



# Exploring on Research Ethics in Humidifier Disinfectant Case from the Court Judgement

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## Abstract

**Purpose:** The purpose of this study is to identify what research ethics issues are related to chemical incidents at the level of national disasters in Korea, and then to secure clear research ethics to prevent similar incidents from recurring. **Research design, data and methodology:** The study design was a case study of the humidifier disinfectant disaster in Korea. The humidifier disinfectant incident is a worldwide issue that has never occurred in the world. The main cause of the humidifier disinfectant incident that occurred only in Korea was the toxicity of the humidifier disinfectant contained in the humidifier spray. In this regard, research ethics will be derived through related laws and systems, research ethics status, incident damage and compensation, prosecution's investigation status, and the final precedent of the Supreme Court. **Results:** Although the lack of laws and systems of government departments related to humidifiers is important in the research results, the violation of ethics regulations by researchers during research experiments has become a decisive problem. **Conclusions:** In conclusion, the most important thing is that the research bioethics of researchers at the forefront should take precedence over any other values, especially during experiments and research related to public health.

**Keywords :** Humidifier Disinfectant, Research Ethics, Biocide, Lung Disease, Toxicity

**JEL Classification Codes :** I10, I12, I18, I19, Q53

## 1. Introduction

Humidifier Disinfectant Case in Korea is known as a kind of biocide disaster case. In Korea The humidifier disinfectant incident in 2011 refers to the death of many pregnant women and infants exposed to toxic substances due to unknown lung disease and asthma. Considering the

scale of damage and ripple effects of the incident, this incident is called the 'worst biocide incident ever' (Im, 2018; Ko & Han, 2018). The first humidifier sterilization issue in Korea in 1994 first appeared externally in 1995. It was pointed out as a big problem that damage from humidifier disinfectants was regarded as a 'disease of unknown cause' and that it had rather increased the situation for a long time.

In the humidifier disinfectant case, a “latent disaster” began to materialize from the moment the disinfectant product was sold in the market (Gu, 2018). The humidifier disinfectant incident is an event that has never occurred in the world. The main cause of the humidifier disinfectant incident that occurred only in Korea was the toxicity of the humidifier disinfectant contained in the humidifier spray. The humidifier disinfectant damage case is the world's first large-scale fatality case caused by household products, and it is a case of biocide damage caused by chemical substance misuse (Moon, 2014). It is called “the biggest environmental disease in history in Korea” because people exposed to toxic disinfectant substances contained in humidifier sprays died or died from lung, non-pulmonary and systemic diseases. Humidifier disinfectant adversely affects the whole body, and it occurs in various parts of the body, such as toxic hepatitis, rhinitis, and atopy and so on. However, the current enforcement decree and enforcement regulations of the Humidifier Disinfectant Act have different purposes and meanings, so many victims have not even heard an apology or consolation from the perpetrator company (Park, 2013).

In 2011, as the enormous damage to humidifiers first surfaced in the media, humidifier disinfectants were pointed out as the cause. At that time in 2011, it was known as a lung disease for which the exact cause of lung transplantation was unknown due to problems with the lungs of infants and pregnant women. However, as a result of an actual epidemiological investigation, it was found that the causes were all caused by humidifier disinfectants, and on November 11, 2011, all six types of humidifier disinfectants were recalled. On October 8, 2012, according to Asian Citizen's Center for Environment and Health(ACCEH) of Korea, 78 people, including 36 infants, died (Park & Koh, 2020). Since then, the prosecution investigation and trial were held in 2016, and it became a big social issue over the country and media. In the meantime, the problem that society or the state did not actively respond to this problem has also emerged.

In the process of finding out the truth about the damage caused by the humidifier disinfectant and identifying the cause, the product manufacturing company and the government showed passive countermeasures such as avoiding responsibility for management and compensation (Park et al., 2021). As a result, the victims of the humidifier disinfectant incident gradually spread the damage. In other words, in the humidifier disinfectant case, the conflict of interest and friction between victim groups, the government, corporations, and other policy actors was repeated. This incident, which could have ended as a simple incident, spread to a social disaster, furthermore, a social catastrophe, and the damage was further amplified. (Kim et al., 2013).

As of February 2017, there were 5,432 reports of damage in this case, of which 1,131 people died (20.8% of the reported cases). According to the “Humidifier Disinfectants Victims” in January 2018, 5,960 victims of humidifier disinfectant reported to the government, and 1,296 deaths. In the 5th damage claims conducted by the government, in addition to pulmonary fibrosis, asthma patients were also recognized as damages from humidifier disinfectants, so the number of victims increased (Park & Koh, 2020). On July 17, 2020, according to the count of the “Special Investigation Commission on Humidifier Disinfectants & 4·16 Sewol Ferry Disasters”, 6,817 people reported damage to the Ministry of Environment, of which 1,553 people died. It is estimated that 14,000 deaths have not yet been identified, and 670,000 people have experienced health damage. The “Special Investigation Committee on Humidifier Disinfectants on Social Disasters” is an independent national organization established to uncover the truth of the humidifier disinfectant incident and the 4/16 Sewol ferry disaster and to check damage support measures (Byeon et al., 2020).

Looking at the comparison of follow-up measures in the case of Korea and Japan, in the domestic humidifier disinfectant case, from the time the “Korea Centers for Disease Control and Prevention(KCDCP)” recognized the humidifier disinfectant problem in 2011, the cause was identified and recall measures were swiftly carried out. On the other hand, in the case of hepatitis C in Japan, the response of the “Ministry of Health, Labor and Welfare” was considerably delayed (Park & Kim, 2022).

Former Vice President of SK Chemicals, who was charged with concealing the results of harmfulness testing in relation to the humidifier disinfectant case, was sentenced to prison in the first trial of the court. The Seoul Central District Court Criminal 15 Single Chief Judge sentenced former Vice President, who was accused of destroying evidence, to two years in prison (2019-1852). 10 months in prison to 1 year and 6 months in prison were also sentenced to SK Chemicals executives and employees who were prosecuted together (Hwang et al., 2021). The court acquitted SK Chemicals and SK Innovation, which were charged with violating the “Special Act on Remedy for Damage Caused by Humidifier Disinfectants(SARDCHD)”. On this day, the court did not detain the accused, including former vice president. Former vice president and others are accused of concealing the results of a harmfulness test commissioned by Seoul National University in 1994, when Yugong, the predecessor of SK Chemicals, developed a humidifier disinfectant for the first time in Korea.

However, it is known that the researcher's violation of research ethics is seriously involved in the background of the humidifier disinfectant incident (Kong et al., 2016). In other words, researchers such as university professors received money and valuables from the humidifier disinfectant manufacturer and intentionally manipulated unfavorable experimental data at the request of the company. Therefore, the purpose of this study is to identify what research ethics issues are related to this national disaster-level chemical incident, and to secure clear research ethics through safety measures and prevention of similar incidents.

## 2. Background of the Humidifier Disinfectant Incident

### 2.1. Manufacturing Status of Humidifier Sterilizer

In 1991, a company named Yugong (currently SK Chemicals) in Korea developed PHMG and CMIT/MIT manufacturing methods, raw materials for humidifier sterilizers (Choi, 2015). In 1994, the Yugong Biotech business team invested a total of 1.8 billion Korean won(KRW). It is said that 'Humidifier Mate' has been developed that completely sterilizes germs that cause various diseases by adding the developed raw material to water. Yugong's research team decided to make a disinfectant that kills germs by mixing it with water, not a detergent that cleans humidifiers, and chose CMIT/MIT, which was used as a pesticide and industrial fungicide, as a raw material (Lee, 2019). At the time, the manufacturer of merit publicized extensively that it was the first in Korea as well as the first in the world to develop a humidifier sterilizer. A total of 27 vendors and 20 raw material suppliers and manufacturers of Yugong were involved. From 1998 to 2011, the company supplied humidifier disinfectants to major manufacturers and distributors such as Oxy Reckitt Benckiser, Homeplus, and Lotte Mart.

Established in Korea in 1991 as an affiliate of Dongyang Chemical Group (currently OCI), Oxy's household goods business was sold in April 2001 by Reckitt Benckiser, a British multinational corporation. The humidifier disinfectant, released in 1994, sold about 600,000 units annually by 2011. According to the results of a survey by the KCDCP and some groups, 37.2% of the general population uses a humidifier. Among them, the humidifier disinfectant use rate is 18.2%, and considering that 20 types of humidifier disinfectants and 600,000 units were sold annually, the population using humidifier disinfectants is estimated to be about 8 million per year (Moon, 2014). However, on August 31, 2011, the KCDCP first announced

the results of an epidemiological investigation of humidifier sterilization damage. At this time, the cause of lung damage of unknown cause was presumed to be a humidifier disinfectant. Therefore, the KCDCP recommended the suspension and recall of humidifier sterilization products sold on the market. "Fair Trade Commission(FTC)" estimated the annual market size of humidifiers at 1 to 2 billion KRW.

### 2.2. Damage Caused by Humidifier Disinfectants

By February 9, 2017, 5,342 cases had registered for health problems and 1,131 of them were already dead (20.8% mortality rate) (Choi, 2017). From July 2013 to April 2015, as a result of the 1st and 2nd investigations conducted by the "Ministry of Health and Welfare", KCDCP, the "Ministry of Environment", and the "Korea Environmental Industry and Technology Institute", a total of 530 victims (146 deaths and 384 surviving patients) were found. The third investigation, which was conducted until the end of December 2015, received a total of 752 cases, including 79 deaths and 673 surviving cases. Afterwards, the investigation was not conducted in 2016, but when the issue of humidifier disinfectant aroused national attention, the investigation was started again. From 2016 to the present, a total of 1,528 victims have been confirmed, including 239 deaths and 1,289 surviving patients, of the 246 victims received by the ACCEH (Park & Koh, 2020).

According to the ACCEH, about 20 types of humidifier sterilizers, first developed by Yukong in 1994, have been released over the past 17 years, and about 600,000 units have been sold annually. Humidifier disinfectant was first launched in 1994 by Yugong, the predecessor of SK Chemicals, and by 2011, about 20 types of humidifier disinfectant were sold at a scale of 600,000 per year (Ko & Han, 2018). Users are estimated to be between 8.94 million and 10.87 million, and potential victims between 290,000 and 2.27 million. In addition, among the total number of applicants, the victims were mainly infants and those in their 20s and 30s. This seems to be because young couples with children used a lot of humidifier disinfectants. More than half of infants and young children who complained of damage from humidifier disinfectant died, and the elderly over 60 also had the second highest mortality rate after infants and young children at 37%. In conclusion, it was revealed that the mortality rate of infants and the elderly who suffered from lung damage of unknown cause was very high.

**Table 1:** Victims of Grade 1 and 2 Humidifier Disinfectants by Manufacturer (Unit: No.)

Manufacturing company	Death	Wound	Total
Oxy	70	107	177
Lotte	16	25	41
Homeplus	12	16	28
Sepyu	14	13	27
Total	94	127	221

Source: Keiti (2022)

**Table 2:** Victims of Grade 1 and 2 Humidifier Disinfectants by Investigation Stage (Unit: No.)

Classification	Total	Death		Patients	Government (Agency)
		Deaths (Mortality rate)	Deaths at the time of judgment (Death after judgement)		
1 <sup>st</sup> investigation ('13.7~'14.4)	361	106(29.4%)	104(2)	255	Ministry of Health and Welfare (Korea Centers for Disease Control and Prevention)
2 <sup>nd</sup> investigation ('14.7~'15.4)	169	40(23.7%)	36(4)	129	Ministry of Environment (Korea Environmental Industry and Technology Institute)
3 <sup>rd</sup> investigation ('15.4~'15.12)	752	79(10%)		673	Ministry of Environment (Korea Environmental Industry and Technology Institute)
4 <sup>th</sup> investigation ('16.4.4.~present)	246	14(5.7%)		232	Asian Citizen's Center for Environment and Health
Total	1,528	239(15.6%)		1,289	

Source: Keiti (2022)

**Table 3:** Humidifier Disinfectant Damage by Adult and Infant (Unit: No.)

Classification		Almost certainly (Stage 1)	Likely (Step 2)	Unlikely (Step 3)	Very little (Step 4)	Undeterminable
Adult	103	9	13	8	73	0
Infant	66	19	8	13	25	1

Source: Keiti (2022)

**Table 4:** Humidifier Disinfectant Damage by Gender (Unit: No.)

Classification		Almost certainly (Stage 1)	Likely (Step 2)	Unlikely (Step 3)	Very little (Step 4)	Undeterminable
Male	89	13	9	12	55	0
Female	80	15	12	9	43	1

Source: Keiti (2022)

### 3. Cause and Process of the Humidifier Disinfectant Incident

#### 3.1. Toxic Substances in Humidifier Disinfectants

The disinfectant components of humidifiers are mainly poly-hexa-methylene guanidine (PHMG) and oligo-(2-)ethoxyethyl guanidine chloride (PGH). Occasionally, methyl-chloro-isothiazolinone (MCI; MCIT) is used as an ingredient in products. These substances have skin toxicity that is only about 5 to 10 times that of other disinfectants, so they are used in various products such as shampoo and wet wipes as well as humidifier disinfectants (Mukherjee, 2016). However, since little research has been done on the toxicity that occurs when these ingredients are inhaled into the respiratory tract, no sanctions or regulations have been made in advance until victims occur in Korea.

Toxicologists conducted a risk assessment of representative products based on data previously published in the academic world for the three major humidifier disinfectant disinfectants. When they calculated the respiratory toxicity values, they reported to the Journal of the American Chemical Society that they were CMIT/MIT 9.41, PHMG 2,500, and PGH 10,500. Researchers pointed out that a respiratory toxicity value greater than 1 is dangerous, and the higher the number, the greater the risk, so manufacturers will not even conduct basic safety investigations at the product development stage (Choi, 2017). In particular, since the humidifier disinfectant was classified as an industrial product, only the general safety standards according to the "Quality Control and Safety Management of Industrial Products Act." were applied, not the "Food Sanitation Act" or the "Pharmaceutical Affairs Act", so great damage could not be prevented. PHMG series of humidifier disinfectants include Oxy Ssac Ssac (Oxy Reckitt Benckiser), Weislec (Lotte Mart), and Homeplus (Homeplus). The PGH series of humidifier disinfectants includes Sepu (Butterfly Effect), and the MCIT series includes Aekyung Humidifier Mate (Aekyung) and Eplus (E-Mart).

#### 3.2. Humidifier Disinfectant Incident and Government Sanctions

It started in April 2011 when a series of pregnant women with acute respiratory failure were hospitalized. On May 10, 2011, a 34-year-old woman died among hospitalized patients, and in June 2011, three women died. On August 31, 2011, the KCDCP estimated that humidifier disinfectant was the cause of the lung disease (Park et al., 2017). On September 30, 2011, the "Korea Consumer Agency"

recommended the use of humidifier disinfectant, and on November 11, 2011, the KCDCP issued an order to collect humidifier disinfectant. On January 17, 2012, four victims started to file a damages suit against the humidifier disinfectant company and the government.

On February 3, 2012, the KCDCP finally confirmed that humidifier disinfectants were the cause of lung damage. On July 23, 2012, the FTC filed a complaint with the prosecution and imposed fines on four humidifier disinfectant vendors. On November 11, 2011, the KCDCP announced the humidifier disinfectant that has been ordered to be recalled, that is, the product that has been ordered to be recalled. These products are Oxy Ssac Ssac humidifier liquid (Hanbit Chemical), Sepu humidifier sterilizer (Butterfly Effect Co., Ltd.), Weislec humidifier sterilizer (Lotte Mart PB product/Yongma Industrial Co.), Homeplus humidifier cleaner (Homeplus PB product/Yongma industrial company), Atoorganic humidifier sterilizer (Atoorganic), and humidifier cleanup (Costco PB products/Glo&M). On April 28, 2016, the special investigation team of the Seoul Central District Prosecutor's Office in Korea summoned the representative of Sepu, a domestic humidifier manufacturer, for questioning (Park & Koh, 2020). In 2009, while selling its own humidifier sterilizer, Sepu marked "harmless to the human body and safe even when inhaled" at the bottom of the product. However, investigations have revealed that PGH (a chemical substance used in disinfectants) used as the main raw material for disinfectants contains toxicity that causes lung damage.

And suspicion arose that Oxy fabricated the harmfulness test report and gave back money to university professors. Police seized and searched Seoul National University and Hoseo University, and among them, someone, a veterinary poison professor at Seoul National University, was arrested on suspicion of bribery. When this fact was revealed, civic organizations and consumers voluntarily joined the boycott. In the early stages of the disaster, a social movement in response to the humidifier disinfectant disaster began as the ACCEH, a civic organization for environmental movement, set the agenda of receiving victims' reports, finding out the truth, and demanding compensation for victims (Park & Koh, 2020). Subsequently, social interest in the humidifier disinfectant disaster spread as victims' organizations, organized around the victims, informed citizens of the truth of the disaster and launched a campaign to demand truth-finding and compensation (Sun, 2018). In the end, the prosecution investigation and government investigation were conducted in 2016, the SARDCHD was implemented in 2017, and the "Special Commission on Social Disaster Investigation" was established in 2018.

In addition, Oxy's former CEO A and Sepu's CEO B, who caused the most casualties, were arrested due to this incident. Large marts that produced their own humidifier sterilizers, such as Homeplus and Lotte Mart, were included in the investigation. Sepu went out of business in 2011 when the humidifier disinfectant incident broke out, raising suspicions that other companies, including Oxy Reckitt Benckiser, were also withdrawing from business. Oxy Reckitt Benckiser denied the rumor that it was withdrawing from the business and said, "We are focusing on compensating for damages from humidifier disinfectants, and we are solving the problem company-wide, but there is no plan to withdraw." From January 16, 2017 to January 25, 2018, a total of three trials were held.

The former CEO of Oxy was sentenced to 7 years in prison for not confirming the fact that the humidifier disinfectant would have inhalation toxicity. On June 15, 2017, the special investigation team of the Seoul Central District Prosecutor's Office arrested and indicted Mr. C, the head of Oxy's research institute, on charges of manslaughter and manslaughter. From the end of 2003 to August 2011, Mr. C was accused of causing 70 deaths and lung disease in 105 people by allowing them to manufacture and sell humidifier disinfectants despite knowing the harmfulness. He was also accused of authorizing the marketing department of Oxy Reckitt Benckiser to use phrases such as 'use of ingredients safe for the human body' and 'safe for children' without scientific basis. Meanwhile, Oxy received damage cases from humidifier disinfectant users in 2007 and 2010, but it was investigated that Mr. A was ignored.

On June 24, 2017, a criminal trial was held against nine people, including employees of Lotte Mart and Homeplus, and the Supreme Court sentence was handed down on January 25, 2018. Homeplus Co., Ltd. was sentenced to a fine of 150 million KRW, and the head of Homeplus Grocery Purchasing Department and the Legal Management Team were each sentenced to 4 years in prison, and the remaining defendants were sentenced to 2 to 4 years in prison. On January 6, 2017, the court convicted 17 out of 19 former and current employees of a humidifier disinfectant manufacturer. Oxy Corporation, Lotte, and Homeplus were fined 150 million KRW for violating the "Act on Fair Labeling and Advertising". On January 20, 2017, the National Assembly passed the SARDCHD and ordered humidifier disinfectant manufacturers and raw material suppliers to pay a total of 125 billion KRW to the special relief account. The law enacted in February 2017 introduced a special relief account (financial source: KRW 125 billion for business contributions) to support victims who are not recognized for damage from humidifier disinfectants such

as HDLI levels 3 and 4 or who cannot receive compensation due to corporate bankruptcy (Kim et al., 2022).

On August 8, 2017, the President of South Korea made the first official apology and promised to expand damage relief funds in a meeting with victims of humidifier disinfectant. On August 9, 2017, a special law for damage relief from humidifier disinfectants was enacted. On September 8, 2017, Oxy Reckitt Benckiser paid a lump sum of KRW 67.4 billion for its contribution to the Special Relief Fund. On September 21, 2017, Rakesh Kapoor, chairman of the Reckitt Benckiser Group, met with the special committee of the National Assembly and the families of the victims at the UK headquarters to formally apologize to the victims. On December 19, 2017, the chairman of the FTC announced an apology after acknowledging the mistake of exonerating SK Chemicals and Aekyung in the process of dealing with the humidifier disinfectant issue. On August 9, 2018, an amendment to the SARDCHD was approved and entered into force on February 15, 2019 (Park & Koh, 2020).

## **4. Research Ethical Issues in the Humidifier Disinfectant Incident**

### **4.1. Research Ethics Issues for Public Health**

The humidifier disinfectant incident first became a big social problem in 2011 as pregnant women and infants who were vulnerable to health died one after another. On August 31, 2011, the KCDCP, announced that, as a result of an epidemiological survey of maternal patients admitted to a general hospital in Seoul, the possibility of lung damage of unknown cause was 47.3 times higher when humidifier disinfectants were used (Im, 2018). Among the total of 94 deaths, Oxy manufacturers included 70 of them. Other manufacturers include Lotte Mart with 16, Butterfly Effect with 14, and Homeplus with 12. In 2011, as the number of deaths increased and the situation grew, Oxy manufacturing company completely eliminated the existing company corporation and established a new corporation. Also, in 2011, as soon as the KCDCP announced that humidifier disinfectant appears to be a factor in the lung disease that caused the fatal accident, Oxy is known to have requested research results from research teams such as Seoul National University to produce a research report favorable to them.

Yoon et al. (2017) analyzed the organizational culture of companies and governments as an important factor in the occurrence of humidifier disinfectant disasters through a literature review. This science and technology research examines the elements of the bureaucratic organizational culture of corporations and governments, namely structural

secrecy, cubicle culture, internal communication and disconnection of feedback (even within the Oxy, the regulatory department raised issues about the risk, but Oxy no communication with the Customer Satisfaction Center). It was revealed that the same things became routine and led to the humidifier disinfectant disaster (Kim et al., 2019). Oxy issued an apology in 2011 when the prosecution investigation began in this regard and said that Oxy felt a sense of social responsibility. However, Oxy denied the allegations raised during the investigation. Rather, it is said that Oxy gave an opinion to the prosecution that yellow dust could be a factor in death.

The Seoul National University research team cannot be free from the aspect of research ethics. Seoul National University Professor D's team conducted a low-concentration experiment of PHMG, a harmful substance, with Oxy manufacturing company's research service, and reported an interim report that 13 out of 15 pregnant mice died due to the humidifier disinfectant. Summarizing the words of the prosecution and the Seoul National University professor who conducted the harmfulness test of Oxy products, Oxy announced in August 2011 that the KCDCP announced the results that 'humidifier disinfectant is a risk factor for lung disease'. The professor's team was commissioned to conduct a toxicity test of poly-hexamethylene-guanidine (PHMG), a raw material for humidifier disinfectant. A month after the request for research, a midterm fertility experiment with pregnant mice revealed that "out of 15 pregnant mice, 13 pups died in the belly" (Park, 2016).

However, a research team led by a professor D at Seoul National University made a separate report at Oxy's request, but it is known that additional research is needed as the causal relationship between humidifier disinfectant and lung disease is not clear. This is why it is pointed out that if the Seoul National University research team had not broken research ethics, the situation would have been settled early and many people would not have died. In December 2018, the Research Integrity Committee of Seoul National University pointed out Professor D's intentional data omission as an act of research misconduct, and socially considered it as an incident that research misconduct should be strictly regulated.

In December 2020, the government's "Special Commission on Social Disaster Investigation" and the Seoul National University Research Integrity Committee in December 2018 considered professor D's act of omitting research data as research misconduct. In addition, this committee proposed a written opinion with the position that disciplinary action and punishment are necessary because

research misconduct is strictly regulated in society. Meanwhile, in 2011, Professor D of Seoul National University was indicted by the prosecution for arbitrarily manipulating the experiment report to the effect that there was no causal relationship between Oxy's humidifier disinfectant and human lung damage, and receiving 12 million KRW in return. In 2016, D was also handed over to trial on charges of unfairly receiving 56 million KRW for goods regardless of research on humidifier disinfectant at the Seoul National University Industry-Academy Cooperation Foundation.

#### **4.2. Moral Hazard in Government**

In the previous government, the government and administrative agencies such as the Ministry of Environment, which were the governing bodies, could be said to be accomplices of humidifier disinfectant manufacturers. And, it was confirmed that the head of the Oxy research institute, who was arrested in this case, served as a member of the government's industrial product safety review committee from 2003 to 2006. It is absurd that an executive of a company with an interest enters the government's regulatory committee that is supposed to supervise the company. In this case, the responsibility of the government and relevant institutions for not properly managing hazardous chemicals is high. Basically, it is a problem of serious policy failures in which the government has neglected the management of hazardous substances, putting innocent citizens in a fatal situation where they lose their lives and are revived only with lung transplantation (Choi et al., 2012).

#### **4.3. Suspicion of Experimental Manipulation of Humidifier Disinfectant Toxicity**

Seoul National University's humidifier disinfectant toxicity study already concluded in 2012 that humidifier disinfectant does not have a significant adverse effect on the human body. Even the results of their research are even more serious because they were used as decisive evidence to defend Oxy during the trial. In other words, there is also a suspicion that the manufacturer manipulated the research to suit the taste of the perpetrator and used the results as false evidence. There is an "unethical" situation in which companies like Oxy sell products that are obviously lethally toxic, and intervene in their favor with experimental data to protect the organization even after the cause of the problem has been identified (Hong, 2018).

In 2016, South Korean prosecutors found that research results conducted by a research team at Seoul National University on behalf of Oxy Reckitt Benckiser were fabricated. The prosecution summoned and investigated

Professor D of Seoul National University's Veterinary Medicine College, focusing on excessive research expenses. On April 15, 2016, during the prosecution's investigation, it was confirmed that tens of thousands of KRW of unidentified money was deposited from the Oxy side into the personal account of the Seoul National University D professor at the time of the 2012 research. Professor D of Seoul National University is known to have admitted that he received tens of thousands of KRW during the investigation. Prosecutors said they also obtained statements from related persons that Oxy asked the Seoul National University research team to conduct an experiment and asked them to reduce toxicity in the research results (Kim, 2021).

In December 2018, Seoul National University concluded that it violated research ethics. It has been two years since they started their own investigation. The Seoul National University Research Integrity Committee found that experimental data that had not been revealed in court was manipulated or entered incorrectly. The Seoul National University Research Integrity Committee said, "The act of manipulating research data by arbitrarily changing or omitting research data constitutes research misconduct. Research data were reduced and distorted to derive untrue research results. The degree of violation of research integrity is judged to be very serious" (Mukherjee, 2016).

To summarize, Oxy entrusted the research service to the veterinary school of Seoul National University and gave 200 million KRW for the research service. Professor D of Seoul National University was requested to remit the additional tens of thousands of KRW and fabricate the research results, and the suspicion that the professor manipulated the toxicity test results in accordance with this request materialized. Professor D of the College of Veterinary Medicine at Seoul National University received Oxy's request and submitted a research report favorable to Oxy, concluding that "the causal relationship between the humidifier disinfectant and the fact of damage is not clear." Oxy is known to have deposited tens of millions of KRW into Professor D's personal account under the name of 'consultation fee' in addition to the 250 million KRW in research service expenses for this experiment (Lee, 2019).

On May 4, 2016, the special investigation team of the Seoul Central District Prosecutor's Office raided the homes of Seoul National University and Hoseo University research labs and related professors, and urgently arrested Seoul National University Veterinary Medicine Professor D on charges of destroying evidence and taking bribes.

There are three main areas of concern in this section. The first is the issue of fabrication of results, which is the suspicion that the study results were fabricated through

deliberate selection of results. There is suspicion of evidence destruction in this part, and even if there is a full result, it is not easy to prove it, so it is highly likely that it will end in insufficient evidence. The second was excessive research service expenses, which was the subject of investigation by the prosecution in the early days. It is doubtful whether this itself has the nature of a bribe. Third, tens of thousands of KRW were additionally remitted to the individual accounts of professors at Seoul National University and Hoseo University, respectively. Although an investigation is required, it is unlikely to be cleared of bribery charges for that part.

#### **4.4. Judgement Result in Humidifier Disinfectant Toxicity Test**

In May 2016, the special investigation team of the Seoul Central District Prosecutor's Office prosecuted Seoul National University and Hoseo University laboratories and related professors, and the trial results are as follows. On September 29, 2016, the first trial sentenced Professor D of Seoul National University to two years in prison, a fine of 25 million KRW, and an additional fine of 12 million KRW (Kim, 2021). Accordingly, Professor D was arrested and indicted on charges of fraud, falsification of evidence, and fraud after accepting bribes for omission of data and fraudulent research funds during the prosecution's investigation into the humidifier disinfectant case in 2016. In September 2016, he was found guilty of all three charges in the first trial court and sentenced to two years in prison and a fine. However, in April 2017, the second trial court found that the omission of data was not cheating, and acquitted the fraudulent treatment and falsification of evidence after taking the bribery, and convicted the assistant professor on the charge of fraud (Lee, 2019).

This is the first judgment in the case of death from humidifier disinfectant (Lee, 2016). The court judged that the case report prepared by the defendant was one of the obstacles to identifying the cause of the damage, delaying the investigation of the truth, and adding to the pain of the family members of the humidifier disinfectant victims who were blaming themselves for not knowing the cause. Even the results of Seoul National University's research turned out to be a socially serious problem because they were used as decisive evidence to defend Oxy during the trial. In other words, he was suspected of manipulating the research to suit the offender and using the results as false evidence. The prosecution summoned and investigated an assistant professor D at Seoul National University's College of Veterinary Medicine, focusing on excessive research service expenses, and also conducted an investigation at Hoseo



University, reporting that the above research manipulation had occurred (Park, 2013).

Later, on October 14, 2016, Professor E in the Department of Food and Nutrition at Hoseo University, who was arrested and indicted for receiving money in return for writing an experiment report favorable to Oxy Reckitt Benckiser (Oxy), was sentenced to prison (Lee, 2016). The Seoul Central District Court's Criminal Justice Department sentenced him to 1 year and 4 months in prison and an additional fine of 24 million KRW, saying, "All of the crimes of breach of trust and fraud applied to Hoseo University Professor E are recognized as guilty."

However, on April 28, 2017, the judgment of the second trial reversed the first trial (not guilty of fraudulent conduct after taking bribes and forgery of evidence) and only admitted fraud charges, and sentenced to 1 year in prison and 2 years of probation. Regarding the charge of fraudulent treatment after receiving a bribery, the court of the second trial judged that the fact that the defendant initially conducted the inhalation toxicity test and the reproduction toxicity test separately could not constitute an act of violation of duties while conducting research in this case (Kim, 2021). In addition, the defendant excluded the control group, which was additionally conducted using deionized water in the final report, from the test results, and it was judged that excluding the interstitial pneumonia item could not be regarded as a dishonest act in violation of duties.

Regarding bribery, the court judged that the amount of 12 million KRW in the form of consulting fees received by the defendant was insufficient to be regarded as having the nature of compensation for duties related to the research in this case beyond the nature of consulting fees only with the evidence submitted by the prosecutor. However, in connection with the crime of fraud, it was judged that the research fund in this case was paid to the Seoul National University Industry-Academic Cooperation Foundation, which was the owner of the research fund in this case and was the victim. As for the intention to illegally acquire the crime of fraud, it is sufficient to have the intention to infringe on ownership, etc., and it is not necessary to have the intention to acquire property for one's own benefit (Kim, 2021). It could not be said that he had no will to do so, so he was judged guilty. Therefore, in the second trial, the Seoul National University Professor D, who had been sentenced to prison in the first trial, was acquitted in part on the charge of fabricating the report in the appeals court (guilty in the fraudulent part of the research item payment), and the sentence was rather lowered with a suspended sentence.

However, around April 2019, it was again revealed by the media that the Seoul National University Research

Integrity Committee had finally decided that Professor D's humidifier disinfectant toxicity experiment had been manipulated. According to Seoul National University, which re-examined the professor D's humidifier disinfectant toxicity test at the time, it was considered that the test animal was falsely written as if it had not lost weight rapidly (Lee, 2016). In addition, even though interstitial pneumonia occurred during the experiment, it was not recorded in the final report, and this was an obvious misconduct by changing/omitting data, and it was considered that "the degree of violation of the integrity of the study was judged to be very serious." Therefore, it was the view that there was a problem with the partial acquittal in the fabrication charge.

On April 29, 2021, the Supreme Court ruled that the professor D received a bribe of 12 million KRW from Oxy in the name of consulting fees and made a report with new contents by omitting experimental data unfavorable to Oxy, etc., and found it not guilty of falsifying evidence and fraudulent acts. final verdict. However, the original verdict was confirmed as guilty of 'fraud' that the research funds were defrauded as if they were expenses spent on research while using them for purposes unrelated to research (Supreme Court 2021. 4. 29. Decision 2017 Do7138). The 3rd Criminal Division of the Supreme Court confirmed the lower court sentenced to 1 year in prison and 2 years of probation for Professor D, who was charged with bribery and other charges (Park, 2016). It was decided that it was difficult to admit that the professor in question committed dishonest acts in violation of his/her duties while conducting research on this case and writing the final report, or forged evidence regarding another person's criminal or disciplinary case. In addition, the Supreme Court accepted the lower court's judgment of innocence because the evidence submitted by the prosecutor was insufficient to admit that the consulting fee received by the defendant went beyond the nature of the consulting fee and had the nature of a reward for the duties related to the research in this case.

On the other hand, it is known that there were two research institutes, Seoul National University and Hoseo University, that were able to carry out that kind of research service at the time. In other words, the same research manipulation as above occurred in Hoseo University. On September 26, 2017, the Supreme Court upheld the lower court sentenced to 1 year and 4 months in prison and an additional fine of 24 million KRW to Professor E of the Department of Food and Nutrition at Hoseo University, who was accused of breach of trust and other charges (Lee, 2016). From October 2011 to September 2012, Professor E of Hoseo University received 24 million KRW in the name of consulting fees from Oxy and was arrested and indicted for manipulating the experimental results in favor of Oxy. The

prosecution found that Professor E of Hoseo University opened a window at the home of an Oxy employee at the end of 2011 to test the inhalation toxicity of a humidifier disinfectant in order to obtain favorable experimental results. In addition, the professor is accused (fraud) of receiving and intercepting 68 million KRW from the Hoseo University Industry-University Cooperation Foundation, including inflated labor costs, including the researchers. The 1st and 2nd trial sentenced him guilty, saying, "The 24 million KRW in advisory fees that Professor E of Hoseo University received was an implied request to conduct experiments in a direction favorable to Oxy." He also judged that even if there was no personal embezzlement of the fraud charge, it was sufficient to be considered fraudulent. The Supreme Court Justice said, "Even if the contents of the final report are not false, a crime is constituted if payment is received for improper solicitation." The Supreme Court judged, "As a university professor, he had to maintain his fairness and objectivity, but he received unjust solicitations and received money, greatly damaging the trust of society in general."

## 5. Conclusions

Research ethics of researchers or professors must be followed in any case. In particular, if the research results cause a lot of health or economic damage to many unspecified people, the research misconduct of the researcher goes beyond the ethical aspect and constitutes an irreversible criminal act to the state or society. Rather, if the researcher did not break the research ethics, the situation would have been settled early and many people would not have died, which is why research ethics are emphasized and pointed out. Research integrity refers to a kind of undesirable behavior. The meaning of this term is still being debated, and in particular, the biggest problems with maintaining research integrity are cases of fraudulent acts of fabricating, falsifying, or plagiarizing data (or theories).

As the humidifier disinfectant case became an issue for a long time through the media, a policy advocacy coalition was formed. Policy advocates acted as a learning facilitator as they exerted pressure on policy makers with the people's interest in the incident (Lee & Son, 2012). It is an irrational logic that companies and governments admit that humidifier disinfectants are toxic substances that are strong enough to damage the lungs, but cannot admit that they cause 'pneumonia'. It is the same that Seoul National University and Hoseo University humidifier sterilization experiment professors received money and valuables from Oxy company in common and fabricated and transformed the research results through fraudulent acts.

However, in the final verdict of the Supreme Court, the professor of Seoul National University was found not guilty and the professor of Hoseo University was found guilty. Although the legal situation or interpretation of analyzing and judging research misconduct may be different, what is clear is that both professors violated research ethics. This is because it falls under forgery and falsification among the 7 representative types of research misconduct. Research ethics is to conduct research based on the researcher's academic integrity, bioethics, and ethical standards of research, not by legal standards and grounds. In the future, it is necessary to present case-oriented education and guidebooks for research ethics education. As with other applied ethics education, research ethics education is necessary focusing on ethical conflict cases or hypothetical cases that occurred in the actual field in the research ethics curriculum. It is important to gain insight into the positions of the stakeholders one by one and share their opinions on which decision is the fair and reasonable.

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