Understanding New Foods: Water Quality

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Abstract

Water scarcity and water pollution are in hot debate in society, and water reuse has become an important measure of the water conservation plan. It is important to understand consumers' perceptions of the environment, water quality, and food wastewater reuse. Food wastewater reuse is a promising method of reclaiming wastewater. For example, by-products such as acid whey and tofu whey can be used to manufacture new products. This report aims to assess consumers' perceptions of water quality and acceptance of new whey beverages in 26 provinces in China. Data are collected by referring to peer-reviewed literature, related websites, social network sites, and other platforms, and formulating a questionnaire survey of 18 questions (n = 130). The results show that consumers have a certain degree of concern about the water quality of their living environment and worry about the safety of reclaimed water. Food safety is a priority for consumers when buying new whey products. Curiosity, environmental awareness, and the price will also affect their purchase intention. The research and development on the food application of acid whey and tofu whey are still in progress, and converting them into functional beverages is the main innovation direction of researchers. Reducing consumers' risk perception of these two whey types will help increase their acceptance.

Keywords

Water reuse · Circular economy · Consumer · Purchase intention · Acid whey · Tofu whey

13.1 Introduction

Water is not only an important material for maintaining a healthy ecosystem, but also an indispensable resource for social and economic development. Due to the acceleration of industrial construction, economic development, and

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urbanization, water consumption continues to increase (Meneses et al., 2017). It is estimated that by 2040, global water consumption will reach 4.35 trillion cubic meters (Tiseo, 2019). The water footprint represents the number of freshwater resources consumed to produce a certain product or provide a certain service (Hogeboom, 2020). Agriculture is one of the industries that consumes the most water in the world, especially in irrigation. For example, in China, agricultural water consumption accounts for 70% of the total water consumption (Winpenny et al., 2010). Crops have a higher water footprint, but animal-derived foods generally have greater water footprints than plant-derived foods (Mekonnen & Hoekstra, 2012). Human living standards have gradually improved, and more and more people's dietary choices have turned to high protein foods, some of which have led to an increase in water demand, resulting in water scarcity (González et al., 2020). For example, production of 1 liter of milk requires approximately 5,000 liters of water (Mekonnen & Hoekstra, 2011). A common alternative to milk, that is considered more sustainable by many, is almond milk. Nonetheless, almond production requires much more water, as high as 13,000 L of water per kg almonds (Vanham et al., 2020) while almond milk only delivers low quantities of nutrients due almonds limited solubility in water. Nutrient density and protein content must be factored in when comparing the environmental impact of food industries. When doing so, almonds require the least water per protein, closely followed by milk: 65 vs. 145 L water/g protein for almond and milk, respectively. This estimate is greatly outweighed by almond milk: 3,270 L water/g protein, which is 50 times higher than the value recorded for almonds (Mekonnen & Hoekstra, 2011; NZ Food Data Composition, 2021; USDA, 2021; Vanham et al., 2020).

In addition, in food processing industries, water participates in many food processing unit operations, which produce large amounts of wastewater that pose harm to the environment (Casani et al., 2005). The problems of water scarcity and environmental pollution have seriously affected the living environment and economic development, restricted the development of agriculture, and endangered food security and public health. These issues are a source of heated discussion among global lawmakers as well as the public.

In order to solve or alleviate the global water scarcity situation, many countries are working on improving the water utilization rate in terms of irrigation and reclaimed water, and they research and promote actively various water conservation technologies (Casani et al., 2005). Food Codes (Code of Federal Regulation CFR and Codex) stated that wastewater must be treated in a hygienic manner that does not contaminate food or food equipment (FDA, 2017). At present, the food processing industry has taken relevant measures to treat food wastewater, including membrane filtration technology (such as ultrafiltration, nanofiltration, reverse osmosis), biological treatment technology, Membrane Bioreactor (MBR), and others (Meneses et al., 2019). In addition, an effective way to save water is to recycle wastewater and make it into edible products. The annual output of wastewater from the food industry is large. Wastewater such as acid whey and tofu whey, which are by-products of the production of Greek yogurt (Lindsay et al., 2018) and tofu (Chua & Liu, 2019), respectively, both have high nutritional value. However, they contain high levels of biological oxygen demand (BOD) and chemical oxygen demand (COD), which in some cases is up to 10 g/L (Cassano et al., 2015). These high BOD and COD cause environmental issues if the wastewater is discharged. Specifically, high levels of these indicators can cause eutrophication: excessive concentration of nitrogen and phosphorous in freshwater. The result is a lack of oxygen for native species (such as fish) resulting in altered ecosystems, with fish death and production of toxins (Khan & Mohammad, 2014). Hence, using them to make new products is a sustainable solution that can reduce water eutrophication and water pollution caused by discharge into rivers.

Currently, there are no products derived from acid whey and tofu whey, and there is also a lack

of consumer perception of them and no evaluation of the potential acceptance of their products. Therefore, the purpose of this study is to investigate consumers' perceptions of water quality and the discussion of these two types of whey as sources of new products. Conducting this research generates justification to improve research and promotion of such new products since it aims to collect and judge consumers' attitudes toward the recycling of food wastewater.

13.2 Consumer Discussion on Social Media

13.2.1 Data Collection

13.2.1.1 Peer-Reviewed References and Websites

The main websites include ScienceDirect, Lincoln Library, Google Scholar, and so on. The data were searched in terms of water conservation, water management, reclaimed water, water shortage, wastewater treatment, acid whey, tofu whey, risk perception, etc. The nutrition and food applications of acid whey and tofu whey as examples in this report will be mentioned. Moreover, the papers found will be compared with the results of the questionnaire survey to confirm their correctness or incorrectness.

13.2.1.2 Social Network Site and Forums

Social network sites mainly include Facebook, Twitter, Instagram, and Zhihu (a Q&A community in China). In view of the fact that acid whey and tofu whey are a new type of food raw materials, people talk less about them on social network sites and forums. Therefore, consumers' views and perceptions of water quality are the key data for the main search. In addition, people's attention to local water quality, wastewater treatment methods, and sources of water pollution will be discussed. These data will be used to create word clouds through the WordArt website, and will be compared with the results of the survey.

13.2.1.3 Consumers' Survey on Their Views Toward the Reconditioning and Reuse of Wastewater from Food Processing

The questionnaire survey collected data from 26 provinces in China through Sojump (an online survey tool). There were a total of 130 respondents, of which 93 were female and 37 were male. The age of the respondents ranged from 18 to 60, and most of them were 18–25 years old. The educational background includes high school, technical secondary school, junior college, bachelor's degree, master's degree and above, most of which have a bachelor's degree. The professional positions of the respondents include students, government officials, ordinary office clerk, professionals, etc. The specific demographic information is shown in Table 13.1 (Q1–Q5).

Using survey data on consumers' views of water reconditioning and reuse, we first assessed people's attitudes and perceptions of the living environment, water treatment, and wastewater sources, which came from Q6 to Q11. Questions 12 to 18 investigated consumers' acceptance of new products made from acid whey and tofu whey, mainly reflecting in terms of their perceptions of the two whey, curiosity of the products, environmental awareness, price, and food safety. The design of the questionnaire refers to the survey method of Adams et al. (2013). A questionnaire is deemed invalid if any one item is missing in the basic information column of the survey object or if two or more other questions are not answered. In the end, 130 valid questionnaires were obtained. The survey results are shown in Table 13.2.

In the survey, questions about consumers'perception of water quality and water treatment include: (1) Do you often pay attention to local water quality? (2) Do you think the current water pollution is serious? (3) The main sources of water pollution (e.g., industrial production wastewater, domestic sewage, agricultural wastewater); (4) The impact of untreated food industry wastewater on the environment; (5) Food industry wastewater treatment methods; (6) Acceptance of the

Table 13.1 Demographics of survey respondents (n = 130)

	Respondents (%)
Gender	
Male	28.5
Female	71.5
Age	
18-25	67
26-30	16
31-40	7.0
41-50	4.0
50-60	6.0
Educational background	
High school	3.0
Technical secondary school	6.0
Junior college/ Bachelor degree	77
Master degree and above	8.0
Position	
Student	60
Government officials	4.0
Ordinary office clerk	13
Professionals (e.g. teacher, doctor, etc.)	11
Others	12

Table 13.2 Statistical analysis of questionnaire survey (n = 130)

Description	Results
Degree of concern for local water quality (1-Never, … 5- Always)	3.41 ± 0.98
The main sources of water pollution industrial wastewater (1-yes, 0-no) domestic sewage (1-yes, 0-no) agricultural sewage (1-yes, 0-no) others (1-yes, 0-no)	0.90 ± 0.30 0.87 ± 0.34 0.47 ±0.50 0.02 ± 0.15
Degree of understanding of wastewater treatment (1- don't know, … 5- know well)	2.58 ±1.00
Acceptance of water reconditioning and reuse (1- low acceptance, … 5- high acceptance)	3.3 ± 1.13
Food safety consideration of food industry wastewater (1- not worried, … 5- very worried)	3.86 ± 0.94
Degree of understanding of tofu whey (1- yes, 0- no)	0.50 ± 0.50
Degree of understanding of acid whey (1- yes, 0- no)	0.24 ± 0.46
Buying products made from acid whey or tofu whey due to curiosity (1- unwilling, … 5- very willing)	3.13 ± 0.79
Buying the products due to environmental awareness (1- unwilling, … 5- very willing)	3.31± 0.85
Buying the products due to low price (1- unwilling, … 5- very willing)	3.53 ± 0.86
Buying the products due to guaranteed food safety (1- unwilling, … 5- very willing)	3.99 ± 0.89

recycling of wastewater from the food industry. Moreover, questions about consumer acceptance of products made from acid whey or tofu whey include: (1) The hygiene and safety of products made from food industry wastewater; (2) Understanding of acid whey and tofu whey; (3) Purchase intention of the new products.

13.2.1.4 Data Analysis by Word Clouds

All data were searched based on the purpose of this research report. Making word clouds can combine the relevant discussions of water quality, acid whey and tofu whey, and highlight the key points. Referring to Adams et al. (2013), the results of this questionnaire survey are listed using quantifiable single-choice or multiple-choice options (the scale is 1–5 or 0–1), and they were quantitatively analyzed. In order to conform to cognition and facilitate comparison, the questionnaire scores are finally converted into averages and percentages. The risk perception of consumers was evaluated by comparing the knowledge, attitudes, and behaviour of consumers on water reconditioning and reuse.

13.2.2 Discussion of Consumers' Perception

13.2.2.1 Perception of Water Quality

The problem of water pollution and water scarcity has always been a frequently debated topic in modern society. It will continue to be a permanent topic in the world, since it is related to human health and development (Fig. 13.1). People's perception of water resources affects their water use concepts and behaviour (Lease et al., 2014). Their awareness of water quality issues is the first research field of this investigation. The questions and corresponding results of the questionnaire survey are summarized in Table 13.2.

When respondents were asked how often they are concerned about the water quality of their living environment, with a scale of 1–5 to determine the data, most people will sometimes pay attention to water quality issues (mean 3.41). This mean also shows that they have a certain degree of attention to water and environmental issues. The results of the study by Eck et al. (2019) are similar to this data, but more respondents are paying

Fig. 13.1 Word clouds from social discussion on water quality, acid whey, and tofu whey

attention to the water situation. It shows that most of the general public, water professionals, and professional students in Oklahoma State are concerned about clean water (Eck et al., 2019). The reason for the higher attention is likely to be the difference in the region, the water quality, and the deeper understanding of water (Moosavi et al., 2021). When asked to choose the main source of water pollution among industrial wastewater, domestic sewage, agricultural wastewater, and other pollution sources (1 = yes, 0 = no), most questionnaire respondents chose the first two (mean value 0.9 and 0.87, respectively), about half of the people chose agricultural wastewater (0.47), and a very small number of them chose other pollution sources (0.02) but did not specify the source. According to UNESCO (2016), global industries discharge 30–40 billion tons of wastewater into water bodies every year, which also reveals that industrial wastewater is putting increasing pressure on the implementation of measures to protect water bodies. It is reported that agricultural water consumption accounts for 70% of total water consumption, and the amount of sewage produced is also harmful to the environment (Winpenny et al., 2010). More and more people believe that inorganic substances (such as nitrogen, phosphorus, cadmium, etc.) and organic substances (such as pesticide residues) contained in domestic sewage and agricultural wastewater pose great threats to the ecosystem, which greatly increases the total pollutant load (Xie et al., 2007). Based on statistics, Asia's annual wastewater volume is as high as 160 million cubic meters, while North America and Europe produce approximately 67 billion cubic meters each year (Tiseo, 2020). Hence, people have a great responsibility for the treatment of wastewater.

The composition of wastewater from food processing plants is relatively complex, including production processes such as sugar making, brewing, meat, and dairy processing, which all contain organic matter with a strong aerobic property, and a large amount of suspended matter is discharged with the wastewater (Cassano et al., 2015). When the respondents were asked whether the direct discharge of untreated food industry wastewater into water bodies or other places would affect the environment, 89.6% of them thought the impact was greater, and only 2.22% of them disagreed with this point of view, which reflects the importance of wastewater treatment. The survey by Petrescu et al. (2019) also shows that consumers agree that untreated wastewater has a highly negative impact on the environment and human health, which is consistent with the results of this survey. It is reported that food industry wastewater is a biodegradable water resource and does not contain toxic chemicals, but it has significant BOD and COD values, which can increase the pollution level of water resources if without wastewater treatments (Meneses et al., 2019). In the Food Code, the FDA (2017) requires food processing plants to treat wastewater in a wastewater treatment plant before discharging the wastewater into the water body, so as to meet the dischargeable wastewater standards. On average, most consumers do not know much about wastewater treatment methods in food factories (mean response of 2.58, on a 1–5 knowledge scale) (Table 13.2). Consumers seem to care more about the cleanliness and safety of water than wastewater treatment or water management.

13.2.2.2 Acceptance of Whey Products

Acid whey and tofu whey are recycled by food factories or laboratories because of their valuable nutrients to make new whey products, so as to realize the valorization of these two kinds of food wastewater (Chua & Liu, 2019). Consumers'willingness to buy new products often depends on their knowledge of the product's raw materials, processing methods, product innovation, price, and product safety. Therefore, the purchase intention of consumers is mainly collected through questionnaire surveys (Table 13.2).

When consumers were asked about their acceptance of water reconditioning and reuse, with a scale of 1–5 to test, and the result was that most people chose the median value (3.3). It is obvious that their acceptance of reclaimed water was at a general level, but there were still some consumers who fully accept this recycling measure. The main reason is reflected in the next question of the survey, "Are you worried about the

hygiene and safety of products made from food industry wastewater?" Most consumers are worried about the kind of product (3.86). Consumers lack the perception of wastewater reuse, which will increase their negative attitudes towards reclaimed water. Lease et al. (2014) found that consumers' responses become positive when they obtain trustworthy information, and they generally accept or try to accept reclaimed water. Tofu whey and acid whey were previously considered to be of little value by the food industry, but now as a new type of food raw material, it can reduce the burden on wastewater discharge (Wang & Serventi, 2019). However, consumers also have little knowledge of tofu whey and acid whey. It is investigated that on the scale of 0–1, half of the consumers know about tofu whey, but most people pour it away directly. In contrast, people know less about acid whey, with an average value of 0.24. The reason may be different regional diets. Greek yogurt is very popular in the United States, and its production is increasing year by year (USDA, 2021), hence, consumers also have a certain understanding of acid whey. Some content about consumers cooking acid whey or tofu whey into new foods can be found on social network sites such as Twitter and Facebook, and the food applications of these two types of whey will be shown later. These two sources of whey as well as other types have been mentioned in the questionnaire for follow-up investigation.

The survey investigated consumer attitudes and behaviour toward whey products in terms of curiosity, environmental awareness, price, and food safety issues. It can be found from Table 13.2 that the average score in all aspects is 3–4. A study believes that new products can attract consumers' attention, stimulate their curiosity, and generate an urge to approach the product (Gerrath & Biraglia, 2021). However, the survey showed that respondents were hesitant to such products (mean 3.13). Curiosity cannot increase their purchasing desire, which reflects consumers' neophobia. Neophobia is defined as a resistive response to a food that people have never eaten before, and it is an inadaptability to new things (Nezlek et al., 2021). Uncertainty about the reliability of whey wastewater reuse technology makes consumers fear new products, and this phenomenon exists in both developing and developed countries (Coppola & Verneau, 2018). When asked whether they would include environmental awareness in their decision to accept these whey products, respondents selected 3 in the range of 1–5 most often, resulting in an average of 3.31. Environmental value has a positive impact on consumers' purchasing behaviour, but their cognitive value prompts them to show hesitation in accepting sustainable products (Khan & Mohsin, 2017). Consumers' negative perceptions of food wastewater hinder the development of environmental awareness. Compared with curiosity and environmental awareness, the average score of prices is relatively high (3.53), showing that low prices seem to be more effective in attracting consumers, but obviously, consumers do not pay too much attention to the economic loss of food. Among four aspects, food safety is the first choice of consumers. The result shows a higher average value (3.99) than the other three aspects, which is close to 4. Consumers' attitudes toward product safety is the same as the result of water quality safety issues. What is interesting is that none of the 135 respondents chose option 1, which proves that food safety can increase consumer acceptance of whey products. Consumers' desire to buy will be motivated while ensuring food safety. Lease et al. (2014) recovered and treated wastewater to meet drinking water standards, and then applied it to meat food, which gained high consumer acceptance. Acid whey and tofu whey have a higher safety factor than other wastewater, but consumers'negative attitudes toward whey wastewater is a problem that needs to be solved. In general, consumers do not have a high degree of acceptance of new whey products, and most of them hold a conservative attitude.

The survey results are mainly due to consumers' risk perception of acid whey and tofu whey. Similarly, research has shown that one of the important hindrances to the implementation of water reuse is consumers' risk perception (Meneses et al., 2017). Consumers obtain information on food safety issues from social network sites, news, or magazines, but fail to think deeply about the true source of food pollution, leading to a negative attitude toward the reuse of food wastewater (Machado Nardi et al., 2020). Reducing risk

perception is very significant to increase the recognition and acceptance of whey products. In terms of food risk perception, consumers have a higher perception of experience risk, psychological risk, and health risk (Carducci et al., 2019). They are desperately focused on the quality and characteristics of the product, and care about the emotion produced by the product (Khan & Mohsin, 2017). Their purchase intention also depends on the emotions of consumers (Liang et al., 2019). Functional foods have nutrition as their basic attribute, while hedonic foods that satisfy the need for taste are the main attribute (Machado Nardi et al., 2020). Studies have shown that the acceptance of hedonic foods is higher than functional foods (Madzharov et al., 2016). Making acid whey and tofu whey into palatable pleasure foods seems to effectively reduce food risk perception.

13.3 Food Applications of Whey Ingredients

13.3.1 Acid Whey

Acid whey is a by-product produced during the processing of fermented dairy products such as cottage or quarg cheese and Greek yogurt. According to statistics from the U.S. Department of Agriculture, the production of Greek yogurt in 2021 is about 400 million pounds, an increase of 14% over 2020 (USDA, 2021). For every pound of Greek yogurt produced, approximately 3 pounds of liquid whey waste are produced (Rocha-Mendoza et al., 2020). With increasing sales of Greek yogurt in the US market, the production of acid whey has increased. Acid whey contains more than 93% water, minerals, protein, and lactose-based compounds, but it has a high BOD and COD content (Lievore et al., 2015). Compared with sweet whey, it has a lower content of protein and a higher content of lactose, with the pH value ranging from 4 to 5 (Wherry et al., 2019). The processing of acid whey is considered an additional cost for the dairy industry. However, the treatment of discharging acid whey directly in their waste stream by Greek yogurt manufacturers has been controversial in terms of environmental impact and protection. At present, acid whey is generally used for anaerobic digestion and converted into methane that can generate electricity, which is the best way to treat large amounts of acid whey (Danovich, 2018). It can also be used as crop fertilizer or animal feed (Menchik et al., 2018). In recent years, whey processing has become an emerging industry. Sweet whey has been ultrafiltered by the food processing industry to obtain whey concentrate and spray-dried to produce sweet whey powder, which is widely used in confectionery products, cereal and nutrition bars, processed cheeses, baked goods, sports beverages, muscle gain formulations, and desserts (Prazeres et al., 2012). However, the processing method of sweet whey is not suitable for acid whey, because most of the lactose will be converted into crystal structure due to the high lactic acid content and low pH value during the spray drying (Rocha-Mendoza et al., 2020). However, the nutritional value of acid whey cannot be ignored. Although the development and comprehensive utilization of acid whey are still in the research stages, the potential applications of acid whey as a sustainable product raw material are promising.

The valorization of acid whey is a challenge for dairy industries, but its application in the food processing industry can relieve the pressure of handling large amounts of whey. Although acid whey causes agglomeration of particles during spray drying (Rocha-Mendoza et al., 2020), nanofiltration technology can remove or concentrate 50% of the lactic acid in acid whey to increase the possibility of processing it as a spray-dried whey powder (Chandrapala et al., 2016). Lactose can also be purified from acid whey by ultrafiltration, concentration, and crystallization, and can be used to produce glucose syrup or galactose syrup by enzymatic (such as β-galactosidase) or acid-catalyzed hydrolysis, which can replace sucrose as sweeteners of ice cream, candy, and other foods (Lindsay et al., 2018). It is also a high-quality raw material for the production of fermented probiotic beverages, which provide rich nutrients for lactic acid bacteria (LAB) (Rama et al., 2019). Due to its antibacterial and antioxidant functions, it could become a potential functional beverage (Dragone et al., 2009). It is reported that acid whey can replace all the water in the original fermentation formulation to produce fermented milk because lactose and other solid components provide

energy for fermentation, which can shorten the fermentation period and give fermented products a body-full sensory experience (Lievore et al., 2015). Since there is little casein in acid whey, replacing part of the milk with acid whey will reduce the gel strength and viscosity of the fermented product (Lievore et al., 2015). In addition, it can be used to produce a new type of alcoholic beverage with acceptable organoleptic properties by yeast (Dragone et al., 2009). Moreover, it is considered to be a powerful antioxidant and can inhibit the release of iron during the oxidation and deterioration of sausage production to stabilize the bright red colour of sausages (Wójciak et al., 2014). The food applications of acid whey can bring economic benefits to the dairy industry, and be beneficial to consumers' health.

13.3.2 Tofu Whey

Tofu whey contains nutrients such as protein, minerals, monosaccharides, oligosaccharides, and soy isoflavones (Chua & Liu, 2019). Among them, the anticancer factor trypsin inhibitor can effectively prevent liver cancer, colon cancer, and breast cancer (Kobayashi et al., 2004). Every 1 kg of soybeans can produce about 9 kg of tofu whey during tofu processing (Chua et al., 2018). It will promote the growth of microorganisms, resulting in high levels of BOD (8,000–10,000 mg/L) and COD (17,000–26,000 mg/L) when discharged as waste without treatment (Chua & Liu, 2019). The protein and soluble sugar in tofu whey give it a high spoilage rate and consume oxygen in the water and pollute sewers. With the increasing acceptance of tofu by consumers, the risk of environmental pollution continues to increase (Wang & Serventi, 2019). Although tofu whey is rich in nutrients, most of it will be used as crop fertilizer, animal feed, or directly treated as wastewater (Meneses et al., 2017). As a feed, it can provide more nutrition for animals, reduce human competition for feed and the cost of animal products, and reduce the water footprint. However, anaerobic treatment and aerobic treatment cannot recycle the effective ingredients in tofu whey (Hongyang et al., 2011). Using tofu whey to make new products can improve the utilization of nutrients and reduce environmental pollution.

Studies have shown that tofu whey can be used as a culture medium for LAB during sauerkraut fermentation (Cai et al., 2013). It can also be used to produce the next batch of tofu because the fermented tofu whey contains the strong acid-producing *Lactobacillus plantarum* strain JMC-1, which can coagulate soy milk and make the tofu moderate in firmness (Chua & Liu, 2019). Water kefir is a natural starter, and its microbiota includes LAB, yeast, and acetic acid bacteria. It can convert tofu whey into a biologically active beverage that has the function of scavenging free radicals and generating flavonoids, biologically active peptides, and glycerophospholipids that are beneficial to human health (Azi et al., 2021). Kombucha consortium can also convert tofu whey into a potential new functional beverage, which is composed of tea fungus, bacteria, and yeast. Studies have proven that the DPPH scavenging activity and antibacterial activity of tofu whey fermented by the kombucha consortium is improved, and the beany taste is reduced (Tu et al., 2019). Tofu whey, like acid whey, can be made into alcoholic beverages. Both *Saccharomyces cerevisiae* and non-*Saccharomyces cerevisiae* can be used to ferment tofu whey, showing different flavour characteristics (Chua et al., 2021). Researchers at the National University of Singapore (NUS) successfully developed the fermented tofu whey into an alcohol-containing beverage product, namely Sachi, which is rich in isoflavones and antioxidants and has attracted widespread attention worldwide (Chua et al., 2018). In addition, tofu whey can be dried into powder by a vacuum freeze dryer and mixed with flour to make wheat bread, resulting in improving the protein and nutritional quality of the bread, reducing the baking loss, and increasing the total phenols and flavonoid content (Barukčić et al., 2019). The mentioned food applications show that tofu whey is a potential functional food raw material. However, there are currently few sensory studies on the manufacturing of tofu whey into edible food and beverage products, thus, this will be the next research direction to obtain more realistic sensory data from the mass market.

13.4 Conclusion

Eco-environmental resources are allocated globally, and benefits are shared globally. The use of eco-environmental resources by a country or region often affects the well-being of people in all countries. For example, climate warming will not lead to the collapse of Earth itself, but will devastate the fragile human beings, and even make the whole of human society disappear. People have promoted the slogan of "protecting the earth", but what they really need to protect is our own community and our shared future. The depletion of the ozone layer, climate warming, dramatic decline in biodiversity, and global transport of persistent organic pollutants represent the primary challenges facing the community of shared future of mankind. All countries must join in addressing these challenges. No single country, region, or organization can lead such a large-scale global ecological and environmental governance action alone. The ecological and environmental crisis must and can only be resolved through the organization of a community of shared future for humans. As a community, humankind must respect, conform to, and protect nature. The sustainable development of a community with a shared future will only be possible if all countries in the world make positive changes and embark on the path of green development.

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