed with coffee will flourish. Researchers have also found that coffee grounds aid in keeping ideal temperatures in compost piles. This allows compost to stay free of potentially harmful pathogens that effect delicate seedlings later (40), (41), (43), (44). One of research in Viet Nam about used coffee residue to made subtrate for Lizhing mushroom growing show that: the substrate environment including sawdust (75%), rice bran 25%) and water (enough humidity 60%) were used as controls survey growth of the fungus Ganoderma. The alternative sawdust with coffee grounds with different ratios (0% - 25% - 50% - 75% - 100%) in order to find rate proper mixing coffee grounds in a field mushroom substrate. In addition, Ganoderma mushroom on the lips contains 100 percent coffee grounds to develop better compared to the rest of the environment and better compared to the control environment contains 100% humus Saw (34).

As a fertilizer, used coffee grounds are slightly acidic and full of nitrogen, a mineral that aids vegetable and plant growth. Coffee grounds are particularly good for tomato plants, which thrive on nitrogen. What is more, the grounds, when used for planting, create a natural acidic form of bacteria which boosts the growth of acid-loving plants like tomatoes, roses, blueberries and evergreens. According to the composting Council of Canada, adding coffee to soil not only increases the nutritional value, but also betters the texture and fertility of the soil and aids in attracting earthworms (37).

Coffee residue could be a good source of plant nutrients and its efficient use could enhance improvement in soil organic matter, grain yield and water-use efficiency (WUE). A field study was conducted to determine the effect of different rates of coffee residue (0, 3, 6 and 90 kg ha-1) on soil moisture, soil nitrogen and organic matter, grain yield and water-use efficiency of maize. The treatments were laid out in a factorial arrangement in randomized complete block design with three replicates. Coffee residue with and with cut N fertilizer raise soil moisture ranging from 13 to 82% and 30 to 48%,

respectively, relative to the control. Fifty-seven percent of the total variations in soil moisture content were attributed to coffee residue as expressed by the regression model (Effect of coffee Residue and N fertilizer on grain yield and whater-use efficiency of Maize in Maize-Haricot Bean intercrop in the semi-arid part of Southern Ethiopia.

Tenaw Workayehu; Husni,M.H.;Anuar,A.R. and Zaharah A. Ethiopian Journal of Natural Resources. (2008)(35).

According to Oregon State University, july 2008 (36), About 2 percent nitrogen by volume, used coffee grounds can be a safe substitute for nitrogen-rich manure in the compost pile. Contrary to popular belief, coffee grounds are not acidic. After brewing, the grounds are close to pH neutral, between 6.5 and 6.8. The acid in the beans is mostly water-soluble, so it leaches into the coffee we drink. Add some nitrogen fertilizer if you do this, as coffee grounds encourage the growth of microbes in the soil, which use up

nitrogen. While microbes are breaking down the grounds, the nitrogen will provide a source of nutrients for your plants.

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Last but not least, coffee-ground mulch has the added benefit of deterring veggie and flower-munching slugs and snails. There are also other organic pesticides that can also deter certain garden pests (36).

Conclusion:

By introducing our proposed project to Shizouka prefecture, it will be helping for the factory owners gaining economic benefits as well as keeping surrounding environment clean. Apart from that huge amount of Tea and Coffee waste being accumulated in the area will create number of problems, so it is very important to introduce how to utilize these waste in an effective way by using simple technology. Therefore making plant pots and planting medium out of these waste materials will be an environmentally friendly, timely needed type of business for the producers as well as for the consumers living in and around highly populated cities like Tokyo.

Perspective

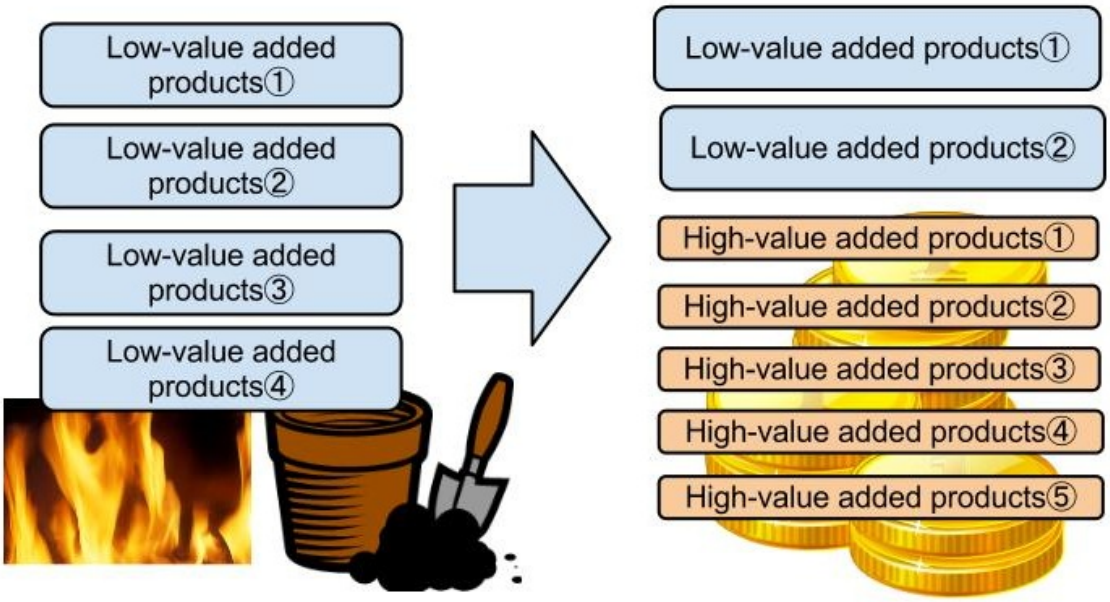
As what we mentioned above, our proposal here to Shizouka prefecture is helping the factory deceasing producing cost, in the mean time, providing better and cleaner environment. The first project is coming up with the new marketing plan that selling processed orange peel to inland china, aiming at making better use of orange peel residue instead of selling them as fertilize. By the feasibility analysis, it proves to be profitable and efficiency.

From another point of view, if we can take advantage of the large amount of coffee and tea residue by using simple and easily gain technology, it would be very helpful and efficiency. The second proposal is exactly provide by this motive.

In a conclusion, we hope our proposals can provide a new perspective for the factories.

Whole Conclusion and Discussion

Both two groups' idea aimed at making high-value added products for beverage residue problem. Now, low-value added products such as bio-pellet cannot compensate companies' cost for recycling and they have to pay much money for disposal. Then it makes sense that both groups choose high-value added ones. Thanks to the careful consideration both ideas are feasible, However beverage residue problem cannot be cleared up by only these two plans because the amount of residue is too huge and the capacity of the two plans will not fulfill the amount. Now we have to cultivate new choices for recycling beverage residue, especially choices by which companies can earn more money. If we have many plans for making high-value added products, all of the residue can be recycled. High-value added products tend to be made in low quantity but many high-value added products will cover the all residue.



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Summary

Chapter1

What is environment of Shizuoka prefecture and what is the problem. Problem comes from huge amount of wastes of beverage industry in Shizuoka prefecture. We divided into 2 sub-groups and each sub-group researched recycling method.

Chapter2

Sub-group1 researched recycling extracted citrus peels as a Chinese herbal medicine, chinpi. Sub-group1 researched feasibility of that method carefully from the viewpoint of breed variety of Japanese citrus, nutrition contents, risks from Chinese policy, and economical evaluation. Two kinds of experiments are conducted to reveal the density of packed dried citrus peels (by Ishiwata), and the quality of Japanese chinpi (by Li). Then Sub-group1 concluded that “it is feasible.”

Chapter3

Sub-group2 focused on recycling residues of coffee and green tea which are accumulated in the factories and they found difficulties to remove. They can be used as the planting pots and planting medium (alternative materials of soil). Sub-group2 applied the molding techniques for making planting pots, and found out the feasibility of making planting medium from residues using different ratios of coffee and green tea, focusing on the market in the Tokyo and highly populated cities in Japan.

Whole conclusion and discussion

We write about desirable vision of recycling byproducts.