Review

China food safety hits the “gutter”

Fangqi Lu, Xuli Wu*

School of Medicine, Shenzhen University, Shenzhen, Guangdong Province 518060, PR China

A R T I C L E   I N F O

Article history:
Received 23 October 2013
Received in revised form
13 January 2014
Accepted 13 January 2014

Keywords:
Gutter oil
Food safety
China

A B S T R A C T

Gutter oil, or illicit cooking oil that has been recycled from waste oil collected from restaurant fryers, drains, grease traps and slaughterhouse waste from “table to table” has emerged as a serious food-safety issue in China and exposed the shortcomings of China’s food-safety assurance systems. This paper investigates the industrial chain of production and sale of gutter oil in China. Moreover, we discuss the impediments to and the government countermeasures being implemented in supervising the use of gutter oil in China. The positive lessons in monitoring use of gutter oil in China may help improve food-safety management throughout China and other developing countries.

1. Introduction

In recent years, as a developing country, China has made great progress in food safety (Wu et al., 2010). However, the Chinese government still faces serious problems in ensuring food safety. Indeed, the number of criminal cases of hazardous food-safety practices has sharply increased since 2010. In 2011 and 2012, the number of criminal cases of making or selling hazardous and noxious food or food not conforming to food hygiene standards grew by 179.8% and 224.6% over the previous year, respectively. In addition, the number of people sentenced for food-safety crimes increased by 159.9% and 257.5%, respectively (SPCS Bulletin, 2012). Serious food safety scandals have occurred, such as toxic infant formula, problem capsules, exploding watermelons, pesticide-tainted vegetables, “lean meat powder” (clenbuterol hydrochloride), and pork reconstituted as beef.

Gutter oil is illicit cooking oil that has been recycled from waste oil collected from restaurant fryers, drains, grease traps, and slaughterhouse waste. It has emerged as a serious food-safety issue...
in China. Its presence in any form of food is illegal and may cause many harmful effects to humans (Felizardo et al., 2005; Hageman, Kikken, Ten Hoor, & Kleinjans, 1988; Kitts, 2005; Lapointe, Couillard, & Lemieux, 2006; Leong, Aishah, Nor Aini, Das, & Jaarin, 2008; Martin, Christopher, Paul, & Andrew, 2001; Siti, Srijit, Ima, Nor, & Kamsiah, 2008; Yang, Grey, Archer, & Bruce, 1998). It clearly violates the aspect of “fit for human consumption” of most food laws. Moreover, the illicit introduction of toxic materials, such as polychlorinated biphenyls (PCBs) and dioxins, into such recycled oils is a major public health threat that has caused major disruption of the food supply (Abalos, Parera, Abad, & Rivera, 2008). Two incidents involving PCBs and dioxin contamination of feed and foodstuff led to crises in Belgium and the Republic of Ireland in 1999 and 2008, respectively (Bernard et al., 1999, 2002; Jacob, Lok, Morley, & Powell, 2011). Therefore, control over the recycling of such oil needs to be closely regulated.

In March 2010, the State Food and Drug Administration published “Strengthening the Prohibition of Gutter Oil in the Catering Industry” (SFDA Document, 2010), thus confirming the presence of gutter oil recycling for the first time. Chinese consumers were shocked by the announcement that gutter oil was present in food, which reduced confidence in food safety in China. The Chinese government needed to establish an entire monitoring and implementation system for gutter oil.

This study analysed the industrial chain of the production and sale of gutter oil in China and the impediments and countermeasures being implemented in the supervision of this industry.

2. What is gutter oil

Gutter oil, or “recycled cooking oil”, is a general term used in China to describe all cooking oil illicitly processed to be resold as a cheaper cooking oil. It can be divided into 3 groups: 1) in a narrow sense, waste cooking oil, collected as food waste from restaurants or collected as the greasy floating material from slaughterhouse waste, restaurant fryers, grease traps, and drains, then reprocessed rudimentarily to draw out oils; 2) extracted from inferior or rotted meat and discarded animal parts (animal skins, fat and internal organs); and 3) collected as fried oil, which is used frequently and then reused. According to the National Bureau of Statistics of China (NBSC, 2011), the annual output of vegetable refined oil was 28 million tons in 2008 and 34 million tons in 2009, except that the amount of restaurant vegetable refined oil purchased in 2009 was 9.67 kg.

Proper disposal of used oil is a huge problem. Approximately 10 million tons of lipid-containing wastewater is discharged every year in China, most of which is from catering industries and restaurant kitchens (Zhang, Xiang, Zhang, Cao, & Meng, 2009). In China, because gutter oil is so profitable, some unscrupulous businessmen sell it as edible oil. Because of oxidation and hydrolysis and other hazardous substances from draining and reprocessing, the oil can cause health problems in humans (Felizardo et al., 2005; Kock, Botha, Blerh, & Nigam, 1996; Li & Wrenn, 2004).

3. Production and underground sale of gutter oil in China

In July 2011, the Ministry of Public Security dismantled an enormous gutter oil industrial chain in 14 provinces in China, smashed 6 factories and sale terminals, and tracked down 2 illegal production lines and 100 tons of cooking oil made from gutter oil that was being processed for sale (CPG Bulletin, 2011). An entire chain, from raw material collection to use of reprocessed gutter oil, disappeared.

In China, an industrial chain “from dining table to dining table” of gutter oil production has been established (Fig. 1). The process is as follows. 1) Raw material collection: individuals collect different kinds of gutter oil, which is called “raw oil”, and then separate the oil from water, which is called “crude oil”; 2) Crude extraction: illegal workshops or lawbreaking traders purchase all kinds of “crude oil” from sellers, then create crude extract by filtration, decolouration, dehydration, boiling, and removal of adulterants to obtain “fine oil”; 3) Deep processing: industrial oil refineries to refine the fine oil via multiple decolouration, dehydration, deodorization and condensation, to obtain “clear oil,” which is similar to cooking oil in sensory characteristics. 4) Wholesale: the “clear oil” is sold to local small factories or workshops for packaging. 5) Retail: sellers resell the oil to end consumers or restaurants. In some cases, some industrial oil refiners package the oil, then sell it to retail outlets as legitimate oil.

The industrial chain of gutter oil has multiple links, so convicting people in the different links is difficult. Merely modifying the raw gutter oil is illicit. However, deep-processing gutter oil may not constitute an offence because it can be used to produce rubber, soap

![Fig. 1. The industrial chain of production and sale of gutter oil in China.](image-url)
and bio-fuel. The sale of gutter oil as cooking oil may constitute a crime, but this link is underground. Therefore, in China, there are many rumours about gutter oil processing, but cases are infrequently prosecuted.

4. Impediments in the supervision of gutter oil

4.1. Lack of waste food logistics system

The fundamental way to solve the food waste situation is utilization. Gutter oil can be used as a raw material for producing bio-fuel, soap, and rubber, for example (Mangesh & Ajay, 2006). China has no integrated food waste recovery system or “green” industrial chain. In comparison to returnable refuse, there is no retrieval and proven system for waste food, which restricts the waste food recovery. The recycling channel is blocked, so most waste food is mixed with house refuse or poured directly in sewers. Currently, farmers and individual sellers undertake the waste food recycling, do the work just for profit and lack technology and equipment. The collection, disposal and recycling of waste food is not monitored, so the illegal trader can obtain gutter oil.

4.2. Imperfect laws, regulations and supervision system

The Food Safety Law (FSL) was enacted and was enforced on June 1, 2009, putting China’s national food safety on the legal track. The law has made tremendous progress to ensure food safety. However, it has revealed several shortcomings in the current management of gutter oil. Although the law emphasizes the responsibilities of different departments, the food safety supervision system in China is based on a segmented supervision model, which overlaps and intercrosseffectively (Jia & Jukes, 2013; Wang, Zhu, Ge, & Qiao, 2009).

Moreover, food safety assurance in China is managed on a panregional principle. Gutter oil is not food; it is “converted food waste into edible food,” and the industrial chain of gutter oil has multiple links and is trans-regional. The country has no effective way to cooperate trans-regionally and overcome local protectionism. In China, the implementation of gutter oil supervision is still not institutionalized.

In addition, for illegal foods and medicines, the penalties have increased, but they are still not enough (Liang, 2011). In Article 28 of the FSL, producing and trading gutter oil under the “use of non-food raw material” or “adding chemical substances except food additive” or “using reclaimed food as raw material” to produce food, which are prohibited. The maximum penalties for the food traders and producers are as follows:

1) Confiscate all illegal benefits, food or food additives, equipment or tools and food raw material
2) If the total value of the food or food additive is <RMB 10,000, a fine of RMB 2000–50,000
3) If the value is >RMB 10,000, a fine from 5 to 10 times of the total value
4) License revoked

However, as compared with the great potential profit from the production and sale of illegal reprocessed gutter oil, the fines are too little.

4.3. Deficiency in establishing standards

China lacks standards to detect reprocessed gutter oil and classify waste food recycling. Reprocessed gutter oil involves the use of alkali additives to reduce the abnormal pH caused by high rates of animal fats and bleach to convert the dark colour to clear. Therefore, distinguishing legitimate cooking oil and reprocessed gutter oil is difficult. According to the GB 2716-2005 (Hygienic Standards for edible vegetable oil), physical–chemical properties include 9 indexes to detect reprocessed gutter oil: acid value, peroxide value, extracted oil solvent remaining, free phenol (cotton oil), total arsenic, lead, aflatoxin, benzopyrene and pesticide residue. Paradoxically, according to these indexes, gutter oil will meet the prescribed standards. Moreover, cooking oil can generate chemicals that can cause cancer when overheated at high temperature. Unfortunately, China lacks standards for how many times cooking oil can be used at high temperature.

In addition, China has not established national qualitative standards for waste food recycling at different levels, which is the key for building the food waste recovery system.

5. Countermeasures to enhance the supervision of gutter oil in China

5.1. Developing food waste resource utilization and treatment

On May 4 2010, the State Development and Reform Commission (SDRC), Ministry of Housing and Urban–Rural Development (MOHURD), Ministry of Environment Protection (MOEP), and Ministry of Agriculture (MOA) jointly released the “A Pilot Program of Organizing the City’s Food Waste Resource Utilization and Innocuous Treatment” (SDRC Document, 2010). The goal is to control the root causes of reprocessed gutter oil and to prevent the use of waste food as fodder to enter the food chain.

The main contents of the document include the following:

- Establish a waste food registry, recovery at certain places, centralized treatment, recycled product evaluation, management and inspector system.
- Establish a demonstration project for waste food resource regeneration and innocuous treatment, with an optimizing technique to improve the level of resource regeneration and innocuous treatment.
- Establish and promote an incentive mechanism encouraging resource utilization for waste food.
- Guide consumers to consume appropriately and reasonably, to reduce the generation of waste food; implement catering industry garbage sorting and display, clean production, resource utilization and education in innocuous treatment to reduce the sources of waste food.

5.2. Enforce a legal system

Law enforcement is a key to China’s food safety (Ni & Zeng, 2009). Previous food safety laws did not establish a specific management system for reprocessed gutter oil, which led to inefficient supervision. With this background, China has enforced laws and regulations and reformed the food-safety management system for gutter oil.

The acts “Strengthening the Prohibition of Gutter oil in the Catering Industry”, “Administrative Measures for Food Safety of the Catering Industry” and “Administrative Measures for License of the Catering Industry” were implemented in March 2010 (MOH Document, 2010a, 2010b; SFDA Document, 2010) to prevent reprocessed gutter oil from entering the catering industry, regulating the catering industry and food markets, and safeguarding the health of people. They require supervising and inspecting the procurement and use of cooking oil in restaurants with investigation of the status of inspections. As well, they require paying close...
attention to complaints or reports from consumers and verifying the complaints or reports. If the government detects cooking oil from an unknown source or procurement and use of reprocessed gutter oil in a restaurant, the restaurant will be ordered to stop using the cooking oil and the cooking oil will be destroyed; the restaurant’s license could be revoked if the case is serious.

The “Criminal Law Amendment” came into force in May 2011 (CPG Document, 2011) for punishment in criminal cases of food safety. The amendment states that anyone violating this law and harming human health or other serious circumstances should be sentenced to 5–10 years in jail. People who cause death or in especially serious circumstances should be sentenced to 10 years or longer, for life, or even death.

The “Strict Punishment for Gutter Oil Crimes” was published in January 2012 to demand that the people’s court (MPC Bulletin, 2012) and the people’s procuratorate and public security organ of local governments at all levels severely punish gutter oil criminals according to the law protecting human health and life. The law emphasizes that when a gutter crime is decided and the penalty is decided, the court needs to decide the amount of value involved, the subjective damage and artifice of the criminal, the harm to human health and life, damage to the market economy, and pernicious influence, for example. For the criminal who has a criminal record or is the ringleader of organized crime, if the amount of money involved is extremely large, or if the case is extremely abominable and has caused grave consequences, the case is considered serious and capital punishment is considered; the sentence should be death according to the law. The law strictly controls the conditions of suspension of the sentence and exemption from criminal responsibility. If the court must suspend the sentence, it must proclaim an injunction to stop any food production and sales during probation.

The “Interpretation of Applicable Law on Handling Cases of Food Safety Crimes” was executed in May 2013 (SPCS Document, 2013) defining the standards for sentencing criminals who endanger food safety, putting forward the judicial standards of the crime, and unifying the applicable legal advice about new types of complicated cases. The interpretation explicitly states that illegally adding items to food is extremely serious and will be penalized. It clearly states that people processing edible oil by using gutter oil as raw material will be convicted in accordance with “adding toxic and hazardous non-food items in producing and selling food” under the “Criminal Law”.

The legal system of supervising gutter oil was enforced, and the severe penalties for illegal activities of gutter oil were enacted with the implementation of these laws.

5.3 Reform food-safety supervision

To better control gutter oil, the Chinese government continues to institutionalize the supervision of gutter oil by the following.

- Establishing a system of overall responsibility by mayors (county heads) to administer gutter oil and manage waste food.
- Clearly assigning responsibility to different departments: commerce departments to manage and guide the catering industry; quality inspection departments to supervise food processing links and disrupt illegal activities using gutter oil to produce food; the municipal industry and commerce administration to supervise the circulation of cooking oil and disrupt the illegal activities of the reprocessed gutter oil trade; the food and drug administration to supervise catering enterprises and disrupt the use of reprocessed gutter oil; the hygiene administration to strengthen risk monitoring and implement prompt detection methods.
- Establishing and perfecting a system of supervision in overall process and linked law enforcement, and setting up a cooperative management mechanism to supervise gutter oil from “table to table”.

In March 2013, the new China Food and Drug Administration (CFDA) was established to integrate the functions of the State Food Safety Office (SFSO), the State Food and Drug Administration Department (SFDAD), inspection processes of the Inspection and Quarantine Department (IQD) and the food safety supervision and management functions of the Industry and Commerce Department (ICD). We hope that this administration will help assign responsibility and supervise the illegal use of gutter oil efficiently.

5.4. Promote supervision by society, publicity and education

Society must supervise and all stakeholders must be educated in the human food chain (FAO & WHO, 2003). China’s government encourages the media and general public to supervise the gutter oil process by establishing a paying offence reporting system; encouraging the public to participate in the supervision of gutter oil and waste food; regularly publishing the names of enterprises that have a problem managing gutter oil and waste food; encouraging the news media to report the measures, progress and results, and revealing the catering enterprises and illegal producing and selling hideouts.

Furthermore, the Chinese government will propagate food safety and relevant law about cooking oil to guide public consumption appropriately and improve health and environmental consciousness; enforce employee training; and promote food safety and legal consciousness among food enterprises.

6. Conclusions

Using unsafe non-food items as raw materials for food production may cause potential food safety incidents, and imperfect food safety supervision can make the probability into a reality. Preventing the use of gutter oil as raw materials for food production is the key. Therefore, establishing a system for food waste recycling to turn waste material into useful items is essential. In addition, efforts should be made to evaluate the hazard of gutter oil to people’s health, develop the supporting technology, including refuse reclamation and gutter oil detection, then establish waste food recycling standards and perfect the existing food safety standards.

Enforcing food safety laws and strengthening food safety supervision are the keys to food safety in China. The use of gutter oil has exposed the shortcomings of the food-safety assurance systems in the country. However the response of the Chinese government to this problem is rapid and effective. The Chinese government is showing a positive attitude to the gutter oil situation and has enforced food safety laws and regulations and reformed management systems to control the spread of this non-food item to improve food safety in China. The positive lesson of managing gutter oil may help improve food-safety supervision throughout China and other developing countries.

Acknowledgements

This study was supported in part by the Natural Science Funding of Guangdong Province (no. S201210008514) and Shenzhen Funding for Technology Development Project (no. CXZZ20130320165017541) to Xuli Wu.