



## **THE USE OF POTASSIUM CYANIDE TO CATCH FISH IN BENGAWAN SOLO RIVER, INDONESIA: THE PERSPECTIVE OF HEALTH LAW**

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### **Abstract**

Even though it is commonly known that the use of potassium cyanide is prohibited to catch fish, fishermen in Bengawan Solo River, Central Java, Indonesia still freely use it. This is due to the government's limited capability in supervising the fish-catching activity in this river. The potassium cyanide poison is massively used to ease the process of catching fish. Considering that potassium cyanide poses high dangers to humans and the environment and that there are already regulations that prohibit its use to catch fish, there needs to be strict enforcement of these policies. This law enforcement can be carried out by putting up signs around the banks of the Bengawan Solo River concerning the prohibition laws as well as socializing the legal method of catching fish in that river. After announcing and socializing the laws, legal actions may be imposed through imprisonment or fines according to the legal regulations.

**Keywords:** Potassium Cyanide; Fish; Rivers; Environment.

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## 1. Introduction

Even though it is commonly known that the use of potassium cyanide (locally called *potas*) is prohibited, fishermen in Bengawan Solo River, Central Java Province, Indonesia freely use it to catch fish. This is due to the government's limited capability in supervising the fish-catching activity in this river. The potassium cyanide poison is massively used to ease the process of catching fish. Potassium cyanide is a chemical compound containing the CN compound group, with a carbon atom that is bound to three nitrogen atoms. The CN group is found in many compounds. Some take the forms of solids, gas, or liquid. Some others are in the form of salts, covalent, and molecules. Some are ionic, while many are polymeric [1].

Cyanide refers to the  $CN^-$  anion that can form the hydrocyanide acid. Cyanogen is formed from the oxidation of the cyanide ion. But the term "cyanogen" also comes to refer to a substance that forms cyanide in metabolism that produces a biological effect [2]. A cyanide (HCN, NaCN) is a compound which is dissociated with a cyanide anion ( $CN^-$ ) and ( $H^+$ ,  $N^+$ ) cations. Nitril is an organic compound that contains cyanide. Cyanogen usually refers to nitrile that dissociates with a cyanide anion ( $CN^-$ ) during metabolism, resulting in a biological effect [3].

Fish-catching activities using potassium actually harm fishermen, as they threaten the sustainability of the fishermen's business [4]. This method of catching fish influences the river fish ecosystem which holds a crucial role, especially for small-scale traditional fisheries in Bengawan Solo River, Central Java. The value of these small-scale fisheries often lacks consideration as most fishermen catch fish only to fulfill their daily needs. Thus, the statistics on the number of small-scale fishermen are often left unrecorded by the government. The fish-catching activity using toxic materials such as potassium cyanide carried out by fishermen violates the Republic of Indonesia's fish-catching code of ethics and regulations [5].

The fish-catching process using the poisoning technique cannot be separated from the use of the V synthetic chemical substance that brings negative impacts to target and non-target fish as well as the ecosystem. Rubec et al stated that fish exposed to potassium cyanide will experience shortness of breath (dyspnea) even if they have been moved to clean water. Apart from that, the fish-catching process using potassium cyanide has been proven to damage the river fish ecosystem. When carried out in the sea, this method can damage coral reefs [6]. The exposure of sea coral reefs to cyanide for ten minutes can kill them in seven days. Then, in lower concentrations, it can cause the release of zooxanthellae which formed a symbiosis with

corals. The photosynthesis capacity will be disturbed. This may cause corals to die within a longer period.

The crime of catching Fish using potassium cyanide is a concerning issue as it brings impacts that harm society. This crime threatens the sustainability of society's lives as it is closely linked to the mutualism symbiosis between humans and the natural environment. This is because the use of fish stun and potassium cyanide can damage the environmental ecosystem and harm other creatures living in the river [7].

The use of potassium cyanide is ever popular among Bengawan Solo River fishermen as it is cheap and easy to use. Some of the fish commonly caught using potassium cyanide are cultivated fish such as Nile tilapia fish (*Oreochromis niloticus*), striped catfish (*Pangasius hypophthalmus*), and Java barb (*Barbodes gonionotus*). Locals catch fish using the potassium cyanide poison because it makes the fish easily obtainable without killing them. The fish is caught by poisoning them using chemical substances in the form of liquid potassium cyanide (KCN) which is very toxic. Apart from targeting cultivated fish, the use of the potassium cyanide poison also targets endemic fish such as local striped catfish (*Pangasius jambal*), Asian redbtail catfish (*Mystus nemurus*), shark catfish (*Pangasius macronema*), and blue sheatfish (*Cryptopterus spp*) [8].

The state of the Republic of Indonesia has prohibited the catching of fish using fish stuns. This state has issued regulations on this, starting from the highest level to the lower-level regulations. Sanctions and punishments vary for every crime perpetrator and they are proportional to the crime committed [9].

The prohibition of catching fish using chemical substances (potassium cyanide) has been regulated in the Republic of Indonesia's Law No. 45 of 2009 on the change of Law No. 31 of 2004 on Fisheries. One of its regulations is Article 8 clause (1) of Law No. 45 of 2009 on Fisheries which states, "Everyone is prohibited from carrying out fish catching and or fish farming using chemical substances, biological materials, explosives, instruments, and or methods, and or buildings that can harm and or endanger the sustainability of fish resources and or its environment in the Republic of Indonesia's marine territory".

Law No. 45 of 2009 on Fisheries Article 84 regulates the threats of sanctions for anyone who catches fish using potassium. It states, "Anyone that purposefully, in the fishery management territory of the Republic of Indonesia carries out fish-catching or fish-farming using chemical substances, biological materials, explosives, instruments and or methods, and or buildings that can harm and or endanger the sustainability of fish resources and or its environment as aforementioned in Article 8

clause (1) is imprisoned with a maximum imprisonment of 6 (six) years and fines with the maximum amount of Rp.1.200.000.000,00 (one billion two hundred million rupiahs).”

The mentioned stipulations of Article 8 clause (1) of Law No. 45 of 2009 on Fisheries prohibit any individual or legal entity to carry out fish-catching or fish-farming using chemical substances and the like that can harm the sustainability of fish resources and its environment [10]. Thus, policies that orient towards public health must be emphasized [11].

## **2. Methods**

This research applied the normative juridical method [12]. This was qualitative research which used the descriptive analysis method which aimed to analyze the act of illegal fish-catching using potassium hazardous chemical substance and which impacts the catch in Bengawan Solo River, Surakarta and Sukoharjo Regencies, Central Java Province, Indonesia. The sources of information were the data collected from literary studies [13], where the researchers analyzed previous research documents using the qualitative research technique of analysis [14]. Through the analysis, the data were interpreted using qualitative sentences or descriptions [15]. From the results of that data analysis, researchers drew a final conclusion on the research. The researchers employed the validity technique of trust data using the techniques of accurate observation, triangulation, referential adequateness dependency, and certainty. This research analyzed the catching of fish in the Bengawan Solo River using the perspective of health law [16].

## **3. Results and Discussion**

Potassium cyanide brings many negative impacts. According to the standard of WHO (2004), the PTWI (Provisional Tolerable Weekly Intake) of cyanide in human bodies is 0,02 parts per million (ppm) in a day. The PTWI is 0,05 ppm for potassium cyanide.

Thus, the cyanide contents in the bodies of fish and shrimp caught from Bengawan Solo River exceed the maximum dosage. This means that it is dangerous and it may disturb consumer health. Some types of cyanide in waters will become highly dangerous compounds when they accumulate through the toxins consumed by fish.

Therefore, there is a great chance that these compounds are absorbed by humans as they impact the fish consumed by humans according to the food chain process. The WHO (2004) states that the CN concentration of 0,05 milligrams per deciliter (mg/dl) or 0,05 ppm in blood will bring intoxication

effects to the body. Then, if the concentration is higher than 0,3 mg/dl it will cause death [9].

Water pollution due to cyanide waste often attracts the special attention of many parties. This is because this issue may cause chronic poisoning to biota in river waters [17]. Cyanide has long been known as a toxin as it can disturb the functions of the brain and heart. It can become an obstacle to the respiratory tissues. Anyone exposed to it may experience the sensation of being strangled and it can quickly lead to death.

The toxic effects of heavy metals and chemical substances are difficult to detect in humans as their reactions do not immediately emerge after they enter the body. Many disorders such as tumors, fetus abnormality, and heart or kidney diseases occur a long time (even years) after chronic pollution. Even, at that time, a case-by-case causal relationship cannot be determined. This is because such disorders may also immediately occur, similar to diseases. This can only associatively be linked in an epidemiological study [18].

Potassium cyanide is a type of toxin that reacts most quickly. When consumed by humans, this material can paralyze the oxygen transport system. Even, in higher dosages, it can weaken the heartbeat and stop the electrical activities in the brain, leading to death [19].

The influence of this toxin on fish is not limited to making them intoxicated and then suffocate and die [20]. But it has other influences such as hindering growth and development, preventing the development of metabolism, and making fish biota cells become dry and in the end die. Potassium cyanide may also be accumulated in invertebrate animals, including coral reefs and the river environment. Thus, it is difficult to recover the damages made. This condition significantly influences the environment [21].

Based on the data of the results of potassium cyanide (KCN) content examination in fish, it was known that in many locations where fish samples were caught, the cyanide contents have exceeded the threshold in waters determined by governmental regulations. In Governmental Regulation No.82 of 2001 (class II) on Water Quality and Water Pollution Control Regulations, the maximum (CN<sup>-</sup>) cyanide level allowed is 0,02 mg/L. Alert and Santika state that the maximum (CN<sup>-</sup>) cyanide level allowed in waters is 0,02 mg/L [22].

Potassium cyanide takes the form of white powder. The symptoms that occur from exposure to this chemical substance vary, starting from pain in the head, vomiting and nausea, shortness of breath, chest palpitations, and always perspiring. It can even make the victim unconscious. If victims are not immediately handled well, they can die. The management of intoxication victims must be carried out quickly. This is because the prognosis from the

therapy administered highly depends on the duration of contact with this toxic substance.

The main effect of cyanide is the occurrence of tissue hypoxia that may progressively occur. The physical symptoms and signs highly depend on the dosage of cyanide and the amount of cyanide exposure. Cyanide can cause many symptoms in the body, including affecting blood pressure, sight, lungs, the central nervous system, the heart, the endocrine system, the autonomous system, and the metabolism system.

Many victims complain about the occurrence of sore eyes due to irritation and difficulty in breathing due to the irritation of the breathing tract mucosa. Cyanide gas is highly dangerous when exposed to high concentrations. In merely fifteen seconds, the body will respond with hyperpnea. Then, fifteen seconds after that, a person will lose consciousness. Only three minutes after, that person will experience apnea. In five to eight minutes, it will inhibit the activities of the heart muscles due to hypoxia and end in death.

Cyanide may bind and inactivate some enzymes. But what causes death is cyanide's property that binds the active part of the cytochrome oxidase enzyme, causing the aerobic cell metabolism to stop. In consequence, in only several minutes, it will disturb neuronal transmission. Cyanide may be excreted through several processes before reaching the cell. This toxic substance may penetrate the cell membrane. The process has the highest role in the formation of cyanmethemoglobin as a result of a reaction between the cyanide ion and methHb.

In low concentrations, the effect of cyanide will only occur fifteen to thirty minutes after. Thus, the victim may still be saved with the administration of an antidote. Early symptoms of cyanide are temporary hyperpnea, headache, dyspnea, anxiety, behavioral change such as agitation and anxiousness, abundant perspiration, reddish skin color, and the body feeling weak. Vertigo may also occur [23].

End symptoms that characterize that there is an emphasis on CNS are going into a state of coma, pupil dilatation, tremor, arrhythmia, convulsions, emphasis on the respiratory center, respiratory failure, and up to the cardiac arrest. But these symptoms are not specific for those poisoned by cyanide. Thus, it makes it difficult to undergo an examination if victims do not have a history of being exposed to cyanide. The toxic effect of cyanide is blocking the obtainment and use of oxygen. This will lead to a low level of oxygen in the tissue.

In the funduscopy examination, it can be seen that the artery and vena retina have a bright red color due to the low oxygen delivery to the tissue. The increase of the oxygen level in the vena blood vessels will cause the skin to show a cherry-red color. But this symptom does not always occur [24]. Prosecution in the form of well-enforced legal policies should

immediately be carried out to prevent victims of potassium cyanide poisoning perpetrated by fishermen in Bengawan Solo River. People need to obtain socialization that eating fish that was obtained through poisoning potassium cyanide is highly dangerous for the body and can cause poisoning and even death.

#### **4. Conclusion**

Considering that potassium cyanide poses high dangers to humans and the environment and that there are already regulations that prohibit its use to catch fish, there needs to be strict enforcement of these policies. This law enforcement can be carried out by putting up signs around the banks of the Bengawan Solo River concerning the prohibition laws as well as socializing the legal method of catching fish in that river. After announcing and socializing the laws, legal actions may be imposed through imprisonment or fines according to the legal regulations.

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