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Analysing the Efficacy of a Decolourisation Agent by the Soaking Method for Mashaf Al-Quran

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Abstract

This study investigates the effectiveness of acetone and methanol as decolourisation agents for removing ink from damaged Quranic manuscripts, with the goal of developing a sustainable, cost-effective, and environmentally friendly disposal method that aligns with Islamic principles. The research evaluates two paper types, which are wood and glossy, by using a soaking method with varying concentrations of acetone and methanol. After treatment, pH and colour coefficient tests were conducted to assess decolourisation efficiency and environmental impact. The findings indicated that acetone was more effective on wood paper, achieving faster and clearer ink removal, while methanol performed better on glossy paper, ensuring thorough ink removal while maintaining paper integrity. Both agents helped to preserve the pH levels, minimising environmental harm. This study presents an innovative solution to the disposal of Quranic manuscripts, striking a balance between religious respect and environmental sustainability, thereby reducing waste and enabling resource reuse, and providing a viable alternative for the respectful and eco-friendly disposal of damaged Quranic texts.

1. Introduction

The Quran is a religious text of Islam received by the Prophet Muhammad SAW [1]. With the increase in printing in different countries, naturally used or decayed Quran copies are becoming difficult to dispose of. Ways to dispose of a Quran include burning, soaking, burying, or shredding to preserve its sanctity [2]. The burning and ink-removal forms are the most preferred methods for disposing of the Quran in Malaysia, with the latter being a more environmentally friendly option, as the ink is first separated from the paper for recycling [3]. This study focuses on enhancing the soaking method for Quran disposal using decolourising agents—acetone and methanol—to improve ink removal efficiency while maintaining religious respect and environmental sustainability. The research aims to determine the optimal concentration and soaking duration required for effective decolourisation on both glossy and wood paper.

The major hurdle in Quran disposal is its high cost, lack of centralised disposal facilities, issues in transporting ashes, and unsatisfactory disposal regulations [4,5]. While the burning method is widely adopted, it is tedious, expensive, requires special equipment, and raises environmental concerns [6]. Other methods are slightly better, such as sea disposal, which presents logistical and ecological challenges [7]. This study is important because it will be a viable alternative to the existing methods of disposal of the other Quran. The soaking method should

contribute to greater environmental protection while simultaneously facilitating the disposal of the Quran in a peaceful manner. It will standardise the disposal process worldwide, ensuring consideration of both religious and environmental concerns.

Nomenclature is included if necessary	
CH_3COCH_3	Acetone
CH_3OH	Methanol
ADMI	American Dye Manufacturers Institute (Color)
pH	Potential of Hydrogen (Acidity/Alkalinity)

2. Material and Method

The methodological section presents a detailed account of how the study approaches and examines the methods of disposal of the Qur'anic text. Fig. 1 outlines the thorough procedures required to conduct an experiment comparing two approaches to ink removal from glossy and wood paper: decolourisation agent and de-ionised water. To assess the efficacy of each approach on glossy versus wood paper, the flowchart concludes with data collection and analysis. This provides insights into the most effective ink removal methods for various types of paper.

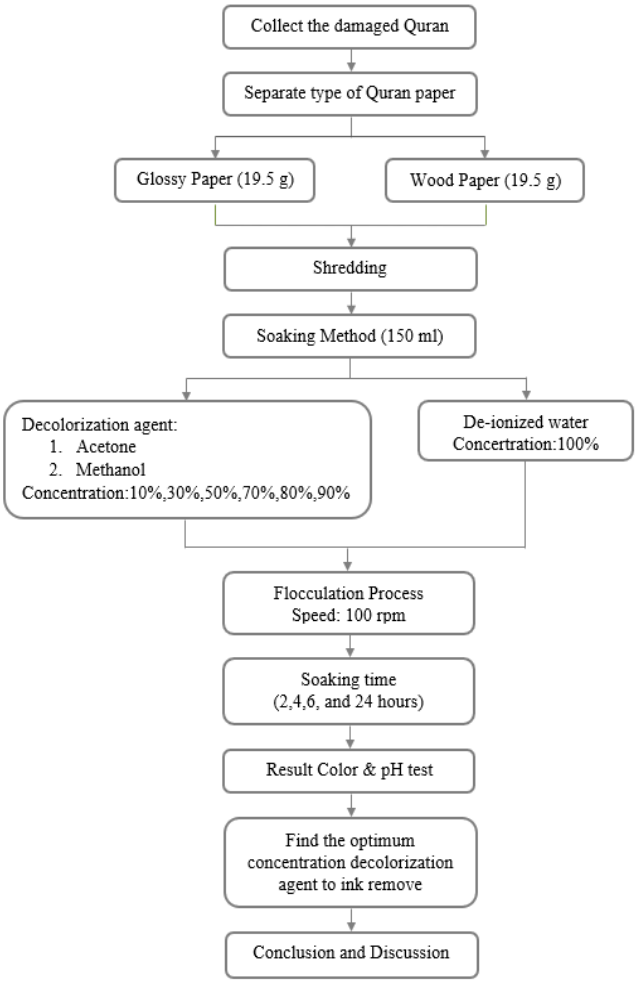

Fig. 1 *Flowchart*

2.1 Experimental Equipment

In this study, several key pieces of equipment (Fig. 2) were used to ensure the effectiveness of the decolourisation process and accurate measurement of the results. A shredder (a) was used to uniformly cut the paper samples (glossy and wood paper) into smaller pieces. This step was necessary to provide an even surface area for better contact with the soaking agents, promoting a more efficient ink removal process. The electronic balance (b) was

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then used to weigh 1.5 grams of each paper sample, ensuring consistency across the experiments. This precision was crucial for comparing the results reliably. The flocculator (c) played a vital role by agitating the paper and solvent mixture at 100 rpm for 24 hours, enhancing the interaction between the paper and the decolourising agents, which improved the ink removal efficiency.

To assess the success of the decolourisation process, the DR6000 spectrophotometer (d) was used to measure the colour intensity of the soaking solutions. The readings from this device, expressed in ADMI, indicated the extent of ink removal from the paper. Lastly, the pH meter (e) was used to monitor the pH levels of the soaking solutions, providing insights into the chemical properties of the mixture and its potential environmental impact. These tools together allowed for a comprehensive evaluation of the decolourisation process and ensured that the study was conducted with precision and accuracy.

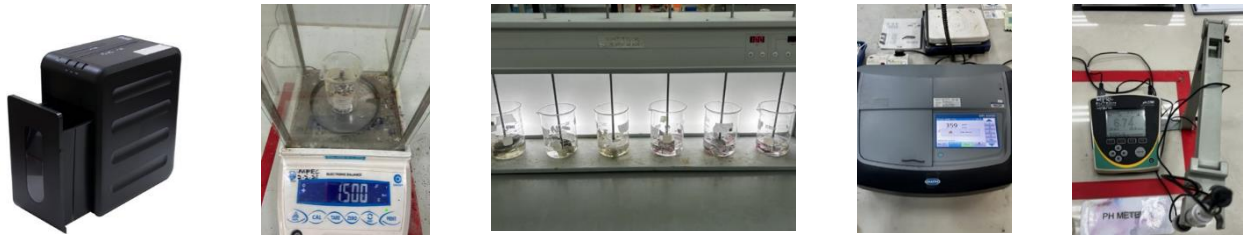

Fig. 2 *(a) Shredder; (b) electronic balance; (c) Flocculator; (d) DR6000; (e) pH meter*

2.2 General Procedure

The general procedure for this experiment involves several meticulous steps to ensure accuracy and thoroughness. Initially, the waste paper is shredded into small, uniform particles. Solutions are prepared using Equation 1 which involves mixing acetone (80%) with de-ionised water (20%). The shredded paper samples are then soaked in these solutions using a flocculator for varying durations of 2, 4, 6, and 24 hours. After each soaking period, data on colour tests (measured in ADMI) and pH are collected, with the pH test specifically designed to assess the alkali level of the solution. To ensure comprehensive results, the experiment is repeated with a different solution mix, where methanol (80%) is combined with de-ionised water (20%). This helps to compare the effectiveness of acetone and methanol as decolourising agents. The experiments are conducted on two types of paper: wood paper and glossy paper, as outlined in Table 1:

Table 1 *Types of paper use for remove ink*

Experiment	Type of paper	Details
Paper 1	Wood	Commonly used in previous printouts of the Quran.
Paper 2	Glossy	Often used in current printouts of the Quran.

2.3 Equation

The soaking method involves preparing solutions of acetone and methanol at specific concentrations to evaluate their effectiveness as decolourising agents. The required volume of the pure agent is calculated based on the relationship between the concentration of the pure agent in Equation (1), the desired concentration, and the total solution volume (fixed 150 ml). To evaluate the effectiveness of these decolourising agents, the change in ADMI values over time is analyzed by calculating the Ink Removal Efficiency (Equation 2). This measures the relative change in intensity values during the soaking period.

$$m_1 v_1 = m_2 v_2 \tag{1}$$

$$\text{Ink Removal Efficiency} = \frac{Final\ Value - Initial\ Value}{Initial\ Value}\ x\ 100\% \tag{2}$$

3. Data Result

The results from this study highlighted the importance of solvent concentration in the effectiveness of ink removal from paper surfaces. Both acetone and methanol were found to be effective in decolourising the paper samples, but their performance varied depending on the concentration of the solution. Generally, higher concentrations of both acetone and methanol resulted in more efficient ink removal. This trend suggests that the strength of the solvent plays a significant role in the decolourisation process.

Moreover, the type of paper also influenced the results, with different papers reacting differently to the solvent solutions. The data collected underscores the need to consider both the concentration of the decolourising agents and the type of paper. The findings highlight the potential for both acetone and methanol to serve as effective decolourisation agents, with some variations in their performance based on the paper type and concentration used.

3.1 Wood Paper

The study on wood paper, as presented in Table 2, showed that higher concentrations of aqueous acetone and methanol solutions were more effective in removing ink. The results indicated that as the concentration of the decolourising agents increased, the colour intensity measurements increased, signifying better ink removal. However, some high-concentration solutions evaporated during the experiment, resulting in missing data. Acetone demonstrated slightly better ink removal performance than methanol at higher concentrations, highlighting its suitability for effectively decolourising wood paper.

Table 2 *Data for wood paper*

No.	Decolourisation Agent	Colour (ADMI)
1	De-ionised water (100)	391
2	Aqueous acetone (90:10)	No data (Evaporated)
3	Aqueous acetone (80:20)	1865
4	Aqueous acetone (70:30)	1790
5	Aqueous acetone (50:50)	1680
6	Aqueous acetone (30:70)	1580
7	Aqueous acetone (10:90)	910
8	Aqueous methanol (90:10)	No data (Evaporated)
9	Aqueous methanol (80:20)	1811
10	Aqueous methanol (70:30)	1708
11	Aqueous methanol (50:50)	1158
12	Aqueous methanol (30:70)	888
13	Aqueous methanol (10:90)	771

Fig. 3(a) shows the data for acetone on wood paper, illustrating its effectiveness in decolourising ink stains over the soaking period. Similarly, Fig. 3 (b) presents the data for methanol on wood paper, demonstrating its performance in ink removal, although it was slightly less efficient than acetone.

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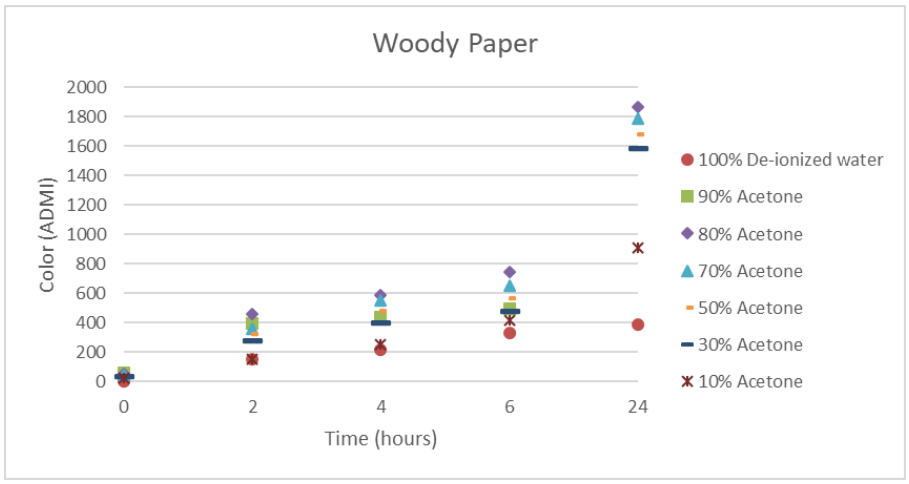
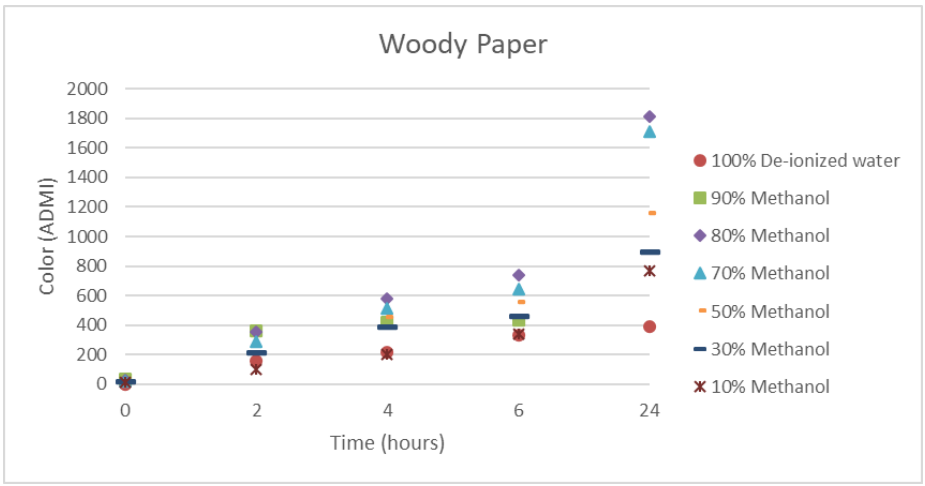


(a)



(b)

Fig. 3 *(a) Data acetone for wood paper; (b) Data methanol for wood paper*

3.2 Glossy paper

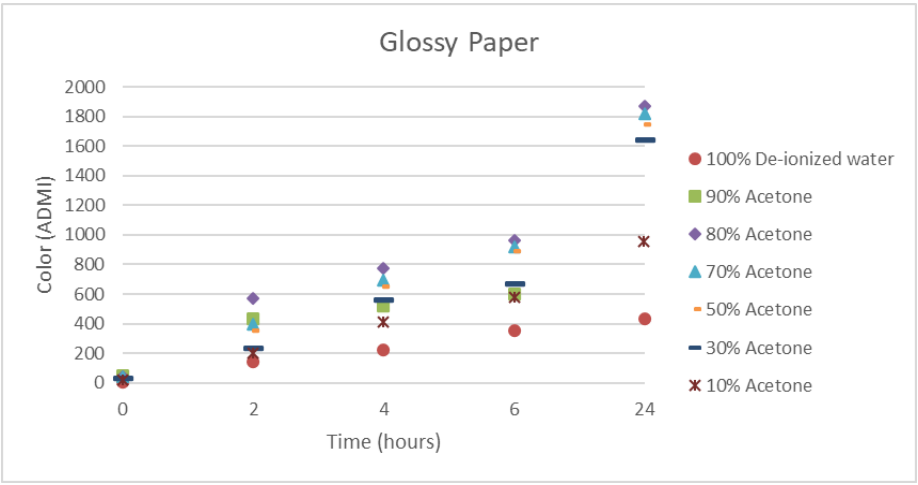
For glossy paper, as shown in Table 3, the results similarly revealed that higher concentrations of decolourising agents were more effective in ink removal. Glossy paper, however, showed greater resistance to ink removal compared to wood paper under the same conditions. Methanol consistently outperformed acetone at higher concentrations, achieving better decolourisation results. These findings suggest that using higher concentrations of decolourising agents is critical for achieving effective ink removal, especially for glossy paper, which poses additional challenges due to its surface properties.

Table 3 *Data for glossy paper*

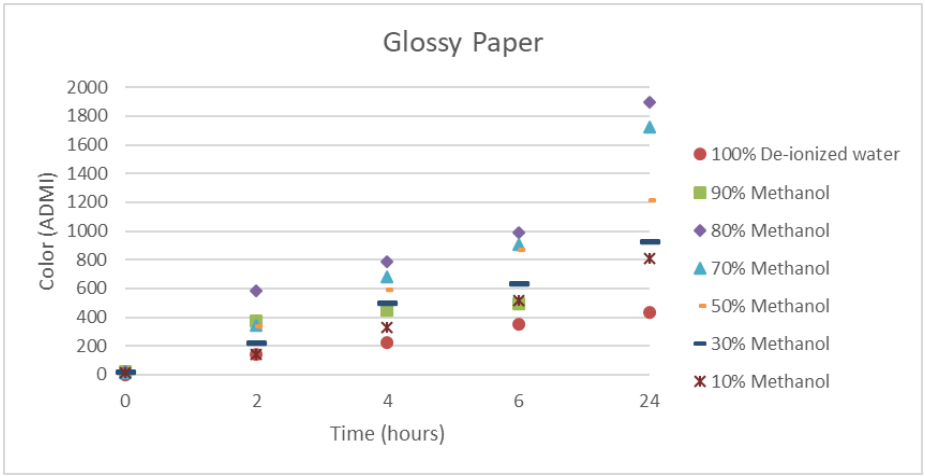
No.	Decolourisation Agent	Colour (ADMI)
1	De-ionised water (100)	436
2	Aqueous acetone (90:10)	No data (Evaporated)
3	Aqueous acetone (80:20)	1871
4	Aqueous acetone (70:30)	1821
5	Aqueous acetone (50:50)	1750
6	Aqueous acetone (30:70)	1642
7	Aqueous acetone (10:90)	955

8	Aqueous methanol (90:10)	No data (Evaporated)
9	Aqueous methanol (80:20)	1897
10	Aqueous methanol (70:30)	1721
11	Aqueous methanol (50:50)	1211
12	Aqueous methanol (30:70)	920
13	Aqueous methanol (10:90)	811

Fig. 4(a) shows the data for acetone on glossy paper, illustrating its effectiveness in decolourising ink stains over the soaking period. Similarly, Fig. 4 (b) presents the data for methanol on glossy paper, demonstrating its performance in ink removal, although it was slightly less efficient than acetone.



(a)



(b)

Fig. 4 *(a) Data acetone for glossy paper; (b) Data methanol for glossy paper*

4. Conclusion

This study evaluated the efficiency of acetone and methanol in removing ink stains from glossy and wood paper, revealing that both solvents performed well, with acetone being more effective than methanol on the wood paper. It can be seen that with the 90% acetone solution, a sharp decline in the colour ADMI values and a change in the pH profile indicate that the solution possesses sound decolourisation potential. However, it was very difficult to make measurements over a 24-hour period; therefore, the study was limited to shorter times. To this end, the study recommended the use of 80% acetone and methanol concentrations since they produced constant and

rhythmic reactions without evaporation during the soaking time. Methanol was slightly less efficient than acetone for glossy paper, though it was efficient for the gloss papers. The results provide a relatively eco-friendly and effective procedure that is safe for the texts of the Quran and suitable for total ink removal. These findings are relevant in establishing the right method for handling and disposing of a damaged Quran, particularly in terms of sustainability.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design****: Siti Nurul Aisyiah Rahimpudin@Rahimudin, Rafidah Hamdan;* ***data collection****: Siti Nurul Aisyiah Rahimpudin@Rahimudin;* ***analysis and interpretation of results****: Siti Nurul Aisyiah Rahimpudin@Rahimudin, Muhammad Hafiq Afifi Azman, Rafidah Hamdan;* ***draft manuscript preparation****: Siti Nurul Aisyiah Rahimpudin@Rahimudin, Muhammad Hafiq Afifi Azman, Muhammad Aliff Iman Shamsudin. All authors reviewed the results and approved the final version of the manuscript.*

References

[1] Anwar, K., Halimah, N., Tulsadiah, R., & Amelia, I. (2023). Menjaga Kemuliaan Al-Qur'an Dalam Islam. *Jurnal Multidisiplin Indonesia*, *2*(6), 1330–1340. https://doi.org/10.58344/jmi.v2i6.288

[2] Mamat, M. R. (2023). Bongkah abu al-Quran dan bahan bercetak mengandungi ayat al-Quran dikeringkan sebelum dilupuskan ke laut. NSTP/Mohd Rafi Mamat. 1–10.

[3] Shalihah, F. (2022). Media Islam dan Kesalehan Publik: Kajian terhadap Ragam Cetakan Al-Qur'an Kontemporer di Indonesia. *Nun: Jurnal Studi Alquran Dan Tafsir di Nusantara*, *7*(2), 301–328. https://doi.org/10.32495/nun.v7i2.244

[4] Karim, A. K. B. (2017). Amalan Pengurusan Pelupusan Bahan Al-Quran Di Malaysia. 1–23.

[5] Taqwa Zabidi, S. N. H. K. (2018). Pandangan Syarak Mengenai Pengurusan Pelupusan Teks atau Bahan al Qur'ān Realiti Aplikasi di Malaysia. 1–16.

[6] Roslan, M. N. A., & Mohamad, Z. (2022). Kaedah-Kaedah Pelupusan Mushaf Al-Qur'an: Satu Analisis. *Al-Takamul Al-Ma'rifi*, *5*(1), 1–11.

[7] Abdul Majid, L., Mohd Saad, M. F., Ishak, H., Abdul Majid, M. N., & Mohd Azhar, A. A. I. (2022). Pandangan dan Penilaian Ilmuan Agama Terhadap Kaedah Pelupusan Teks Al-Quran Di Malaysia. *Islamiyyat*, *44*(2), 113–121. https://doi.org/10.17576/islamiyyat-2022-4402-08