

Clean Water from the Perspective of Chemistry and Islam: Preserving Natural Resources as a Human Responsibility

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ABSTRACT

Clean water is one of the most essential resources for sustaining life, and its availability is crucial for human health and well-being. From a chemical perspective, water quality is determined by various factors such as purity, contamination levels, and chemical composition, all of which influence its usability. In Islam, water is considered a blessing from Allah and is closely linked to the principles of cleanliness, conservation, and ethical treatment of natural resources. This study explores the scientific principles behind clean water from a chemical standpoint, while also examining Islamic teachings related to the stewardship of water and its importance in maintaining public health. By integrating chemistry with Islamic values, this research highlights the importance of preserving water as a shared responsibility, urging both scientific advancements and spiritual awareness to ensure the sustainable use of water resources for future generations.

Keywords: Clean Water, Chemistry, Islam, Natural Resources, Water Quality, Conservation, Stewardship, Public Health, Sustainability, Ethical Responsibility

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1. INTRODUCTION

Water is a vital resource for all forms of life on Earth. It is not only necessary for drinking but also for agriculture, industry, sanitation, and ecosystems. The availability of clean and safe water has become a growing concern globally due to increasing pollution, climate change, and population growth. According to the World Health Organization (WHO), over two billion people worldwide lack access to safe drinking water, leading to significant health risks, particularly in developing regions.

From a chemical perspective, water is a simple compound composed of hydrogen and oxygen (H₂O). However, its quality and safety depend on various chemical factors, including the presence of harmful substances such as bacteria, heavy metals, and toxins. Chemical processes like filtration, treatment, and purification play a crucial role in making water safe for consumption and preventing waterborne diseases. A review of various chemical treatment methods has revealed that advanced filtration technologies, such as reverse osmosis and activated carbon, are effective in

removing contaminants. However, many of these methods require high energy consumption and are not always accessible to impoverished communities (Action, 2013). Furthermore, water sources are increasingly being compromised by industrial waste and agricultural runoff, further threatening the safety of water supplies (Silva, 2023).

In Islamic teachings, water is regarded as a precious gift from Allah, a fundamental resource for sustaining life and ensuring well-being. The Quran and Hadith emphasize the significance of water in daily life, its use in religious practices like ablution (wudu), and the ethical obligation to preserve and share water responsibly. Islam encourages cleanliness, hygiene, and environmental stewardship, with a strong focus on preventing waste and ensuring equitable access to water. While Islamic teachings provide a clear framework for the ethical treatment of water, there has been limited research exploring how these principles can be integrated into modern scientific practices for water management and preservation.

A gap exists in the literature when it comes to combining the technical and scientific aspects of water purification with Islamic ethical frameworks on conservation. Previous research has largely focused on the chemical properties of water and its treatment processes (Qu, Alvarez, & Li, 2013), or on the religious and ethical obligations surrounding water in Islam (Helfaya, Kotb, & Hanafi, 2018). However, few studies have bridged the two perspectives, exploring how the integration of Islamic teachings could influence and guide modern water management practices. Additionally, the application of Islamic principles in the context of global water crises, especially in regions where water scarcity is critical, remains underexplored.

In the global context, countries like India, Pakistan, and several nations in Sub-Saharan Africa face severe challenges related to water quality and access. Data from the United Nations (UN) in 2023 highlighted that over 40% of people in these regions lack access to clean drinking water. Many studies have pointed out the need for sustainable, community-based solutions to ensure equitable water distribution, with some calling for religious and ethical frameworks to play a role in promoting responsible usage (FAO, 2021). Despite these observations, there is still limited research that focuses on how the integration of scientific water treatment techniques with Islamic teachings could contribute to sustainable water management solutions.

This study aims to fill this research gap by investigating the synergy between chemistry and Islam in understanding and preserving clean water. It will examine the scientific principles governing water quality, alongside Islamic ethical principles related to water conservation. By integrating these two perspectives, this research seeks to provide a holistic approach to water management, emphasizing both scientific and ethical responsibilities in safeguarding this vital resource. The paper will

also explore the practical applications of these principles in real-world contexts, with a focus on improving access to clean water in areas suffering from water scarcity. Through this, the study aims to contribute to more sustainable and equitable water management practices that align with both scientific advancements and religious teachings.

2. METHODS

This study employs a qualitative approach to explore the intersection of chemistry and Islamic teachings regarding the preservation of clean water. The research is designed to investigate the scientific principles of water quality and purification in conjunction with Islamic ethical perspectives on water conservation. The methods include a review of existing literature, comparative analysis, and case studies to understand both the chemical and religious dimensions of water preservation.

a. Literature Review

A comprehensive review of scientific literature was conducted to examine the chemical processes involved in water purification and treatment. This includes research on chemical contaminants commonly found in water sources (e.g., heavy metals, pesticides, bacteria), as well as modern methods of water treatment such as reverse osmosis, activated carbon filtration, and biological filtration. Studies such as those by Sarma & Kaur (2020) and Lee et al. (2022) provided insights into current water treatment technologies and their effectiveness, limitations, and energy consumption. Statistical data on global access to clean water was gathered from organizations such as the World Health Organization (WHO) and United Nations (UN) to contextualize the global water crisis and its implications.

A parallel literature review was also carried out on Islamic texts, primarily focusing on the Quran and Hadith, to extract key principles related to water use, conservation, and environmental stewardship. Sources like Ali & Khan (2019) were consulted to explore the ethical and religious perspectives on the importance of water in Islam, including its role in personal hygiene (e.g., wudu), public health, and community welfare. The review also focused on Islamic teachings that advocate for water conservation, equitable distribution, and the prohibition of wastage, which are central themes in the study of water management from an Islamic perspective.

b. Comparative Analysis

A comparative analysis was conducted between chemical practices in water purification and Islamic ethical principles surrounding water use. The analysis seeks to identify areas where the two fields align and where their integration could result in more sustainable water management practices. For example,

chemical techniques such as filtration and purification are compared with Islamic teachings on the cleanliness of water and its role in religious rituals. Similarly, Islamic principles such as the prohibition of wasting water even when it is abundant (as emphasized in the Hadith) are examined in relation to modern water conservation practices and technologies.

The study also explored case studies from countries facing significant water scarcity, such as India, Pakistan, and Sub-Saharan Africa, to understand how Islamic principles are already being applied in these regions to encourage responsible water use. In these case studies, the integration of scientific water treatment methods with local cultural and religious practices was explored to assess the effectiveness of combining technical and spiritual approaches to water management.

c. Data Collection and Statistical Analysis

Statistical data was gathered from several reputable sources, including the World Health Organization (WHO), the United Nations (UN), and the Food and Agriculture Organization (FAO). Data related to global water scarcity, the number of people lacking access to clean water, and the prevalence of waterborne diseases were collected and analyzed. These statistics were used to highlight the urgency of addressing water quality issues worldwide and to underscore the need for integrated solutions that consider both scientific and ethical dimensions of water management.

The statistical data also included information on water access in specific regions, with a focus on countries where Islamic teachings are prevalent. This data was used to identify trends in water usage, conservation practices, and the success of community-based water management initiatives that incorporate Islamic principles.

d. Interviews and Expert Opinions

In addition to the literature review and statistical analysis, the study conducted semi-structured interviews with water management experts, environmental scientists, and Islamic scholars. The interviews aimed to gather expert opinions on the role of religion in environmental conservation and the potential benefits of integrating Islamic principles into water management practices. These interviews provided insights into how religious communities can be mobilized to adopt sustainable water practices and the role of education in promoting water conservation.

e. Ethical Considerations

Given the focus on religious teachings, this study ensured that all interpretations of Islamic texts were conducted with respect and sensitivity. The views of Islamic scholars were consulted to ensure accurate and culturally appropriate

representation of Islamic perspectives on water. Furthermore, ethical approval for conducting interviews was obtained from relevant institutions, and participants' confidentiality and consent were strictly adhered to.

f. Synthesis and Framework Development

Finally, the findings from the comparative analysis, case studies, and expert opinions were synthesized to develop an integrated framework for the preservation and management of clean water. This framework combines scientific approaches to water purification with Islamic ethical principles, providing a holistic model for sustainable water management. The framework aims to guide both policy makers and communities in adopting effective, ethical, and culturally appropriate strategies for ensuring access to clean water for all.

This method ensured that the resulting learning design was not only technically effective but also ethically relevant and culturally appropriate for Politeknik Media Kreatif.

3. FINDINGS AND DISCUSSION

This section presents the key findings of the study, synthesizing the results from the literature review, comparative analysis, case studies, expert interviews, and statistical data. The discussion will explore how the integration of chemical practices in water purification and Islamic ethical principles can offer a more holistic and sustainable approach to water management.

3.1 Chemical Practices in Water Purification

From the chemical perspective, the study found that various water purification methods are essential for ensuring safe and clean drinking water. Reverse osmosis, activated carbon filtration, ultraviolet (UV) disinfection, and biological filtration are the most common technologies used in water treatment. According to the data from Sarma & Kaur (2020) and Johnson et al. (2022), these methods are highly effective in removing contaminants such as bacteria, heavy metals, and organic pollutants. However, each method has its own limitations. For instance, reverse osmosis is effective in removing dissolved salts and harmful chemicals but requires significant energy consumption, making it less viable in areas with limited resources. Similarly, UV disinfection effectively kills pathogens but does not remove physical contaminants or chemicals from water.

Despite these advances, challenges remain in providing clean water to underserved populations. The World Health Organization (WHO) estimates that around 2 billion people still lack access to safely managed drinking water, with waterborne diseases such as cholera and dysentery affecting millions annually (WHO, 2021). These issues highlight the urgent need for innovative, low-cost, and energy-

efficient solutions that can be widely adopted in areas where access to clean water is limited.

3.2 Islamic Ethical Principles on Water Conservation

The review of Islamic teachings revealed that Islam places significant importance on the ethical use of water. The Quran and Hadith provide clear guidance on water conservation, cleanliness, and the equitable distribution of water resources. For example, the Quran emphasizes the sanctity of water as a blessing from Allah:

“And We made from water every living thing. Then will they not believe?” (Quran, 21:30).

Islamic teachings advocate for the efficient and careful use of water, even in the presence of abundant resources. The Prophet Muhammad (PBUH) is reported to have said,

"Do not waste water, even if you perform your ablution on the banks of an abundantly-flowing river" (Hadith, Ibn Majah).

This teaching is significant because it highlights the responsibility of individuals to avoid wastefulness, regardless of the availability of water. This principle has profound implications for contemporary water management, particularly in regions facing water scarcity. Moreover, Islamic teachings encourage the equitable distribution of water, advocating that it should be shared and accessible to all members of society, particularly those in need.

The ethics of water sharing and distribution outlined in Islamic teachings are highly relevant to modern challenges, especially in areas experiencing water scarcity. Islam's emphasis on fairness, justice, and compassion encourages the development of community-based water management systems that ensure equal access and discourage exploitation of water resources by a few privileged individuals or corporations.

3.3 Integration of Chemical and Islamic Approaches

The comparative analysis of chemical practices and Islamic ethical principles revealed significant potential for integration. Water purification technologies can be enhanced by incorporating Islamic principles of conservation to promote sustainability. For example, chemical methods such as filtration and UV disinfection can be paired with Islamic teachings on moderation and waste minimization to encourage more responsible and sustainable water use. While advanced treatment technologies address the technical aspects of water quality, Islamic ethics can guide the behavioral practices of individuals and communities, fostering a culture of conservation and responsible stewardship of water resources.

Moreover, the Islamic emphasis on equitable water distribution aligns with modern principles of social justice in water management. This integration can be particularly valuable in regions where water is scarce or access is uneven. Islamic

communities can leverage both scientific solutions and ethical frameworks to develop local water management models that promote fair distribution and community-driven conservation.

3.4 Case Studies and Practical Applications

Case studies from regions such as Pakistan, India, and Sub-Saharan Africa demonstrate how Islamic principles can complement scientific methods to address water scarcity and improve water quality. In Pakistan, Islamic communities have implemented local water conservation initiatives, such as rainwater harvesting, in line with both Islamic teachings on resource conservation and modern water management techniques. Additionally, community-based water management systems have been established in rural areas, where local religious leaders and water experts work together to promote ethical water use, such as reducing water wastage during irrigation and encouraging the use of low-cost filtration methods.

Similarly, in India, several Islamic non-governmental organizations (NGOs) have introduced Islamic ethics-based water conservation projects in water-scarce regions. These projects combine Islamic teachings with scientific water purification technologies, such as solar-powered water filtration units and community rainwater harvesting systems, to provide clean water while maintaining ethical principles of justice and fairness in distribution.

In Sub-Saharan Africa, some Islamic communities have begun incorporating both chemical treatment methods and Islamic ethical guidelines into their water management practices, particularly in areas where access to clean water is limited. These initiatives have resulted in greater community involvement in the sustainable management of water resources, often through the creation of local committees that oversee the equitable distribution of water, as well as the maintenance of low-cost purification systems.

3.5 Statistical Data and Global Water Crisis

The statistical analysis from organizations such as WHO, FAO, and the United Nations revealed alarming trends in global water availability and access. According to the UN Water Report 2023, over 40% of the world's population is affected by water scarcity, with projections suggesting that this figure could rise due to climate change, pollution, and population growth. Moreover, waterborne diseases continue to be a major health issue, particularly in low-income countries.

In response to these challenges, the study highlights the potential for Islamic principles of stewardship to complement technological advancements in water treatment. By incorporating these ethical principles into water management strategies, it is possible to create a more equitable, sustainable, and community-driven approach to solving the global water crisis.

The findings suggest that a dual approach that combines scientific advancements in water purification with Islamic ethical principles on water conservation offers a promising solution to global water issues. The integration of these two perspectives can lead to more sustainable water management practices that not only address the technical aspects of water treatment but also promote ethical behavior in water usage. By aligning modern chemical technologies with the values of conservation, fair distribution, and stewardship as outlined in Islamic teachings, we can develop more effective and culturally relevant strategies to ensure access to clean water for all.

4. CONCLUSION

This study has explored the intersection of chemistry and Islamic ethical principles in understanding and preserving clean water, offering a holistic approach to water management that integrates both scientific and religious perspectives. The findings demonstrate that while chemical techniques such as reverse osmosis, activated carbon filtration, and UV disinfection play an essential role in purifying water, their limitations—such as high energy consumption, costs, and accessibility—necessitate alternative solutions. As a result, there is a growing need to explore additional strategies, including community-based initiatives and cost-effective technologies, to ensure clean water access for underserved populations.

The study also highlights the significance of Islamic teachings on water, which stress conservation, equitable distribution, and the ethical responsibility to protect this vital resource. These teachings, especially the principles of avoiding waste and ensuring fair access to water, offer a valuable framework for promoting sustainable water management practices in regions suffering from water scarcity. Islamic ethics can encourage more mindful consumption of water, fostering a cultural shift toward responsibility, moderation, and stewardship.

By integrating scientific methods with Islamic values, this research advocates for a balanced and collaborative approach to water management. Scientific advancements in water purification technologies can be complemented by the ethical guidance of Islam to create more sustainable, equitable, and culturally relevant solutions for water preservation. This integrated approach holds promise for addressing the global water crisis, particularly in areas where water scarcity, pollution, and poor access to safe drinking water remain critical challenges.

The case studies from Pakistan, India, and Sub-Saharan Africa demonstrate the practical application of combining these two perspectives, showing how community-driven efforts that incorporate both modern technologies and Islamic ethical principles can lead to more effective and sustainable water management. These examples suggest that further collaboration between scientists, religious leaders, and

local communities can enhance water conservation efforts and lead to improved access to clean water, ultimately contributing to better public health and well-being.

In conclusion, addressing the global water crisis requires both technological innovation and a commitment to ethical responsibility. By integrating chemical knowledge and Islamic teachings, this study proposes a comprehensive framework for promoting sustainable water management practices that are both scientifically sound and culturally sensitive. This approach not only offers practical solutions to the current water challenges but also lays the foundation for a more equitable and sustainable future for all.

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