THE INVOLVEMENT IN THE CANAL WATER POLLUTION MANAGEMENT

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Abstract

Canal water pollution management is a collaborative effort involving government agencies, local communities, industries, NGOs, and academic institutions. Government agencies set regulations and provide funding for pollution control initiatives. Local communities engage in educational programs and lead clean-up efforts, fostering awareness and responsible waste disposal. Industries can reduce their pollution by adopting sustainable practices and supporting local initiatives through Corporate Social Responsibility (CSR). NGOs advocate for environmental health by researching pollution sources and mobilizing community action. Academic institutions offer valuable research that guides management practices. Public participation enhances accountability and encourages sustainable resource management. Integrated approaches that address the interconnectedness of pollution sources are essential for effective management. Ultimately, successful canal water pollution management depends on the cooperation of all stakeholders, leading to solutions that protect water resources and ensure the sustainability of canal ecosystems.

Keywords: Involvement; Management; Canal water Pollution

Introduction

Water pollution is a complex issue with widespread impacts, resulting from various human activities in industry, agriculture, and daily life. Natural water sources, such as rivers, lakes, and oceans, are often used as disposal sites for waste, including industrial wastewater containing hazardous chemicals, heavy metals, and toxic substances, as well as community waste, such as sewage, household waste, and chemical contaminants from washing. If these pollutants are not adequately treated before entering natural water bodies, they can degrade water quality, creating foul odors and discoloration, and deplete oxygen levels necessary for aquatic life.

When these contaminants reach water sources, toxic substances accumulate in sediment and water, damaging ecosystems by causing fish deaths, a decline in aquatic populations, and loss of biodiversity among plants and animals. Chemicals and pesticides from agricultural areas can also wash into water bodies during rainfall. These waters often contain nitrates and phosphates, leading to rapid algae growth. Excessive algae growth depletes oxygen in the water, creating hypoxic conditions that make it difficult for aquatic animals to survive. This phenomenon, known as eutrophication, is a significant issue that has degraded rivers and lakes worldwide. Water pollution also impacts humans both directly and indirectly. People living near polluted water sources are at risk of exposure to toxins that can accumulate in their bodies, leading to health issues such as skin diseases, respiratory disorders, and cancer. Sometimes, toxins enter the food chain through bioaccumulation in aquatic animals consumed by humans, such as heavy metals like mercury and lead found in fish or marine life. When ingested, these metals can accumulate in the human body, affecting the nervous system and internal organs. Moreover, water pollution has economic impacts, such as reduced fisheries due to declining aquatic populations and tourism loss due to polluted or contaminated water sites. This issue also increases government expenditure on pollution treatment and remediation efforts. Water pollution requires comprehensive management and environmentally friendly practices to maintain ecological balance in the long term. Solutions include advancing wastewater treatment processes, reducing chemical use, and raising community awareness about water conservation and pollution prevention. The United Nations has a sixth goal: to guarantee access to water and sanitation for all. Access to clean water, sanitation, and hygiene are

the most basic human needs for health and well-being. Billions of people will not have access to these basic services by 2030 unless progress is made to quadruple the demand for water due to rapid population growth, urbanization, and increased demand for water from the agricultural, industrial, and energy sectors. Thai people can access more drinking water, which can be seen from the following statistical data: The proportion of household members using clean water sources for drinking has increased from 98% in 2016 to 99.5% in 2019. And the proportion of family members who have dedicated hand-washing facilities where water, soap, or other cleaning products are available. The proportion of family members who use sanitary toilets and do not share toilets with other households has increased from 81.2% to 89%. Water quality remains a major issue that needs improvement. From 2010 to 2019, household water consumption accounted for only 97.1%. 34.3% of the quality is suitable for consumption, 49.1% of the quality must be improved before consumption, and 16.6% of the quality is not suitable for consumption. (Office of the National Economic and Social Development Commission, 2021)

The Constitution of the Kingdom of Thailand B.E.2560 (2017) emphasizes the participation of the people in governing the country. According to Article 57 (2), the state must protect it. They are protecting, maintaining, and restoring natural resources, environment, and biodiversity. Local communities participate in operations and benefit from them. In addition, the country must involve the people in its development. In public service challenges, public auditing, anti-corruption, and political decision-making in government operations, local administrative organizations must disclose information to the public and report results. And there is a mechanism for local people to participate. (Government Gazette, 2017) Moreover, the expansion of industrial and residential facilities in the region has led to escalating pollution challenges, underscoring the need to balance economic development with environmental conservation. By involving the community in pollution management initiatives, there is an opportunity to foster a sense of shared responsibility and ownership for preserving the local environment while promoting sustainable development practices. Furthermore, community participation aligns with national and global development agendas, including the Sustainable Development Goals (SDGs) and the Constitution of the Kingdom of Thailand, which emphasize the importance of public engagement in governance, environmental protection, and sustainable development. By actively involving community members in

decision-making processes, there is potential to harness local knowledge, resources, and capacities to develop effective and context-specific solutions to water pollution challenges.

Participation in canal water pollution management involves a collaborative effort from various stakeholders, including government agencies, local communities, industries, non-governmental organizations (NGOs), and academic institutions. Each group plays a vital role in creating effective strategies to address the complexities of canal pollution. Government agencies set regulations and enforce compliance, ensuring that industries and communities adhere to standards aimed at reducing pollutant discharges. They also provide funding for initiatives focused on pollution reduction and infrastructure improvements. In summary, successful canal water pollution management relies on the collaborative efforts of all stakeholders, enabling effective solutions to mitigate pollution, protect water resources, and ensure the sustainability of canal ecosystems for future generations.

Concept of Management

Management generally has the characteristics of a process, the determination of steps in performing work, or a sequence of items in management in the administration. There must be a sequence of items first. What must be done first, and what will be done next? This is considered a principle of the scientific method. The management process determines the scope. And duties according to various steps clearly stated in administrative work; there are philosophers, academics, and administrators in the country. Abroad, as well as educators, the concept of management process has been given as follows:

Phra Dhammakosajarn (Prayoon Dhammajitto) (2006) Mention management is a method of doing work (Getting things done through other people) and says that the duty of executives is the framework for successful consideration of executives. There are five factors, according to the English abbreviation "POSDC", as follows:

1. P is Planning means planning is setting operational guidelines for success that will follow in the future. Good executives must have a broad vision to determine the direction of the organization.

2. O is Organizing means organizing an organization, determining the structure of relationships of members and the chain of command within the organization. There is a division of labor and decentralization.

3. S is Staffing, meaning personnel work, recruiting new personnel, developing personnel, and using people appropriately for the job.

4. D is Directing, meaning administration and communication to bring about action according to the plan; executives must have good human relations and leadership skills.

5. C is Controlling, meaning supervision is controlling the quality of work within the organization, including the process of solving problems within the organization.

Sano Tiyao (2001) Mentioned five important principles of management:

1. Management is working with people and relying on people. This means that management is a social process, a group of people working together to achieve organizational goals. Executives must be responsible for success through the cooperation of others. Otherwise, it will not work successfully. The essence of management in this matter shows that Successful executives must have several things in mind. These are having good interpersonal relationships. Have leadership and can work as a team. Ability to adapt to the environment if circumstances change and can make the work achieve its goals.

2. Management makes work achieve organizational goals. The goals or objectives of the organization must rely on the cooperation of all people to achieve its goals. Executives must have three important characteristics to achieve them. First, the goal must be high and can be made successful. A goal that is too high will not be successful. A goal that is too low will not be challenging or valuable. Second, to reach the goal, there must be a good work system and an effective plan. Lastly, the time must be specified to achieve that goal.

3. Management is a balance between effectiveness and efficiency. The word effectiveness. It means to work and achieve results as specified. The word "efficiency" means to work by using resources economically or at the lowest cost. It is not enough to just succeed in completing a task. Consider the cost savings as well. To achieve both, the work achieves the desired results and uses

minimum resources, thus striking a balance between effectiveness and efficiency.

4. Management is the use of limited resources for maximum benefit. It is known in general we live in a world with limited resources. Therefore, we must be aware of two main things. That is, when any resource is used, it will be depleted and cannot be reclaimed, and you must select resources appropriately and not let them be wasted. Therefore, management and economics are closely related. Economics is the study of distribution. How do you use limited resources? As for executives in the organization, they must produce products and manage them efficiently and effectively.

5. Management must face a changing environment. Executives who experience success requires being able to correctly predict changes that will occur and can adjust itself to those changes.

Concept of Water Pollution

Water pollution significantly impacts both humans and the environment, as water is essential for sustaining life. Water is used for domestic, agricultural, and industrial purposes, and once used, it is often discharged back into natural water sources. This cycle becomes problematic when water is consumed and released as wastewater in high volumes from households, agriculture, and industry, exceeding the natural water body's capacity to recover. Consequently, water quality deteriorates, eventually turning into polluted or toxic water. Aquatic life that once thrived in these waters can no longer survive. Degraded water quality alters its natural properties due to the presence of pollutants. Such water is unsuitable for aquatic life and unfit for human consumption and use. Examples include water with unusual coloration, foul odors, or contamination with toxic chemicals and pathogens, as well as water with abnormally high temperatures. (Mahidol University Learning Innovation Institute, 2024)

Communities and households are major sources of water pollution, as daily waste generated by community members is often disposed of into communal sewage systems, drainage, or directly into rivers and canals. This includes discarded food scraps, water from personal hygiene and household

cleaning, as well as wastewater from other community activities. Most wastewater from communities contains organic materials that contribute to the degradation and pollution of rivers and canals. (Amnat Wongbandit, 2019) Wastewater is water that contains high levels of contaminants, rendering it unsuitable for use. It can be categorized into three main types: physical, chemical, and biological characteristics, as follows: (Textile Industry Faculty, Rajamangala University of Technology Krungthep, 2024).

Physical Characteristics of Wastewater

Color: The color of wastewater can indicate its level of degradation. Freshly generated community wastewater usually has a light brown color that gradually shifts to gray, dark gray, and eventually black due to anaerobic decomposition. Industrial wastewater, however, may vary in color depending on the type of industry.

Odor: Wastewater produced through anaerobic digestion emits a stronger odor than freshly generated wastewater, due to the production of hydrogen sulfide (H_2S) from anaerobic decomposition.

Temperature: Temperature affects the rate of reactions in wastewater, impacting the survival of aquatic plants and animals. As temperature increases, oxygen solubility in water decreases, directly affecting biological reactions in wastewater. Industrial wastewater is often discharged at higher volumes and temperatures, raising the overall temperature of community wastewater. Ideally, wastewater temperatures should range between 25-35 °C.

Solids: Solids in wastewater are classified as:

Settleable solids: Solids that settle at the bottom after 60 minutes in an Imhoff cone.

Suspended solids: Solids that remain suspended and do not settle, typically larger than 1-1.2 microns and removable through filtration.

Dissolved solids: Solids that are dissolved in wastewater, existing in solution form.

Turbidity: This measures the ability of wastewater to transmit light, affected by suspended and colloidal particles present in the water.

Chemical Characteristics of Wastewater

Key chemical properties of wastewater include the presence of organics, fats, detergents, nitrogen, phosphorus, sulfur, heavy metal residues, and imbalanced pH levels.

1) pH Level: The pH scale, ranging from 0 to 14, measures the acidity or alkalinity of wastewater. A pH of 7 indicates neutrality, with values below 7 representing acidity and values above 7 indicating alkalinity. Aquatic life typically thrives within a neutral pH range of approximately 6-8.

2) Dissolved Oxygen (DO): The level of dissolved oxygen is critical for aquatic plants and animals. High DO values indicate good water quality, whereas low DO values suggest pollution. Low DO occur when microorganisms consume oxygen to break down organic pollutants in the water.

3) Biochemical Oxygen Demand (BOD): BOD measures water pollution by quantifying the amount of oxygen bacteria require to decompose organic matter in the water. High BOD indicates high levels of organic pollution, as bacteria consume more oxygen, lowering DO levels.

4) Chemical Oxygen Demand (COD): COD assesses both organic and inorganic contaminants by measuring the chemical oxidation required to break down compounds in the water.

5) Heavy Metals: Toxic heavy metals, mainly released by industrial processes, include mercury (Hg), cadmium (Cd), copper (Cu), lead (Pb), zinc (Zn), arsenic (As), and chromium (Cr). Even in trace amounts, these metals pose risks to humans and animals, accumulating within organisms and transferring through the food chain.

6) Pesticides: These agricultural chemicals include insecticides, herbicides, and fungicides. While some degrade quickly, others persist and accumulate in the environment, with varying degrees of toxicity.

Biological Characteristics

Biological characteristics of wastewater refer to the presence of harmful organisms that pose health risks to humans. These are primarily microorganisms or pathogens, including fungi, bacteria, protozoa, and viruses, which can cause diseases. Coliform bacteria and Fecal Coliform bacteria are commonly used as

indicators to detect contamination from human and animal feces, signaling that the water is unsuitable for consumption or use.

Impacts of Water Pollution: Water pollution, or water quality deterioration caused by contamination, significantly affects various environmental aspects and livelihoods.

1. Consumption and Use: Polluted or degraded water substantially impacts the production of potable water, especially from sources such as rivers, canals, or reservoirs. If these water sources become polluted, the cost of producing clean drinking water increases, as additional treatment is required to meet safety standards.

2. Agriculture: Agriculture relies heavily on quality water. Most agricultural pollution arises from industrial effluents that are highly acidic, contain inorganic compounds, and are toxic. Such water quality is unsuitable for crops, leading to reduced agricultural yields.

3. Industry: Almost all industries require high-quality water in sufficient quantities for Cooling, cleaning, or production processes. If the water quality is inadequate, it must be treated before use, increasing production costs. Issues like high turbidity, improper acidity or alkalinity, and hardness render the water unsuitable for industrial applications.

4. Public Health: Wastewater poses health risks, serving as a breeding ground for various diseases, such as cholera, typhoid, and dysentery. Additionally, heavy metals and toxic substances in polluted water threaten both aquatic life and human health, leading to illnesses like Minamata disease from mercury poisoning and Itai-Itai disease from cadmium poisoning. These toxins can enter the food chain, ultimately affecting human health.

5. Fisheries: Water pollution leads to fish mortality and decreased reproductive rates, depending on the severity of the pollution. High levels of pollution can kill fish species consumed by humans, while lower levels may affect smaller fish that serve as prey for larger species. This disruption in the food chain can diminish fishery yields and directly impact consumers.

6. Aesthetic Value and Recreation: Beautiful rivers, coastlines, and other water sources can lose their charm due to pollution, negatively impacting the scenery and ultimately destroying recreational areas for people.

7. Nuisance Creation: Polluted water bodies not only become unusable but also create unsightly conditions and may produce unpleasant odors, causing disturbances for nearby communities.

The Involvement in the Canal water Pollution Management

Canal water pollution management involves multiple stakeholders and various strategies aimed at reducing and controlling pollution in canal systems. Here's an overview of the key aspects related to this involvement:

Government Agencies

Regulatory Bodies: Government entities are responsible for creating and enforcing environmental regulations aimed at protecting water quality. They establish permissible limits for pollutants and monitor compliance.

Funding and Resources: Governments often allocate funds for pollution control projects, research, and community education programs. They may also collaborate with local authorities to improve infrastructure related to waste management.

Local Communities

Awareness and Education: Community involvement is crucial for successful pollution management. Educating residents about the impacts of pollution and encouraging responsible waste disposal practices can significantly reduce the amount of waste entering canals.

Community Initiatives: Local groups can organize clean-up events, monitor water quality, and advocate for better waste management practices within their neighborhoods.

Industries and Businesses

Pollution Prevention: Industries that discharge waste into canals must adopt practices that minimize pollution. This includes treating wastewater before release and adhering to environmental regulations.

Corporate Social Responsibility (CSR): Businesses can engage in CSR initiatives that focus on canal preservation, including funding clean-up efforts and participating in restoration projects.

Non-Governmental Organizations (NGOs)

Advocacy and Research: NGOs often play a critical role in advocating for environmental protection, conducting research, and raising awareness about canal pollution. They can help mobilize community support and push for stronger regulations.

Partnerships: Collaborating with government agencies and local communities, NGOs can facilitate programs aimed at reducing pollution and restoring canal ecosystems.

Academic and Research Institutions

Research and Innovation: Universities and research centers contribute by studying pollution sources, impacts, and solutions. They can develop new technologies for waste treatment and management.

Monitoring and Assessment: Academic institutions can assist in monitoring water quality and evaluating the effectiveness of pollution management strategies.

Public Participation

Citizen Engagement: Encouraging public participation in monitoring and decision-making processes enhances accountability. Citizens can report pollution incidents and engage in dialogue with local authorities regarding water management policies.

Integrated Management Approaches

Ecosystem-Based Management: Adopting a holistic approach that considers the entire ecosystem helps in understanding the interconnections between various pollution sources and their cumulative effects.

Sustainable Practices: Promoting sustainable agricultural, industrial, and urban practices can significantly reduce pollution levels. This includes implementing green infrastructure, such as rain gardens and permeable pavements, to manage stormwater runoff effectively.

The management of canal water pollution involves a collaborative effort among various stakeholders, each contributing to the protection and restoration of water quality. Government agencies play a crucial role by establishing regulations and enforcing compliance to limit pollutant discharges. They monitor water quality and provide funding for pollution control initiatives, working closely with local authorities to improve waste management practices and infrastructure.

Local communities are integral to this effort, as their daily activities can significantly impact canal health. By engaging in educational programs, residents become more aware of the consequences of pollution and can adopt responsible waste disposal habits. Community-led initiatives, such as clean-up drives and local monitoring of water quality, empower individuals to take ownership of their environment and foster a collective sense of responsibility. Industries contribute to canal pollution but can also be part of the solution. By implementing sustainable practices and treating wastewater before discharge, businesses can reduce their environmental impact. Many industries engage in Corporate Social Responsibility (CSR) initiatives, supporting community efforts to restore and protect local waterways. Non-governmental organizations (NGOs) are essential advocates for canal health, conducting research to identify pollution sources and raising public awareness about their impacts. They mobilize community action and often collaborate with governments and local stakeholders to implement effective pollution reduction programs. Academic institutions also play a significant role by conducting studies on water quality and developing innovative management solutions. Their research informs strategies to combat pollution and improve overall water health. Public participation enhances accountability and ensures that local voices are heard in decision-making processes. Engaging citizens in monitoring and managing their water resources fosters a sense of ownership and encourages sustainable practices. Integrated management approaches that consider the interconnected nature of pollution sources are critical for addressing the complexity of canal water issues. These strategies promote sustainable agricultural, industrial, and

urban practices while implementing green infrastructure to manage stormwater effectively.

Ultimately, successful canal water pollution management hinges on the collaborative efforts of government agencies, local communities, industries, NGOs, and academic institutions. By working together, these stakeholders can implement effective solutions to mitigate pollution, protect water resources, and ensure the long-term sustainability of canal ecosystems for future generations.

New Knowledges

The management of canal water pollution is a multifaceted endeavor that requires the collaboration of various stakeholders, including government agencies, local communities, industries, non-governmental organizations (NGOs), and academic institutions. Government agencies are crucial in establishing and enforcing environmental regulations that set permissible limits for pollutants and conduct monitoring to ensure compliance. They also allocate funding for pollution control initiatives and work with local authorities to improve waste management infrastructure.

Local communities play a significant role by participating in educational programs that raise awareness about the impacts of pollution and encourage responsible waste disposal. Community-led initiatives, such as clean-up events and water quality monitoring, empower residents to take an active role in protecting their environment. Industries must also be involved, as they are often source of pollution. By adopting sustainable practices and treating wastewater before discharge, businesses can minimize their environmental footprint. Engaging in Corporate Social Responsibility (CSR) initiatives allows industries to contribute to community efforts aimed at restoring canal health.

NGOs serve as advocates for environmental protection, conducting research to identify pollution sources and their impacts. They raise public awareness and mobilize community action, often partnering with governments and local organizations to implement programs focused on reducing pollution and restoring ecosystems. Academic and research institutions contribute valuable knowledge through studies on pollution dynamics and innovative

management solutions. They monitor water quality and assess the effectiveness of pollution management strategies.

Conclusions

Public participation is essential in enhancing accountability and fostering a sense of ownership among residents. By involving citizens in monitoring and decision-making processes, communities can better manage their water resources. Integrated management approaches, which consider the interconnectedness of various pollution sources and their cumulative effects, are crucial for effectively addressing canal pollution. This holistic perspective promotes sustainable practices across agriculture, industry, and urban development while encouraging the implementation of green infrastructure to manage stormwater.

In summary, effective canal water pollution management relies on the active involvement of multiple stakeholders working together to implement sustainable practices, enhance public awareness, and protect water resources. This collaborative effort is vital for mitigating pollution and ensuring the long-term health of canal ecosystems for future generations.

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